capitulo 11

Análisis de Información

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11.I INTRODUCCION

Para el hombre de laboratorio como para el técnico de planta, la información que se genera es una parte de su equipo de herramientas, lo mismo que un destornillador o un galvanómetro. No debiera perder tiempo para conseguirla, ni tampoco para conocer su existencia. Es finalidad del Servicio de Análisis de Información dar las posibilidades para que todo profesional obtenga la información que le interesa en el tiempo deseado.

La labor de un analista de la información es la de seleccionar entre los 10 millones de documentos que aparecen anualmente, los pocos documentos que le resultarán más útiles al usuario. El Servicio de Análisis de Información de la Gerencia de Tecnología de la Comisión Nacional de Energía Atómica se ha creado para el beneficio de una colectividad de usuarios más o menos amplia, en que los individuos se encuentran caracterizados por un interés común: los metales. A partir de este momento se han previsto dos propósitos sustantivos:

a) suministrar la información a los participantes de cada uno de los temas elaborados en el presente estudio.

b) suministrar la información a los interesados en incorporar nuevas tecnologías.

11.II GENERALIDADES DEL BOOM DE LA INFORMACION

El científico o tecnólogo considera la publicación o informe final del resultado de una investigación o desarrollo como una formalidad necesaria. La información la transfiere a sus colegas en reuniones, por correspondencia, en seminarios, etc.. El último paso es el de escribir. La publicación forma parte del ritual ya aceptado, pero su función va más allá, ya que con este aporte el autor comunica sus resultados al resto de la comunidad científica y tecnológica. Sus resultados pueden llegar a los lectores dispersos en el mundo a través de la difusión que permiten las revistas científico-técnicas, de publicaciones de resúmenes de listados, etc. ellos son los que podrán discutirlos, comprobar sus resultados y en última instancia, aceptarlos o no.

Todo científico o tecnólogo se encuentra actualmente ante unas 35.000 revistas técnicas que publican cerca de 2.000.000 de artículos por año, escritos por unos 750.000 autores en unos 50 idiomas. Si el número sigue creciendo con la misma exponencial, dentro de 50 años el científico tendría unos 8.000.000 de colegas en el mundo y unas 350.000 revistas para analizar. Como se deduce de lo expuesto, la administración del depósito del conocimiento ya es tarea difícil en la actualidad y resultará casi imposible su manejo en el futuro si no se hallan los métodos adecuados y se los distribuyen en todos los centros de interés.

11.II.a. Existen ciertas características dentro de la transmisión de la información tecnológica, además de la ya mencionada, que las podemos considerar de acuerdo al siguiente esquema:

a) En las pequeñas o medianas empresas los canales de información no están estructurados y los podemos llamar "comunicaciones informales". El método utilizado más comúnmente es que el dueño de la empresa viaja, realiza visitas técnicas, asiste a ferias internacionales, etc. y recibe la información en forma directa e informal. También reciben información las empresas si actúan como representantes de otras, pues su casa matriz es la que elabora y condensa la información y la transmite a sus filiales.

b) Las empresas de mayor envergadura, ya sea estatales o privadas, donde operan departamentos técnicos de producción, y/o de ingeniería, tienen mayor número de usuarios de la información que reciben, por lo tanto se crean bibliotecas internas, unidades de información, relaciones directas con colegas del exterior o expertos que son contratados o relacionados a procesos de importación y negociación de tecnología.

c) Los técnicos que encuentran su información por lectura de las revistas técnico-comerciales, revistas científico-técnicos, asistencia a congresos, relaciones personales con otros colegas, conocimiento de los lugares donde se producen los mejores trabajos o de los de mayor importancia y también a publicaciones.

11.III CARACTERISTICAS DE UN SISTEMA DE INFORMACION

Un sistema de información debe vincular los mecanismos, sistemas y agentes relacionados con la creación y adaptación de tecnologías en trabajos de las características que reúne el presente estudio.

11.III.a. Características de los usuarios

La definición más generalizada es: toda aquella persona, que por su interés profesional o privado quiere o debe ampliar y mantener al día sus conocimientos, es llamada usuario de la información. Al evaluar las necesidades de los usuarios y haber analizado las actividades que desarrollan se podrá determinar las funciones que debe cumplir el o los sistemas de información. La demanda de la información puede tener varias características:

a) Para investigación con fines muy precisos.

b) Para investigaciones en marcha con usuarios muy especializados,

c) para la elección de procesos,

d) para diseño ya sea en ingeniería como en planta,

e) para dirección en la producción; etc.. Una división neta existente entre la información requerida para obtener conocimiento de soluciones y la necesaria para obtener conocimiento de conocimientos. La mayor demanda actual de información es sobre el conocimiento para obtener soluciones, por lo tanto debe estar procesada como para ser utilizada en ese sentido.

11.III.b Operaciones de un Servicio de Documentación.

Las operaciones de un servicio de documentación son: acumulación de la información, procesamiento de la misma, creación de información a través del análisis, operación del sistema, utilización de servicios.

11.III.b.1 En la etapa de **acumulación** es función del sistema de identificación de la información, su evaluación, adquisición con diversas alternativas adecuadas a la naturaleza de las demandas. Deberán evaluarse los costos directos e indirectos para la adquisición de las diversas fuentes de información que son:

a) revistas especializadas, b) libros, c) conferencias, d) publicaciones comentadas de nuesvas aplicaciones o anuncios e) literatura no sistemática compuesta por catálogos, material de representantes comerciales, exposiciones, f) evaluaciones del estado de la tecnología según sectores, procesos, g) información de perfiles de tecnologías a desarrollarse por grupos locales, informes sobre búsqueda internacional y material obtenido por convenios de intercambio, h) informes y reportes técnico-científicos.

11.III.b.2 En la etapa de **procesamiento** debe analizarse el esquema de clasificación, caracterización y definición de acuerdo a los perfiles de interés de los temas y características de los usuarios.

11.III.b.3 En la etapa de **creación de información** deberán elaborarse los datos acumulados para suministrar la información y difundirla en forma periódica o esporádica.

Deberán abarcarse los diversos campos cubiertos durante el desarrollo del trabajo.

11.III.b.4 Desarrollar las **relaciones con los servicios de documentación** ya existentes en el país, saber dónde está la información, cómo está y cómo obtenerla. En síntesis, disponer de la información que contienen las instituciones científicas, industriales, de planificación que puedan contribuir a crear un inventario de recursos científicos y de conocimientos tecnológicos disponibles.

11.III.c. Sistemas de Información

Debido a la complejidad de los requisitos sobre información tecnológica que existen en el país, la diversificación de los temas y el dinamismo que exige la demanda de la información, encararemos el análisis de los sistemas en base a los siguientes puntos: diseño del sistema; características del analista de la información; metas de un servicio de información; métodos de búsqueda de información.

11.III.c.1 Diseño

El diseño del sistema de información deberá basarse en las etapas que se siguen durante la obtención de una tecnología (se analizará el tema con un ejemplo), conocer al usuario, ya sea estatal o privado, crear el sistema que lo ayuda más eficazmente en cada paso de la búsqueda de la información, evaluarla y asesorar hasta la adquisición (este punto se verá en mayor detalle en el capítulo sobre transferencia de tecnología).

11.III.c.2 Características del analista de la información

Con las necesidades y características expuestas anteriormente sobre la demanda de los usuarios, el analista de la información debe ser un técnico (ingeniero o científico) el que ya ha adquirido experiencia en actividades similares a las personas que debe servir. Su capacidad se desarrolla en forma efectiva si se encuentra emplazado en el equipo de trabajo, pues debe auxiliar al experto y por lo tanto debe mantenerse muy bien informado. Con las necesidades y objetivos que se propone para un servicio de información y las características que tienen los variados tipos de usuarios y métodos que ellos utilizan para informarse, queda expuesto un problema sobre cómo debe ser un analista de la información para dicho tipo de demanda. Con la formación de las escuelas de bibliotecarios que dispone actualmente nuestro país, el egresado no se encuentra en condiciones de encarar este tipo de tareas, pues el análisis y la especialización tanto en el área tecnológica como en los métodos a ser utilizados requieren otro tipo de formación. Los profesionales que ya han actuado en cierto número de años en el laboratorio, o en planta, es decir que han sido usuarios de una biblioteca podrán encarar en mejores condiciones la difícil tarea de organizar y planificar un servicio de análisis de información. Deberán estar secundados por documentalistas en las tareas requeridas para que el sistema funcione en forma eficiente.

En la actualidad, en nuestro país son pocos los profesionales que desean o se sienten motivados para realizar dicha tarea por diversas razones. Se expondrán algunas de ellas:

a) el trabajo lo considera tedioso

b) aleja mucho del laboratorio o lugar donde la sensación de innovación o aporte se tiene a través de otros estímulos,

c) considera que se pierde nivel profesional quizá por realizar tareas de servicio hacia los demás.

d) debe gustarle mucho la lectura, etc., etc..

Por otro lado, se pueden aventurar a expresar ciertas ventajas que el analista puede hallar en dichas tareas: a) suplementa el trabajo de cualquier laboratorista, tecnólogo u hombre de producción, b) de aceurdo a la revisión bibliográfica y su posterior análisis está en condiciones de elaborar reports de temas con conclusiones de gran interés para grupos de tecnólogos, c) ofrece mucha libertad intelectual, d) debe auxiliar al experto o especialistas pues su campo de información es amplio, mientras que los usuarios pecan generalmente por obtener su información a través de medios específicos, e) debe estar enlazado directamente al equipo de trabajo con comunicación directa con sus usuarios, lo cual le obliga a mantenerse bien informado, f) como corolario de dichas condiciones, la relación de dependencia en su medio será al más alto nivel pues colaborará con todos los niveles técnicos y los no técnicos, lo cual le permitirá estar enlazado dentro de los grupos con poder de decisión. Los posibles usuarios no concurren con frecuencia a las nuevas fuentes documentarias por desconocimientos, por falta de tiempo o por no tener facilidad de acceso a las mismas. Será el analista de la información junto con los bibliotecarios especializados que irán a proveer la información, a trabajar junto al usuario pues la inversa pocas veces se da.

La presencia de analistas en puntos estratégicos y que se encuentren lo más cerca posible de los usuarios, aseguran un mínimo de servicios inmediatos y pueden servir, si no es para dar respuestas inmediatas, para actuar de enlace con otros centros, tarea muy fructífera, que aporta a la economicidad de los servicios de documentación. El analista debe tener bien claro que la biblioteca, el depósito de documentos y toda otra información de la cual disponga debe ser útil, entonces no sólo se preocupará junto con su personal a ordenarla, catalogarla y mantenerla, sino que mucho más importante será su tarea si se comunica con los usuarios. También promoverá su utilización por los métodos mejores y más eficientes.

11.III.c.3 Métodos de búsqueda de información

Los métodos de búsqueda de información deben ser orientados a suplir las necesidades de los diversos usuarios, donde se complementarán las informaciones para todos los sectores.

11.III.c.3.1 Identificación de las fuentes de información, conocimiento de los recursos de los numerosos centros y organismos afines, servicios especializados, acción de institutos técnicos tanto del país como del exterior.

11.III.c.3.2 El sistema de información deberá actuar como difusor para el sector industrial y de desarrollo del país, Deberá servir como sistema de contacto permanente de las fuentes externas para conocer detalles de soluciones, proyectos concretos, condiciones de realización, etc..

11.III.c.3.3 Orientar la búsqueda a nivel sectorial con alcance inten acional, individualizar los centros, compañías y organismos y conocer de cada una de ellas qué saben hacer y qué servicios ofrecen.

11.III.c.4 Metas de servicio de Información

El servicio de información tendrá como meta la promoción del desarrollo ya sea de tecnología como del conocimiento, promoción del mejoramiento de los métodos en marcha, coordinación de los servicios de información existentes y su eventual complementación y ampliación. Debe considerar los presupuestos con que se cuentan al diseñar un sistema de información. No tendrá mucho sentido tratar de automatizar el sistema cuando no se cuente en el servicio con una biblioteca muy completa, pues de poco servirá ubicar referencias en pocos minutos si luego, para obtener los originales de las mismas, se requerirán entre 3 y 4 meses de trámites. Es muy ilustrativo el siguiente ejemplo sobre costos de un sistema de información y los beneficios obtenidos por el servicio de documentación de la industria farmacéutica en Italia que resulta indispensable para conducir la investigación científica en el sector. Se requieren conocimientos sobre las enfermedades humanas y los avances de la investigación médica, y se requiere estar al día en lo que concierne a los avances de los conocimientos técnicos y científicos mundiales en el terreno farmacéutico. La empresa A resuelve su problema de información a través de una actividad propia de revisión de literatura especializada en su área de trabajo. Utiliza un sistema automatizado para la recuperación de la información que tomó un año instalar.

La información básica de resúmenes bibliográficos, que cubren 350 publicaciones científicas internacionales, la obtienen de una empresa inglesa especializada, la Darwent Publ. a través de la cual reciben 40.000 referencias por año (7 a 8.000 publicaciones científicas en el campo farmacéutico son revisadas con un total de 500.000 referencias anuales) al costo de $ 12.000 como mínimo de costo anual. Este servicio fue mejorado a través de una programación más compleja para el "retrieval" que exige más precisión en la formulación de la demanda de información pero que les permite elevar la tasa de "información útil" del 20o/o al 80o/o. El personal mínimo para este servicio de información consiste en un graduado, sea médico, químico-farmacéutico, farmacólogo o biólogo con un entrenamiento ad-hoc de solamente 2 días y que puede llegar a un óptimo de eficiencia (identifica manualmente 50 referencias por minuto) en el plazo de un mes".

Existen otros ejemplos de sistemas de información por sectores, como es el caso de la industria de máquinas y herramientas de Checoslovaquia (ref. pág. 117). La información técnico-económica necesaria para el desarrollo, diseño y producción de una máquina incluye con mucho detalle análisis de patentes, competitividad de mercado, tendencias del mismo, etc.. Una empresa lo ha organizado con 3 personas que hacen el copio y procesamiento de la información proveniente de 73 publicaciones periódicas bien seleccionadas, así como la selección de patentes relativas.

Cada sistema tiene características propias de acuerdo a los requerimientos de sus usuarios, capacidad de desarrollo y posibilidades económicas. Como metas por tareas podemos analizarlas de la siguiente manera:

11.III.c.4.1. Las publicaciones a que propenderá un servicio serán de tipo de evaluaciones (llamadas "state-of-art-report") de temas específicos, complementándose con especialistas en cada uno de los temas tratados dentro del contexto general. El servicio proveerá la información retrospectiva a cada usuario, se conectará con los centros relacionados, preparará las salidas de la información para una más fácil recuperación de la misma.

11.III.c.4.2 Diseminar la información en forma seleccionada que resulta de la sistematización de la información obtenida o consultada o extraída de algún medio y que se prepara para cada usuario en forma periódica de acuerdo a perfiles de interés prefijados. Dicho sistema reemplaza al usuario a que deba examinar todos los documentos que entran a su empresa o que producen otros servicios. Debe organizarse en forma centralizada conociendo campos de interés y ser suficientemente ágil para responder a una demanda dinámica y generalmente diversificada.

11.III.c.4.3 Almacenar colecciones, libros, documentos, catálogos de diferentes tipos de empresas y servicios, los que deben encontrarse en depósitos propios. En aquellos casos donde la especialización no exige determinadas inversiones, deberán conocerse los medios para obtener la información que se requiera. Con respecto a sistemas electrónicos de acumulación de información no se los considera factibles aún en nuestro país en el que existe una gran descapitalización en la adquisición de colecciones y otro tipo de material que no cuentan con los recursos suficientes.

11.III.c.4.4 Determinar perfiles de interés de grupos de técnicos para programar mejores servicios documentarios, y mejorar los existentes. Deberán estudiarse, por ejemplo, las líneas de desarrollo de los centros o empresas a las cuales perteneces, tecnologías aplicadas en empresas con interese comunes, etc. Estos perfiles deberán estar relacionados por ejemplo a las tareas que cumplen oficinas de evaluación de incorporación de tecnología del extranjero, a oficinas que evalúan solicitudes de patentes de invención, a grupos de investigación y/o desarrollo que encaren nuevas líneas de trabajo, etc.

11.III.c.4.5 Las perspectivas de un sistema de información deben ser los bancos de datos y los centros de información. Los bancos de datos son servicios de información que registra los datos con cierto tratamiento previo de tipo aritmético, lógico o agrupado en formas más o menos complejas. En campos de inversiones económicas existen bancos en varios países, en determinadas propiedades, de compuestos químicos, p. ej., la ASTM compiló datos sobre ensayos y normas, etc.. En materia de tecnología es más difícil crear tablas de tipo numérico pero, por ejemplo, para una oficina de importación de una determinada tecnología se deberá contar con los siguientes detos: conocimiento de la industria local obtenida a través de encuestas, contactos personales, etc., conocimientos de las diversas fuentes de la tecnología buscada, realizar la búsqueda bibliográfica retrospectiva de la misma incluyendo las patentes internacionales y del propio país, tener un buen conocimiento de la capacidad de los laboratorios de investigación y desarrollo del país.

Los centros de información examinan de modo crítico los datos que se le suministran y asume la responsabilidad de registrar sólo los que dan las garantías de validez. Ya han sido definidas las funciones del centro de análisis de información por el COSATI como: "organismo estructurado, establecido, específicamente para adquirir, seleccionar, almacenar, encontrar, evaluar, analizar, y sintetizar un cuerpo de información y/o de datos en un campo bien definido, o agregado a una misión específica de compilación, de condensación, de reestructuración y de modo general de organización y de presentación de información y/o de datos pertinentes bajo forma que revista autoridad".

11.IV OPERACIONES DEL SERVICIO DE INFORMACION DE LA GERENCIA DE TECNOLOGIA DE LA COMISION NACIONAL DE ENERGIA ATOMICA

11.IV.a Introducción

El servicio de Análisis de Información de la Gerencia de Tecnología está organizado de acuerdo a: a) las necesidades de información de los grupos de investigación y desarrollo, b) capacidad tecnológica de la industria metalúrgica argentina y c) concentración de la obtención de datos técnicos.

La estructura y capacidad de trabajo viene dada de acuerdo a las posibilidades económicas y personal disponible (1 profesional, 1 técnico, 2 ayudantes). En el diagrama Nº 1 están representadas las operaciones del Servicio

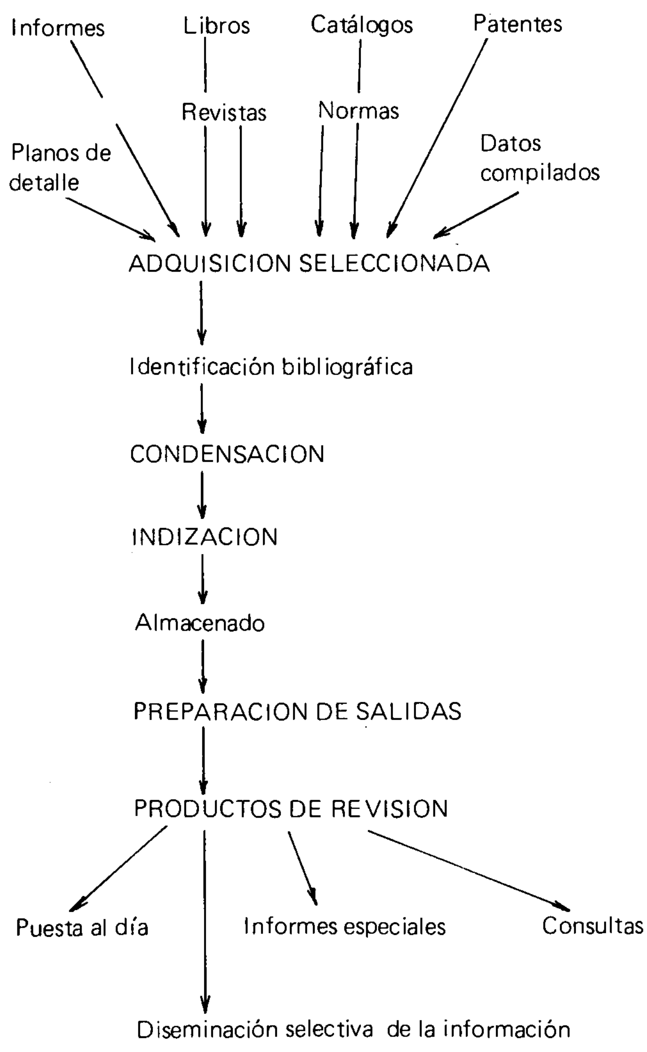

Diagrama Nº 1

11.IV.b. Descripción

Describiremos a continuación las etapas más importantes del diagrama Nº 1.

11.IV.b.1 En el **proceso de adquisición** se verifica, de acuerdo a lo leído en las diversas funetes de información secundaria, para la posterior adquisición del material que interesa, además del que se recibe en forma permanente como ser revistas, catálogos, etc.

11.IV.b.1.1 En información científica-técnica se revisaron los temas de mayor interés en el presente trabajo como ser: aceros, soldadura, fundición de aceros inoxidables, bombas, válvulas, loops de ensayos, tubos.

Hemos consultado las siguientes publicaciones secundarias: Nuclear Science Abstracts, INIS Atomindex, ABTICS, Metal Abstracts, STAR, publicaciones especiales del Iron and Steel Inst. y de la ASTM. Se han seleccionado 400 referencias de más de 1000 trabajos consultados para el presente estudio. Se cuenta con la versión final de 282 trabajos de los mencionados en el fichero de REFERENCIAS. El fichero conteniendo las referencias con su abstract correspondiente se adjunta a la versión original. El lector podrá tener acceso al mismo en el Consejo Federal de Inversiones y también en el Servicio de Análisis de Información de la Gerencia de Tecnología de la CNEA. Las copias de los trabajos están a disposición de todo consultor en el servicio precitado. (Téngase en cuenta al consultar el fichero de referencias que la numeración no guarda estricta correlatividad debido a que se ha hecho una selección muy estricta del material que se entrega acompañado el trabajo, contando con una revisión mas exhaustiva que está depositada en el Servicio).

11.IV.b.1.2 La **catalogoteca** ha sido organizada como consecuencia del desarrollo del presente trabajo. Para la organización de la misma se siguieron los siguientes pasos:

a) se tomó una lista de proveedores de elementos para centrales nucleares publicada por la revista Nuclear Engineering International (versión marzo 1973) de la cual se eligieron 1000 empresas. Se enviaron cartas a todas ellas solicitándoles información específica de los componentes que se consideran como más factible su industrialización en la Argentina, además de otros componentes que se utilizarán en centrales nucleares y deberán importarse. Los temas elegidos fueron los siguientes: protección de radiaciones, sistemas de filtración y ventilación, componentes estructurales, del circuito primario, del secundario, intercambiadores de calor, servicios especiales de ingeniería y otros, instrumentación y control, sistemas de control, recipientes de presión, turbo-generadores. Se recibió respeusta de 450 empresas, reuniendo un total de 1600 catálogos hasta el presente.

b) Se ordenaron los sistemas de recuperación por dos vías: por proveedor y su representante si lo tiene en nuestro país, y por temas.

El sistema de recuperación por tema está ingresando en el sistema tipo Taube-Uniterm que está descripto en detalles en el punto IV.2.d. El tesoro de palabras elaborado para el mismo contiene 400 términos, identificando en la tarjeta al catálogo anteponiendo la letra C antes del número. Por medio de este sistema de usuario puede saber en pocos minutos qué número de catálogos se disponen en el servicio de un dado tema, por ejemplo intercambiadores de calor, pues se encuentran ingresados todos en una misma tarjeta. En el anexo II figuran todas las tarjetas del sistema y en las mismas el usuario puede disponer ya de la cantidad y clase de información que hallará en el servicio.

11.IV.b.1.3 Se ha realizado una revisión exhaustiva de las **normas** existentes sobre los diversos componentes que se analizan en el presente estudio. La revisión se realizó sobre las siguientes fuentes: IRAM, British Sandards, ASME Code, API, NEMA, DIM y ASTM.

Se adquirieron las normas IRAM British Standard, y ASME, de las demás ya nuestra biblioteca contaba con muchas de ellas.

11.IV.b.1.4 Respecto de **patentes** se analizaron temas en publicaciones especiales, como por ejemplo British Patent Abstracts, Patentes de invención de la R.A., habiendo hallado varias referencias respecto de temas como loops de ensayo. No ha sido importante el número de patentes obtenidas para otros componentes como bombas, válvulas, etc.. No se profundizó con más detalles dicha revisión pues en esta etapa del trabajo, donde todavía no entran en proceso de fabricación los componentes, no se conocen las necesidades de los futuros usuarios. Se tiene en este momento acceso a toda información necesaria, en caso que se requiriera dentro de la industria local adquirir tecnología y la misma se encuentra protegida por patentes en el país podrá ubicarse fácilmente dicha información. Este punto es de interés para temas tratados en el capítulo sobre transferencia de tecnología, y se volverá sobre él.

11.IV.b.2 En la etapa de **condensación** se condensan los conceptos principales expresados en el trabajo en consid ración. El presente informe es acompañado por un fichero que contiene una ficha por cada trabajo, libro, o referencia de interés al tema central y otros que se consideró útiles para los usuarios del mismo (referentes al punto IV.2.a.i.). Contiene 400 tarjetas en las cuales se incluyen: referencia bibliográfica, el resumen del trabajo, al lado del número de la referencia se indica por medio de un asterisco si en el servicio de Análisis de Información se halla la copia completa de la referencia. El resumen generalmente contiene el o los tópicos más importantes tratados en el trabajo, la metodología de los ensayos y señales en forma suscinta los resultados y conclusiones. En el diagrama Nº 2 se presenta una copia de una tarjeta tal como fijura en el fichero adjunto.

* 1181
L. Malrin
Progress with the ultrasonic testing of small tubes for the nuclear industry.
C.E.A., 12 colloque de métallurgieu, Saclay, 1968
An improved method for the detection of longitudinal internal defects in small seamless steel tubes is described. Although conventional testing by transverse scanning can be used for good quality tube, an additional testing process with greater efficiency is recommended flat internal defects not found by the conventional test, were detected by the apparatus which is also sensitive to internal splits internal hollows, external grinding, eccentricity in the walls, and shock deformations.

El número que tiene la ficha en el margen a la derecha (en el ejemplo es el número 1181) es el mismo que se le adjudica al documento que se encuentra en el servicio precitado, al asterisco (*) es indicador que disponemos de la copia completa.

11.IV.b.3 En la etapa posterior (como se señala en el diagrama Nº 1) se procede al indizado: que es el proceso de seleccionar o asignar palabras claves de los temas contenidos en el documento. En esta operación se trata de aplicar sobre los documentos las entradas más adecuadas para describir su contenido. Con estas entradas se prepara el material para recuperar la información de acuerdo a las preguntas formuladas. Dichas entradas expresan un conjunto de nociones o ideas que representan el o los conceptos fundamentales desarrollados en el documento. De allí que la representación genera un problema de lenguaje, pues la indización sirve de puente entre el lenguaje de los documentos y el de las consultas. La representación de un documento o de una consulta se hace mediante la operación llamada indización coordinada y que consiste en:

a) una tarea de análisis por extracción de nociones.

b) tarea de síntesis, por reagrupamiento de las nociones a través de un encadenamiento más elaborado.

Como ejemplo describiremos el documento del diagrama Nº 2 que habla sobre ensayos de ultrasonido en tubos para la industria nuclear, la determinación de defectos internos y control de calidad.

INTERNAL DEFECTS (DEFECTS)									
0	1	2	3	4	5	6	7	8	9
	1181								

Diagrama Nº 3

STEELS									
0	1	2	3	4	5	6	7	8	9
C–160	1181	C–532	23093	C–84	C–1245	C–1486		C–498	23069
9080	9081	23102		C–1484	23055			23108	
	23001			9064	23105				
				23064					

Diagrama Nº 4

TUBES									
0	1	2	3	4	5	6	7	8	9
C–1050	1181	9042	C–1443	C–1044	C–1045	C–1446	C–1447	C–1238	C–749
9020	9001	23062	9033	C–1444	C–1245	9026	9077	9038	C–1079
9040	9041			23144	C–1445	9076			C–1239
	9081				9075	23046			9009
					2313	23056			9029
									9039
									9079

ULTRASONIC TESTING (NON–DESTRUCTIVE TESTING)									
0	1	2	3	4	5	6	7	8	9
23110	1181	C–1302	C–1173	C–1174	C–1175	C–596	C–1177	C–1178	
						C–756		C–1298	
						C–1176			

11.IV.b.4 Sistema de control de vocabulario

El lenguaje utilizado en el presente trabajo está basado fundamentalmente en la clasificación elaborada a partir de la información analizada y en estrecha relación con la clasificación del Thesaurus of Metallurgical Terms elaborado por el Metals Information Staff de la American Society for Metals. El vocabulario elaborado figura al final del presente capítulo, los términos figuran en inglés debido a que casi la totalidad de la información citada se encuentra en dicho idioma.

Debido a que un documento trata más de un tema, hemos utilizado un sistema de indizado múltiple para permitir que por yuxtaposición de varios conceptos el consultor consiga extraer la información que más se adecúe a su pregunta.

En el tesoro de palabras claves elaborado figuran varios niveles de jerarquía considerados: a) un primer nivel de jerarquía a los conceptos más amplios como ser Steel, Non Destructive Testing, etc.; b) un segundo nivel que se refiere a términos o conceptos más específicos relacionados con el encabezameinto principal como ser Carbon Steel, Ultrasonic testing etc.; c) un tercer nivel se refiere a un concepto más preciso o de mayor detalle del considerado en b) como ser Low Carbon Steel, etc..

Las tarjetas descriptoras de estos términos se encuentran ubicadas en el fichero según el orden dado en la lista, y que corresponde al orden alfabético de los encabezamientos principales clase a); detrás de los mismos se encuentran también acomodadas alfabéticamente, las tarjetas de la clase b) y luego las c). A título de ejemplo, tenemos la tarjeta Steel, luego la sucede Carbon steel (Steel), y detrás AISI 1010 (Carbon Steel-Steel), High carbon steel (...) etc..

El ejemplo presentado en el diagrama Nº 2 ha sido indizado con las siguientes palabras claves o descriptores: Ultrasonic testing (Non destructive testing), Internal defects, Steel, Tubes, En general, en el presente trabajo las referencias, tanto de tipo informe-documento como los catálogos han sido ingresadas con un promedio de 7 descriptores, para asegurar una mayor precisión durante la operación de búsqueda.

Dentro de las reglas de construcción del tesoro, hemos construído sobre las siguientes bases:

- Materiales
- Propiedades; condiciones y características
- Equipos, mecanismos, aparatos.
- Procedimientos.
- Clases de utilización.

Dentro de la evolución del tesoro hemos realizado un estudio estadístico de la frecuencia que se produce en el indizado de los documentos, para evitar ingresar descriptores que tendrán a posteriori poco uso o que resultan irrelevantes por su precisión. Esta tarea continuará pues se proseguirá ingresando material a fin que ingrese al Servicio. El tesoro contiene gran cantidad de descriptores, esto se debe a la diversidad de temas tratados o consultados por los autores de los diferentes capítulos que acompañan al trabajo.

11.IV.b.5 Métodos de recuperación

11.IV.b.5.1 El método utilizado para el almacenamiento de la indización es el de fichas con columnas tipo Taube-Uniterm (realmente es UNICONCEPTO) (Ver ejemplo Nº 2) (corresponde a la etapa siguiente del diagrama Nº 1).

La ficha descriptora tiene señalada en su parte superior el nombre del tema y el resto está subdividido en 10 columnas numeradas del 0 al 9, donde se ingresa el número del documento, ubicándolo en la columna perteneciente al último dígito. Con esta disposición permite presentar una forma práctica de revisión cuando se enfrentarán varias tarjetas para observar la coincidencia de números que se referirán a coincidencia de documentos que contienen información útil al usuario.

La búsqueda en el anexo II se realiza de la siguiente manera: el usuario tiene formulada su pregunta, deberá acomodar los conceptos a los descriptos en el presente trabajo. Una vez ubicados los descriptores que interesan, el usuario extraerá las tarjetas Taube-Unitem correspondientes. Paso siguiente deberá enfrentarlas y recorrerlas por columna para observar y extraer los números de documentos que se repitan en ellas, tenemos el ejemplo de los diagramas, 3, 4, 5 y 6 donde se repite el núemro 1181 en las cuatro. Si el usuario está solamente interesado en los temas de tubos de aceros puede consultar los trabajos 1181, 9081 y C—1245.

11.IV.b.5.2 Otros método para recuperar informaciónes a través de los **autores** de los trabajos citados: para tal fin se acompaña el presente trabajo con el anexo III que contiene en cada tarjeta el nombre del autor y los núemros de documentos que dicho autor escribió en forma personal o en colaboración (diagrama Nº 7).

En total el tiempo que interviene el consultor para extraer una información con este sistema es del orden de 2 a 3 minutos. Debido a la sencillez y la precisión con que se obtiene la información han utilizado los sistemas descritos en el punto IV.2.d. y subsiguientes para la documentación y análisis de la información del presente estudio.

11.IV.b.5.3 Búsqueda bibliográfica del usuario

La búsqueda en fichero: la consulta de un fichero se efectúa del siguiente modo:

- Búsqueda de la rúbrica de clasificación correspondiente a la materia investigada, tanto en el plan de clasificación, como en el índice alfabético de ese plan.
- Búsqueda del fichero correspondiente.
- Búsqueda de la ficha separadora que indique la localización precisa de las fichas útiles.
- Consulta de las fichas una por una.
- Transcripción de las referencias útiles.

Si la búsqueda se apoya en varios conceptos representados por rúbricas de clasificación diferentes. hay que proceder igual en cada una de esas secciones; el usuario debe coordinar mentalmente los conceptos durante la lectura del título y resumen eventual. Si tiene interés, por ejemplo, en los temas A y B y no en el C, al examinar cada una de las fichas del fichero A y del B, debe preguntarse si el documento correspondiente responde bien al conjunto de la consulta.

La consulta del fichero de autor es más simple: basta buscar allí alfabéticamente por el apellido del autor y en la ficha encontrarán registrados los números de los trabajos por él realizados, ya sea como autor personal o co-autor (diagrama Nº 7). La búsqueda en el fichero presenta las siguientes ventajas:

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— La mayoría de los usuarios la practicaron durante sus estudios escolares y la conoce bien.

— De acceso a una ficha que puede contener datos bibliográficos completos y, llegado el caso, los resúmenes.

— Como los ficheros se mantienen regularmente al dia, consulta se hace en un fichero único; éste no es el caso de los índices, donde casi siempre es necesario consultar varios volúmenes que cubren períodos diferentes..

— Permite el "rastreo" o búsqueda documentaria "ayudando al azar".

11.IV.b.5.4 Cualquiera sea el método utilizado, la búsqueda documentaria tiene las siguientes etapas:

— La formulación de la pregunta.

— La indización de la pregunta.

— La búsqueda propiamente dicha.

— La reproducción de las referencias.

— La filtración de las referencias pertinentes.

— El envío de la bibliografía.

11.IV.b.5.5 La búsqueda (Retrieval):

— Leer e inscribir los números comunes. 3 segundos por respuesta.

— Volver a clasificar las fichas de descriptores. 10 segundos por descriptor.

— Extraer las fichas de los documentos pertinentes. 18 segundos por respuesta.

— Volver a clasificarlas, 12 segundos por respuesta.

En total, el tiempo que invierte el consultor para extraer una información con este sistema es del orden de 20 minutos. Debido a la sencillez en la operación y la precisión que se obtiene, ha utilizado el sistema descripto en el punto 2 para la documentación y análisis de la información del presente estudio. Para la búsqueda el usuario deberá recurrir al sistema Taube-Uniterm descripto y luego con los números de referencia obtenidos dirigirse al fichero de resúmenes extraer las tarjetas de los números seleccionados. En esta etapa ya podría obtener parte de la información requerida, y eventualmente decidirá si le interesa leer el trabajo completo. El Servicio de Análisis de información de la Gerencia dispondrá en forma permanente de las copias de los trabajos al que podrán dirigirse solicitando las mismas o cualquier información conexa. En el anexo I puede consultar el contenido de todas las tarjetas del Sistema Taube-Unitem. Una vez que la pregunta documentaria ha sido formulada e indizada, se puede proceder a la búsqueda propiamente dicha, interrogando a las memorias, en las que se halla almacenado la indización de los documentos. Esto permite extraer un cierto número de trabajos cuya indización corresponde a la pregunta. La selección se hace por lo tanto en dos etapas: primero por el indizado de la pregunta, se obtienen los números de documentos correspondientes a los temas seleccionados y en una segunda etapa se buscan las fichas donde se toma contacto con el autor, título y resumen del documento, posteriormente si es de interés se solicitará la copia del trabajo.

En los diagramas Nº 3, 4, 5 y 6 podemos observar tres fichas de columnas tipo Taube-Uniterm, extraídas del fichero de descriptores.

11.IV.b.5.6 Modo operativo de la Búsqueda

— Extraer las fichas de descriptores de la pregunta. 15 segundos por descriptor.

— Comparar los números de los documentos (supongamos: 10 comparaciones por respuesta). 30 segundos por respuesta.

ANEXO I LISTA DE PALABRAS CLAVES

A

ABRASION
ACCUMULATORS
ACOUSTICS
ACOUSTIC MEASUREMENTS
AIR
AIR CONDITIONING
AIR SAMPLERS
ALKALI METALS
ALUMINIUM
ALUMINIUM ALLOYS
ANNEALING
ANTIMONY
ARCHITECTURAL DESIGN
ARGENTINE
ARGON
ARGON — OXYGEN SYSTEM
ARSENIC
ASSEMBLIES
ATOMIZERS
    Nozzles
AUTOMATION

B

BALANCES
BARS
BATHS
    Salt baths
BEARINGS
BENDING
BIBLIOGRAPHY
BILLETS
BIOLOGICAL CABINETS
BISMUTH
BLOWERS
BOILERS
BONDING
BORING
BRASS
    Admiralty brass
BRAZING

C

CIRCUITS
    Auxiliary circuits
CLADDING
CLAMPS
CLEANING
    Blast cleaning
    Ultrasonic cleaning
COATINGS
    Vacuum deposited coatings
COBALT ALLOYS
COILS
COMPRESSORS
    Air compressors
    Gas compressors
COMPUTATION
    Fortran
COMPUTER COMPONENTS
CONCRETE
CONDENSERS
CONNECTIONS use JOINTS
CONSTRUCTION
CONSTRUCTION EQUIPMENT
    Cranes
CONSTRUCTION MATERIALS
CONSULTANT SERVICES
CONTAINERS
CONVERTERS
    Electric converters
    Motor generators
    Frequency converters
COOLERS
COOLING SYSTEM
COOLING TOWERS
COPPER

- COPPER ALLOYS
  - Cupronickel alloys
- CORROSION
- CORROSION PHENOMENA
  - Corrosion fatigue
  - Fouling
  - Physical effects
    - Erosion
  - Electrochemical effects
    - Ocluded cell corrosion
      - Crevice corrosion
      - Intergranular corrosion
      - Pitting
  - Testing
    - Lab. methods
      - Physical methods
        - Stress corrosion
  - Corrosion resistant alloys
- COSTS
- COUPLINGS
- CRANKSHAFTS
- CREEP
- CRYOGENIC SYSTEMS
- CRYSTALLIZATION PROCESSES
- CUTTING TOOLS
  - Boring tools
  - End milling tools
  - Reammers
  - Saws
  - Slot drills
  - Twist drills
- CHLORINATION
- CHLORINE SOLUTIONS
- CHROMIUM
- CHROMIUM ALLOYS
- CHUKS

D

- DAMPERS
- DAMS
- DATA
- DECARBURIZATION
- DECONTAMINATIÓN
- DEFECTS
  - Internal defects
- DEGASSING
- DESIGN
- DESTRUCTIVE TESTING
- DESULPHURIZING
- DETECTORS
  - Alpha detectors
  - Crack detectors
  - Flow detectors
  - Gamma detectors
  - Gas detectors
  - Germanium dectectors
  - Lithium detectors
  - Neutron detectors
  - Radiation detectors
  - Semiconductors devices
  - X Ray detectors
- DIODES
  - Photodiodes
- DISTILLATION PROCESS
  - Multistage flash distillation
- DOORS
- DREDGERS
- DRILLING
- DRY BOXES
- DRYING
- DUST COLLECTORS

E

- ECONOMICS
- EFFLUENT TREATMENT EQUIPMENT
- ELASTICITY
- ELECTRIC CONDUCTORS
  - Isolators
- ELECTRIC INSTALLATIONS
  - Interruptors
- ELECTRIC INSULATING MATERIALS
- ELECTRIC PROPERTIES
- ELECTROCHEMICAL DEPOSITION
- EMBRITTLEMENT

L

- LABORATORIES ACTIVITIES
  - Chemical laboratories ware
  - Heat resistant laboratories ware
- LEAD
- LEAK DETECTORS
- LEGISLATION
- LINEAR ACCELERATOR
- LITHIUM
- LOAD POSITIONERS
- LOADING
- LOOPS
  - Loop circuits
- LOW TEMPERATURE
  - Containers
- LUBRICANTS
  - Dry film lubricants
  - Graphite

M

- MACHINING
  - Rotating machines
  - Sawing
- MACHINE TOOLS
- MAGNESIUM ALLOYS
- MAINTENANCE
- MANGANESE
- MATERIALS HANDLING
- MEASURING INSTRUMENTS
  - Accelerometers
  - Ammeters
  - Control equipment
    - Tachioratiometers
    - Temperature controller
  - Control services
  - Dilatation joints
  - Pipe joints
  - Pressure joints
  - Stainsless joints
  - Tube joints
    - Automatic control
    - Cryogenics temperature readout
  - Densitometers
  - Digital voltmeters
  - Dosimeters
  - Electrometers
  - Flow meters
  - Gages
    - Hydraulic gages
    - Ionization gages
    - Isotope gages
    - Strin gages
  - Strain gages transmitters
  - Pressure gages
    - Thickness gages
    - Vacuum gages
    - Welding gages
  - Indicator/controller
  - Infrared—spectrum
  - Isotopes
  - Meters
    - Microhom meters
    - Ph meters
    - Potentiometers
  - Pressure transducers
  - Pyrometers
  - Ratemeters
  - Sensors
    - Neutron humidity meas. sensors
  - Temperature controllers
  - Thermocouples
  - Miniature thermocouple
  - Thermocouple vacuum gages
  - Thermometers
  - Time counters
  - Transducers
  - Voltmeters
  - Weight measuring systems
- MECHANICAL PROPERTIES
- MEDICAL SYSTEMS
- MELTING
  - Arc melting

POLYMERS
POLLUTION
POSITIONERS
POTASSIUM
POWDER METALLURGY
- Powder alloys

POWER PRODUCTION
POWER STATIONS
- Hydraulic power stations
- Nuclear power plants
- Thermal power stations

POWER SUPPLIES
- Alternators
- Switchers
- Transformers

PRESSES
PRESSURE VESSELS AND CONTAIMENTS
- Prestressed concrete pressure vessels

PRIMARY CIRCUIT COMPONENTS
PROCESSING
PRODUCTION
PROXIMITY
PUMPS
- Axial flow pumps
- Canned pumps
- Centrifugal pumps
- Circulating pumps
- Condensate pumps
- Corrosion resistant pumps
- Diaphragm pumps
- Diffusion pumps
- Electromagnetic pumps
- Feedwater pumps
- Floating pumps
- Gear pumps
- Glandless pumps
- High pressure pumps
- Horizontal pumps
- Mechanical seal pumps
- Mixed flow pumps
- Plunger pumps
- Radial flow pumps
- Sodium pumps
- Submersible pumps
- Vacuum pumps
- Vertical pumps

Q

QUALITY CONTROL
QUALITY CONTROL SERVICES

R

RADIATION EFFECTS
RADIATION SAFETY EQUIPMENT
RADIATORS
RADIACTIVE MATERIALS
RADIOACTIVE TRANSPORT
RADIOACTIVE WASTES
RADIOACTIVITY
RADIOCHEMISTRY
RADIOGRAPHY
- Gamma radiography
- Industrial radiography

REACTORS
- Nuclear reactors
- AGR
- BWR
- CANDU
- FBR
- Gas cooled reactors
- Gas cooled fast breeder reactor
- HWGCR
- HWR
- HTGCR
- LWR
- Liquid metal cooled reactors
- LMFBR
- PWR
- PICKERING
- Reactor cores
- Sodium cooled fast breeder
- THTR

RECORDERS

Stainless steels
Steel castings
Structural steels

Titanium steels
Tool steels
STEELWORK
STRENGTH TESTING
STRESS
Stress concentration
STRESS ANALYSIS
STRUCTURES
SUPPORTS
SURFACE
SWITCHES (electric use)
SWITCHES (liquid level use)
SWITCHGEARS
SYNCHROS use Servomechanisms'

T

TANKS
TANTALUM
TELLURIUM
TEMPERATURE
High temperature
TEMPERING
TESTING
TESTING MACHINES
Concrete testing
Universal
TESTING LABORATORIES
THERMAL ELECTRIC UNITS
THERMAL EXPANSION
THERMOANALYZER
THICKNESS
THORIUM
TIN
TITANIUM
TITANIUM ALLOYS
TITRATORS
TORQUE
TRAINING
TRANSFORMERS
TRANSMITTERS
TRAPS
TROUGHS
TUBES
Flexible tubes
Phototubes
Spiral tubes
Stainless tubes
Tubes—electronics
Cathode ray tubes
Photomultipliers
TUBING
Conectors
TUNGSTEN ALLOYS
TURBINES
Gas turbines
Steam turbines
Turbine blades
TURBOALTERNATORS

U

ULTRASONICS
UNITED KINGDOM
UNITED STATES
URANIUM
Uranoi

URANIUM
Uranium hexafluoride
Uranium natural
Uranium processing system
USSR

V

VACUUM
Vacuum equipment
Vacuum instruments
Vacuum metallurgy
Vacuum process
Vacuum systems
Vacuum bellows
Ultra—high vacuum systems

Vacuum treatment

VALVES

Actuators

Air valves

Ball valves

Bellows valves

Bronze valves

Butterfly valves

Cap valves

Cast steel valves

Cones

Check valves

Diaphragm control valves

Digital valves

Electromagnetic valves

Flanged valves

Gate and globe valves

High pressure valves

Hydraulic valves

Low temperature valves

Magnetic valves

Membrane valves

Nuclear valves

Plastic valves

Recirculation valves

Relief valves

Screwed valves

Self seating seal valves

Solenoid valves

Stainless valves

Steam valves

Steel valves

Water valves

VANADIUM

VANADIUM ALLOYS

VENTILATORS

VIBRATION

W

WALLS

WARNING SYSTEMS

Alarm relays

Electronic alarms

WASTES

WATER TREATMENT

Cooling water systems

Heavy water

Waste water recycle system

WEAR

WELDED JOINTS

WELDING

Arc welding

Bore welding

Micro welding machine

Seam welding machine

Spray welding

TIG welding

Weldability

Welder qualification

Welding procedure

WELDS

WHEELS

WIRES

WIRE CLOTHS

WORKING

Cold working

X

X RAY DIFFRACTION

X RAY SPECTROGRAPHS

Z

ZINC ALLOYS

ZIRCALLOY

ZIRCONIUM

ZIRCONIUM ALLOYS

ANEXO II – SISTEMA DE RECUPERACION TIPO TAUBE–UNITERM

ABRASION

			C–113		C–115	C–536			

ACCUMULATORS

							C–1647		

ACOUSTICS

							C–457	23268	

ACOUSTIC MEASUREMENTS

C–600									

AIR

23070	C–1561				23095				

AIR CONDITIONING

			C–1193	C–1194					C–759

AIR SAMPLERS

						C–26	C–787		C–269
						C–786			C–509

ALKALI METALS

23100	C–911	C–912					C–1477		

ALUMINIUM

6560	6361	6892	6463	6464	6385	6486	6557	6508	20269
	6451	20202	6603	6524	6445	22126	20107	6528	20649
	22331	20482	6613	20094	6475	22216	20177	20508	C–909
		22332	6803	20284	6505		20247	20568	C–1589
		23222	20293	20414	20095		20907	20678	
			20553	C–154	20215		22187	22188	
			C–1463	C–1044	20285			22328	
			C–1483		20755				
					22295				

ALUMINIUM ALLOYS

C–290		C–292	11133	C–1044	C–1045				C–289
			C–1043						

ANNEALING

1010	1011	6022	6213	6144	6025	6476	6247	1018	1019
6350	6131	6222	6483	6204	6385	6796	6447	6008	6099
6420	6301	6282	6533	6234	6415	6846	6547	6308	6129
6710	6341	6792	6713	6484	6615		6687	6578	6349

	6760 6800	6381 6461 6681		6803	6514 6544 6754 22284			C–1107		6469 6869
ANTIMONY				C–1483	C–574					
ARCHITECTURAL SERVICES				C–343						
ARGENTINE										23249
ARGON	23080		23082		23074				23068	
ARGON–OXYGEN SYSTEM		23071				23065	23066 23076	23067	23068	23069 23089
ARSENIC				22223 C–1483	C–574					
ASSEMBLIES				C–633						
ATOMIZERS										
NOZZLESS(ATOMIZERS)										C–1049
AUTOMATION					20384			23247		
BALANCES		C–411	C–412				C–966	C–407 C–967	C–408	
BARS	22180 C–1610				C–774	8135		1107		9009 23269 C–1529

BATHS									
SALT BATHS (BATHS)									
									C–1109
BEARINGS									
23290		23162	23173	C–1334	C–1335		C–857	C–618	
			C–1333			23326	C–1597	C–858	
						C–856			
BENDING									
C–1610	6391				8005		6537	6008	6499
	8001				22245		9077	5478	9079
	C–1611								
BIBLIOGRAPHY									
23260								23258	23259
BILLETS									
								9078	
BIOLOGICAL CABINETS									
								C–488	
BISMUTH									
				C–574					
BLOWERS									
	C–1341	23082		23074	C–505	C–616			23079
				C–504	C–1195	C–1196			
BOILERS									
C–710		23322		C–1594				C–368	C–1329
				C–1664				C–708	
BONDING									
		23162							
BORING									
				23144					
BRASS									
22230	20091	3072	3073	20104	20015	1056		20018	C–1159
C–1510		20082	20343	20324	20555	20016		20278	
						20106			
						20276			
						20506			

ADMIRALTY BRASS (BRASS)

						20026		20228 20298	C–69

BRAZING

	1141 11131		C–1483	C–1094		C–1096	C–1107	C–1638	

CABLES

C–1460	C–1491	23202 C–1492	23203 C–1493	C–1494			23198	C–1619	

CADMIUM

				20094 C–574			20528		

A. C. CAPACITORS

C–70									

CARBIDES

C–230			C–183						

CARBON

22240	6061	23072	6853 C–943	6824 6884 22204 23074	6325 6635 23205 C–1575	6866 23076	6617	6408 23068	6089 6149

ACTIVATED CARBON (CARBON)

			23303	C–1394					C–629

CASINGS

		23252							

CASTINGS

6070 23070 C–290 C–1590	6281 23351	1132 C–292	6543 C–113		6885 23105 C–885	C–1096	6627 23077 C–1157	6498	6279 C–289 C–489 C–1369

HIGH ALLOY STEEL CASTINGS (CASTINGS)

					C–55	C–1157			

DIECASTINGS (CASTINGS)

	C–291							C–1508	

CONVERTERS

				C–1624	23075 23085 C–695		C–737		

ELECTRIC CONVERTERS (CONVERTERS)

MOTOR GENERATORS (ELECTRIC CONVERTERS–CONVERTERS)

						C–486			

FREQUENCY CONVERTERS (CONVERTERS)

						C–96	C–97	C–98 C–1248	

			C–103						

COOLERS

	C–1561	C–1562	C–1563	C–1564	23135 C–1565	C–1566			

COOLING SYSTEMS

			23163	C–1564	C–1565		23247 C–1617		

COOLING TOWERS

23140		23142		C–144	C–145	C–146	C–147 C–367		

COPPER

20300 20320 20330 20530 22230 C–1100	20151 20271 20321	20202 20212 20262	6673 20013 20073 20133 22233	20094 20204	6495 6715 8105 20075 20255 20515 20695 22285	1056 8106 20006 20016 20296	6557 20117 20567	6168 20588 20698	20299 20319 23299 C–1589

COPPER ALLOYS

				C–1044	C–1045				

CUPRONICKEL ALLOYS (COPPER ALLOYS)

		C–1592							C–69 C–1649

CORROSION

		20132	20183		8025	20006	8027	20018	20239

		C–1582	20623		20005		8107	20038	20689
			C–1573		20015		20007		
			C–1583		20145				
					20755				

CORROSION PHENOMENA

20070	22021		20053	20244	20095			23108	20409

CORROSION FATIGUE (CORROSION PHENOMENA)

20860	20851	20802	20803	20804	20865	20806	20807	20858	20859
20880	20861	20862	20863	20884		20856	20857		
	20881	20872	20873			20866	20887		
	23101	20882	20883			20886			
						20906			

FOULING (CORROSION PHENOMENA)

20600	20281	20532	20183	20944	20995	20506	20137	20708	20109
20720		20542	20723		20705	20956	20937	20728	20559
		20702	23163		20725				20699
		20712							

390

PHYSICAL EFFECTS (CORROSION PHENOMENA)

20500									

EROSION PHYSICAL EFFECTS–CORROSION PHENOMENA)

20600	23051					23106			
	23101								

OCLUDED CELL CORROSION (ELECTROCHEMICAL EFFECTS–CORROSION PHENOMENA)

20320	20281	20002	20013	20264			20257	20008	
20500		20142							

CREVICE CORROSION (OCLUDED CELL CORROSION–ELECTROCH. EFFECTS–CORROS. PHENOMENA)

	23101								

INTERGRANULAR CORROSION (OCLUDE. CELL CORROSION–ELECTROCH. EFFECTS–CORROSION PHENOMENA)

20550	23101	20332		20194					10619
				20844					20229

PITTING (OCLUDED CELL CORROSION–ELECTROCHEMICAL EFFECTS.–CORR. PHEN.)

	23101								

STRESS CORROSION (PHYSICAL METHODS–LAB. METHODS–TESTING–CORROSION)

					675	676	23327		8049

CORROSION RESISTANCE									
C–1530	C–1531	C–1542		C–1594	23015			C–1588	
		C–1592							
CORROSION RESISTANT ALLOYS (CORROSION)									
		C–112	C–113	C–114	23015			C–968	
				C–1044	C–55				
					C–115				
COSTS									
23050	23231	23052	23013	23164	23165			23158	1049
23140		23142	23053					23258	23069
									23129
COUPLINGS									
C–300	C–21	C–302	C–303	C–634	C–645			C–268	
			C–643	C–644					
			C–1523						
CRANKSHAFTS									
							C–917		
CREEP									
22340	6541	23362	6153				6367		6139
									6549
CRYOGENI. SYSTEMS									
		23292	C–1073	C–1074		23326			
						C–1076			
CRYSTALLIZATION PROCESSES									
C–80									
CUTTING TOOLS									
C–1590			C–413	C–774				C–778	C–1609
								C–818	
BORING TOOLS (CUTTING TOOLS)									
				C–774					
END MILLING CUTTERS (CUTTING TOOLS)									
					C–775				
REAMMERS (CUTTING TOOLS)									
						C–776			

INTERNAL DEFECTS (DEFECTS)

	1181								

DEGASSING

						C–1246		C–1558	

DESIGN

23140	23051	23112	23123	23134	23105	9046	8207	23148	11129
23230	23061	23162	23163	23354	23165	23116	23107	23168	23019
C–830	23091	23252		C–1664	23275	23276	23127	23228	23229
C–890	23141	C–1522			C–1575		C–647	C–228	C–619
	C–1571				C–1595		C–817	C–1598	C–1599

DESTRUCTIVE TESTING

C–320	C–321		1193					C–319	
			23013						

DESULPHURIZING

	23081								

DETECTORS

C–1030	C–341	C–1062	C–503	C–684	23245	23256	C–597	23268	23239
C–1360	C–701	C–1352	C–1063	C–934	C–595		C–697	C–698	23269
	C–731		C–1353		C–1105			C–768	C–509
	C–1031		C–1363						C–679
	C–1331								C–1029
	C–1541								C–1359
	C–1631								

ALPHA DETECTORS (DETECTORS)

C–700									

CRACK DETECTORS (DETECTORS)

									23299

FLOW DETECTORS (DETECTORS)

					C–1165				

GAMMA DETECTORS (DETECTORS)

	C–731				C–735	C–696			
						C–1496			

GAS DETECTORS (DETECTORS)

					C–1105				

GERMANIUM DETECTORS (DETECTORS)

C–930	C–931	C–932		C–924	C–925	C–926			C–929
C–1160		C–1572		C–1634					

LITHIUM SILICON DETECTORS (DETECTORS)

C–1160	C–731	C–702	C–703						
		C–1572							

NEUTRON DETECTORS (DETECTORS)

C–1350			23243		C–595	C–26		C–688	23139
			C–683		C–685	C–686		C–1448	C–1449
			C–1453		C–1105	C–1496			
					C–1495				

RADIATION DETECTORS (DETECTORS)

		C–1572				C–736	C–687		

SEMICONDUCTOR DEVICES (DETECTORS)

	C–731						C–337		

X-RAY DETECTORS (DETECTORS)

	C–731	C–1572							C–699

DIODES

		23252							

PHOTODIODES (DIODES)

						C–336			

DISTILLATION PROCESS

C–660					C–55				

MULTISTAGE FLASH DISTILLATION (DISTILLATION PROCESS)

C–660									

DOORS

C–520	C–521		C–513	C–1164	C–515	C–516	C–517	C–518	C–519
	C–1221				C–805		C–1257	C–1258	C–1259
								C–1398	

DREDGERS

	C–981								

DRILLING

						C–366			

DRY BOXES

							C–487		

ENAMELS

		C–122	C–123						

ENGINES

	C–91	20122 C–292			C–815				20099 20119 20219

DIESEL ENGINES (ENGINES)

C–90 C–1210	C–81						C–827		C–89

ENGINEERING SERVICES

C–1280 C–1600	C–561 C–1281	C–1282	C–343 C–1153 C–1283	C–534 C–954 C–1164 C–1284	C–535	C–1226	C–647 C–1277	C–1278	C–1279 C–1389 C–1439 C–1599

ENVIROMENTAL TESTING

C–320 C–340	C–321						C–537	C–218	C–219 C–319

EUTECTICS

				23094					

EVAPORATION PLANTS

		C–82			C–55	C–636			

EVAPORATORS

				C–724			C–637	C–638	

EXPANSION

		C–1642	C–1643				C–1237	C–1238	C–1239

EXTRUSION

C–1510	C–1511 C–1571					22256	C–1597	9078	9009

FABRICATION

8010 8100 8110 20620 C–890 C–1580		8112 23012 C–1072	23013 23103 C–1073 C–1533 C–1573 C–1623	8214 23144 C–1594	8015 23105 23135 C–1595	8056 C–1586	6097 8107 23207	8098 8128 23328	23229 C–1439 C–1589

LIQUID FILTERS (FILTER INSTALLATIONS)	C–350	C–351 C–501			C–454				C–338	C–139 C–349
STRAINERS (FILTER INSTALLATIONS)							C–476	C–477		
FIRE PROTECTION								C–1047		
FITTINGS	9080 C–20 C–540		C–942	20303 C–1523	C–784 C–1294	C–1325 C–1525 C–1575		C–377	C–1538	C–379
TUBE FITTINGS (FITTINGS)	C–1570				C–474			C–377 C–1077		C–199
FLANGES	C–540		C–942			C–1325 C–1575		C–377 C–1397		
FLOWMETERS		C–911 C–981 C–1471		C–893	C–894	C–895		C–1427		C–509 C–769
MASS FLOWMETERS (FLOWMETERS)			C–152							
FLUIDS	C–1660	C–1661	C–1662	C–1663	C–1664					C–1659
FLUORESCENSE									1188	
FORGING	C–1590	20811 C–141 C–1241	C–142	8053 C–143	8054	23105 C–885	8056 22256 C–1486	C–917	C–498 C–818 C–1568	C–489 C–1229
DROP FORGINGS (FORGING)								C–497		
FORMING										

				23144					9079

COLD FORMING (FORMING)

					23055	22226			

FRACTURE

8010	6141	22272	6143	6374	6815	6536	6487	22318	8049
8130	6151		8063	20794			6537		
			8103	22324					
			8113						
			23013						

BRITTLE FRACTURE (FRACTURE)

		6072		6394			8207		6449
				6564					6639

FREQUENCY SIGNALS

									23119

FUEL ELEMENTS

C–310	C–311	C–312			C–65	23256		C–588	C–809
	C–691	C–672						C–758	
		C–1622							

FUEL CLADDING

								23137	C–208

FUEL HANDLING MACHINE

	C–1601			C–14	C–355	C–806	C–807	23318	
				C–1404					

FURNACE

C–310	230[illegible]1	C–312		C–1134	C–565	22346	C–1137	C–568	C–569
C–570	C–311					C–566			
	C–1091					C–1106			

AIR CIRCULATED FURNACES (FURNACES)

C–1130	C–1111								

ARC MELTING FURNACES (FURNACES)

						23076	23067		

BATCH TYPE FURNACES (FURNACES)

		C–1122	C–1123	C–1124			C–1127		

CARBURISING FURNACES (FURNACES)

		C–1112	C–1113						

CONTINUOUS FURNACES (FURNACES)

	6461			6484		6846	6847		
	C–1121								

ELECTRIC ARC FURNACES (FURNACES)

23080					23085		23097		
					23095				

HARDENING FURNACES (FURNACES)

C–1140	C–1131			C–1114					

INDUCTION FURNACES (FURNACES)

		6412	23073	23084	C–1115	23096	C–1117	C–1118	6149
		23072				C–1116			

LD FURNACES (FURNACES)

					23095				

MELTING FURNACES (FURNACES)

								C–1138	C–1139

MUFFLE FURNACES (FURNACES)

	C–1141				C–1135	C–1136			

OPEN ARC FURNACES (FURNACES)

				23084					

PUSHER FURNACES (FURNACES)

						C–1126			

QUENCH FURNACES (FURNACES)

			C–1133					C–1108	

SHAKER HEARTH FURNACES (FURNACES)

								C–1128	

TEMPERING FURNACES (FURNACES)

					C–1125		C–1107		C–1129

VACUUM FURNACES (FURNACES)

		23072	C–1093	23084	C–1095	23096			
		C–1092		C–1094		C–1096			
		C–1132							

CONTINUOUS FURNACES (FURNACES)

	6461			6484		6846	6847		
	C–1121								

ELECTRIC ARC FURNACES (FURNACES)

23080					23085		23097		
					23095				

HARDENING FURNACES (FURNACES)

C–1140	C–1131			C–1114					

INDUCTION FURNACES (FURNACES)

		6412	23073	23084	C–1115	23096	C–1117	C–1118	6149
		23072				C–1116			

LD FURNACES (FURNACES)

					23095				

MELTING FURNACES (FURNACES)

								C–1138	C–1139

MUFFLE FURNACES (FURNACES)

	C–1141				C–1135	C–1136			

OPEN ARC FURNACES (FURNACES)

				23084					

PUSHER FURNACES (FURNACES)

						C–1126			

QUENCH FURNACES (FURNACES)

			C–1133					C–1108	

SHAKER HEARTH FURNACES (FURNACES)

								C–1128	

TEMPERING FURNACES (FURNACES)

					C–1125		C–1107		C–1129

VACUUM FURNACES (FURNACES)

		23072	C–1093	23084	C–1095	23096			
		C–1092		C–1094		C–1096			
		C–1132							

	C–1151								

STEAM GENERATORS (GENERATORS)

23190	23191	23102	23103	23174	23165	23196	23167	23048	C–359
	23211		23183	C–1214	C–95	C–446	C–27	23168	
	C–691	C–522	C–1213		C–275		C–1207	23188	
	C–1201				C–365			C–358	
					C–585			C–628	
					C–1215				

GLASS

						C–1016			

GLASS–to–METAL ASSEMBLIES (GLASS)

	C–31								

GLOSSARY

			23353						

GLOVE BOXES

C–1420	C–521	C–512	C–793	C–794		C–596		C–758	C–459
									C–509

GRAPHITE

			C–943	C–1584	C–25				

NUCLEAR GRAPHITE (GRAPHITE)

				C–944				C–68	C–169

GRINDING MACHINES

C–490	C–491	C–492	C–13						
			C–413						

HAFNIUM

				C–1254					
				C–1444					

HARDFACING

		C–962	C–963	C–964	C–115	C–116			

HEALTH PHYSICS LABORATORIES

							C–277		

HEAT EXCHANGERS

23230	23231	23062	23163	23044	23175	23056	23057	23048	23059
C-210	C-51	23102		23104	23355	23186	C-157	23058	C-69
C-710	C-631	C-12		C-294	C-365	C-1566	C-817	C-558	C-209
C-1420	C-661	C-52		C-1594	C-585			C-628	
C-1520	C-821	C-662			C-615				
C-1570	C-941	C-1072							
		C-1402							
		C-1592							
		C-1622							

AIR, COOLED HEAT EXCHANGERS (HEAT EXCHANGERS)

		C-662	C-663						

PLATE HEAT EXCHANGERS (HEAT EXCHANGERS)

C-50			C-53	23164	C-45	C-46	C-47	C-58	C-49
				C-54	C-55	C-56	C-57		C-69

SHELL HEAT EXCHANGERS (HEAT EXCHANGERS)

	C-661								

TUBE HEAT EXCHANGERS (HEAT EXCHANGERS)

C-1070	C-661								
	C-1071								

HEAT RESISTANT ALLOYS

			C-113	C-114				C-1368	C-1369

HEAT TRANSFER

C-1560	23061	C-212	C-1663	C-1664			23047		23099
C-1660	23231	C-1662							C-1659
	C-51								
	C-211								
	C-1661								

HEAT TRANSMISSION

							23047		23049

HEAT TREATMENTS

		8012		8054	8055	8056		8098	
					8065			C-1568	
								C-1588	

HEATING EQUIPMENT

			C-1613						

HEATING PROCESS

23240	23241	C-1362		C-1664			C-1107	C-1268	C-1269

			C–1033 C–1263						C–1569

AMPLIFIERS (INSTRUMENTATION)

C–950	C–671 C–951 C–1331	C–1552	C–213	C–1064	C–695	C–936 C–946	C–357 C–457 C–947		C–1059 C–1419

ANALYTICAL INSTRUMENTS (INSTRUMENTATION)

C–1320									

ANALYZERS (INSTRUMENTATION)

	23121 C–671	C–1462 C–1552 C–1572		C–1324	C–1625		C–737 C–1337		

CONTROL SYSTEMS (INSTRUMENTATION)

C–1240 C–1470 C–1550 C–1620	C–171 C–341 C–1551	C–222	C–853 C–1263	C–854 C–994 C–1374 C–1614	C–595 C–995 C–1375	23256 C–996 C–1376 C–1546	C–727 C–1337 C–1377 C–1437 C–1487 C–1547 C–1567	C–1378	C–969 C–1469

CONVERTERS (INSTRUMENTATION)

									C–949

DATA ACQUISITION SYSTEMS (INSTRUMENTATION)

C–1340		C–1212		C–1324					C–1059 C–1339

DATA CONVERSION MODULES (INSTRUMENTATION)

	C–951								C–969

DATA HANDLING EQUIPMENT (INSTRUMENTATION)

						C–26			20659

DIGITAL UNITS (INSTRUMENTATION)

C–1160	23121 C–281 C–951 C–1411	C–282 C–1412	C–213 C–1413	C–934 C–1324			C–727 C–737	C–1358	

HIGH VOLTAGE UNITS (INSTRUMENTATION)

	C–1061					C–936			

INDICATORS (INSTRUMENTATION)									
C–1470	C–171		C–1413		C–415	C–1626	C–1337 C–1627	C–1628	C–1629
LEVEL INDICATORS (INDICATORS–INSTRUMENTATION)									
C–990	C–991	C–992		C–244	C–245	C–246			C–989
LOGIC PROCESSORS (INSTRUMENTATION)									
									C–1059
MULTICHANNEL ANALYZER (INSTRUMENTATION)									
C–170 C–1160				C–214 C–1324 C–1544	C–1545		C–457		
NUMERICAL TREATMENT OF IMAGES (INSTRUMENTATION)									
				C–284					
OSCILOGRAPHS (INSTRUMENTATION)									
	C–861								
OSCILLOSCOPES (INSTRUMENTATION)									
C–510						C–916 C–1336		C–728	
OPTICAL CELLS (INSTRUMENTATION)									
C–970									
PREAMPLIFIERS (INSTRUMENTATION)									
	C–1331	C–1572		C–1064	C–595 C–695		C–597		23119 C–1059
PULSE GENERATORS (INSTRUMENTATION)									
C–510		C–1252 C–1572						C–1248	
RECORDING INSTRUMENTS (INSTRUMENTATION)									
C–280 C–510 C–1470	23121 C–171 C–511	C–222 C–1012	C–1413	C–934 C–1324		23116	C–457	C–278	23119 C–279 C–969
SIGNAL GENERATORS (INSTRUMENTATION)									
C–510				C–674			C–737		
SPECTROMETERS (INSTRUMENTATION)									

	C–541	C–1552	C–233	C–544	C–545	C–546	C–927		11129
				C–1324					

TRANSDUCERS (INSTRUMENTATION)

	C–171	C–1052		C–414	C–1055	C–226		C–1338	23119
	C–1051	C–1192		C–674					

INSULATION

	23251	23202							

INSULATING MATERIALS (INSULATION)

C–960	C–331	C–332					C–1497		C–959
	C–961								

ION EXCHANGE RESINS

C-240	C-241	C–232	C–233	C–234	C–235	C–236	C–17	C–18	C–239
		C–242	C–243				C–237	C–238	

IONISATION CHAMBERS

	C–1451	C–1452							C–689

IRON

6360	6351	6132	6333	6574	6675	6816	6147	6568	6159
6570	6361	6562	20503	6864	6865	20056	6397	20808	6379
6580	6561	6572	20803	20134	20175	20416	6547	20828	6599
6690	6571	20692	20823	20504	20825	20666	6567	20838	20029
6890	20111	20832	20833	20514	20875	20876	6607	20878	20209
20010	20831	20842	22323	20784	22235	22046	20217	23068	20269
20180	20841	22242		20824	23205	22206	20317		20549
20830		C–1542		20834		23206	20667		20809
22240				20874			20827		20829
				22214			20877		20879
				22234			22257		22229
									22299

CAST IRON (IRON)

20200		23222							C–1649

IRON ALLOYS

					C–115				

IRRADIATION

		23102						23108	

IRRADIATION SERVICES (IRRADIATION)

C–580	C–581					C–596		C–578	

ISOLATORS

C–1 C–1624

ISOTOPES

23138

JOINTS

C–380	C–381	C–382	C–383	C–1584	23215	C–416	C–417	C–538	C–539
C–480	C–1641	C–1642	C–1193	C–1664	C–1645	C–616		C–1618	
C–1300			C–1643		C–1665	C–1646			

DILATATION JOINTS (JOINTS)

C–38
C–1078

PIPE JOINTS (JOINTS)

C–20

PRESSURE JOINTS (JOINTS)

C–418

STAINLESS JOINTS (JOINTS)

C–418

TUBE JOINTS (JOINTS)

409

23310
C–20

23308
C–538

LABORATORIES ACTIVITIES

C–650	1011	1012	C–643	C–594	C–665	1066	1007	C–588	C–579
C–1590	1041	C–632	C–663	C–614	C–705	C–596	C–627	C–668	C–639
C–1600	C–631	C–652	C–23273	C–664	C–725	C–726	C–647	C–718	C–659
C–1640	C–681	C–672	C–1543	C–1244	C–1595	C–666	C–1587	C–1568	C–1599
C–1650	C–691	C–1652	C–1653	C–1584	C–1655	C–706		C–1648	C–1639
	C–1591					C–1466			
						C–1536			
						C–1596			

CHEMICAL LABORATORIES WARE (LABORATORIES)

C–971	C–1272	C–1367
C–1421	C–1332	
	C–1422	

HEAT RESISTANT LABORATORIES WARE (LABORATORIES)

		C–972					C–1367		

LEAD

20130				20094	3095			20528	
20510				20514	C–795		C–857		
				C–574					
				C–654					

LEAK DETECTORS

C–140				C–1224		C–66	C–67		
C–1570									

LEGISLATION

			23123						

LINEAR ACCELERATOR

								C–458	

LITHIUM

23100	C–1541								6149

LOAD POSITIONERS

		C–32	C–33						

LOADING

								C–1438	

LOOPS

23100	23061	C912	353		23135	23046	23047		23049
23260	C–911		23173		23185	C–1076	C–1477		23319
	C–1401								

LOOP CIRCUIT (LOOPS)

			353	23054					

LOW TEMPERATURES

CONTAINERS (LOW TEMPERATURES)

				C–1074		C–1076	C–107		

LUBRICANTS

23290									
C–1570									23289

DRY FILM LUBRICANTS (LUBRICANTS)

C–60	C–61	23162	C–63	C–64					
		C–62							

GRAPHITE (LUBRICANTS)									
									C–59
MACHINING									
C–1240		23012							C–1439
ROTATING MACHINES (MACHINING)									
C–620									
SAWING (MACHINING)									
						C–1236			
MACHINE TOOLS									
C–1590		C–1222 C–1612					C–1457 C–1617		
MAGNESIUM ALLOYS									
									C–289
MAINTENANCE									
				23134	23195			23318	
MANGANESE									
22240	6061 6191 6551 6881 22321	6452	22223 23083	6354	6725 22315	6826 8106 22166 22266	6457 23087	6158	6649 22239 22269
MATERIALS HANDLING									
C–610						C–606 C–1146		C–608 C–1148	
MEASURING INSTRUMENTS									
C–630 C–740	C–1331	C–742 C–762 C–1552	C–603	C–704 C–1614	C–595 C–765 C–935			23138 C–738 C–748	23239 23259
ACCELEROMETERS (MEASURING INSTRUMENTS)									
								C–1488	
AMMETERS (MEASURING INSTRUMENTS)									
									C–1419
AUTOMATIC CONTROL (MEASURING INSTRUMENTS)									
	C–341			C–224			C–727 C–737		C–1469

CONTROL EQUIPMENT (MEASURING INSTRUMENTS)

C–510 C–771 C–1632 C–1633 C–674 C–616 C–767 23259
C–760

TACHIORATIOMETERS (CONTROL EQUIMENT–MEASURING INSTRUMENTS)

C–510

TEMPERATURE CONTROLLER (CONTROL EQUIPMENT–MEASURING INSTRUMENTS)

C–510 C–511 C–326

CONTROL SERVICES (MEASURING INSTRUMENTS)

C–340 C–72 23274 C–445 23256

COUNTERS (MEASURING INSTRUMENTS)

C–690 C–1552 C–1183 C–744 C–1355 C–1336 C–447 C–739
C–1450 C–1324 C–1455 C–1357
C–1354
C–1454

CRYOGENICS TEMPERATURE READOUT (MEASURING INSTRUMENTS)

C–503

DENSITOMETERS (MEASURING INSTRUMENTS)

C–981 C–982 C–255

DIGITAL VOLTMETERS (MEASURING INSTRUMENTS)

C–510

DOSIMETERS (MEASURING INSTRUMENTS)

23171 23172 C–1324 C–227 C–448 C–509
C–1452

ELECTROMETERS (MEASURING INSTRUMENTS)

C–1419

FLOW METERS (MEASURING INSTRUMENTS)

C–295

GAGES (MEASURING INSTRUMENTS)

C–680 C–1001 C–1324 C–1555
C–1000 C–1554

HYDRAULIC GAGES (GAGES – MEASURING INSTRUMENTS)

C–126

IONIZATION GAGES (GAGES – MEASURING INSTRUMENTS)

C–31

ISOTOPE GAGES (GAGES – MEASURING INSTRUMENTS)

C–980		C–992	C–993 C–983 C–1013	C–1014	C–975	C–976	C–977 C–1017	C–978	C–979

STRAIN GAGES (GAGES – MEASURING INSTRUMENTS)

		C–1142	C–23	C–1324		C–226			

STRAIN GAGES TRANSMITTERS (MEASURING INSTRUMENTS)

			C–223						

PRESSURE GAGES (MEASURING INSTRUMENTS)

		C–782	C–3					C–868	

THICKNESS GAGES (GAGES – MEASURING INSTRUMENTS)

C–1010	C–1001 C–1021	C–1002 C–1022	C–1003 C–1013	C–1014	C–1015 C–1025	C–1006		C–1008	C–1009

VACUUM GAGES (GAGES – MEASURING INSTRUMENTS)

C–900	C–901	C–902	C–903			C–616			C–899

WELDING GAGES (GAGES – MEASURING INSTRUMENTS)

		C–1172							

INDICATOR/CONTROLLER (MEASURING INSTRUMENTS)

C–760 C–770					C–765	C–766			

INFRA–RED SPECTRUM (MEASURING INSTRUMENTS)

							C–987		

ISOTOPES (MEASURING INSTRUMENTS)

			C–1023	C–1004		C–576	C–577		C–999

METERS (MEASURING INSTRUMENTS)

C–750	C–741 C–751	C–1552		C–744	C–1605	C–1606	C–1607	C–738 C–1488	

MICROHOM METERS (METERS–MEASURING INSTRUMENTS)

C–30									

Ph METERS (METERS–MEASURING INSTRUMENTS)

C–10	C–511								

POTENTIOMETERS (METERS–MEASURING INSTRUMENTS)

C–330				C–324	C–325(b)				

PRESSURE TRANSDUCERS (MEASURING INSTRUMENTS)

C–870	C–871	C–782	C–863	C–4	C–865	C–866	C–867	C–868	C–869
C–880	C–881	C–862	C–873	C–864	C–875	C–876	C–877	C–878	C–879
	C–911	C–872	C–883	C–874					
		C–882		C–884					
		C–1142							

PYROMETERS (MEASURING INSTRUMENTS)

C–1470				C–1134			C–327		

RATEMETERS (MEASURING INSTRUMENTS)

					C–1635	C–936			

SENSORS (MEASURING INSTRUMENTS)

					C–985				

NEUTRON HUMIDITY MEASUREMENTS SENSORS (MEASURING INSTRUMENTS)

					C–985	C–986			

TEMPERATURE CONTROLLERS (MEASURING INSTRUMENTS)

C–1470							C–567	C–678	

THERMOCOUPLES (MEASURING INSTRUMENTS)

C–530	C–1		C–503	C–524	C–525	C–526	C–527	C–528	C–529
C–1370	C–511		C–523	C–754		C–1426	C–1347		
C–1380	C–531			C–1494			C–1427		
	C–1351								

MINIATURE THERMOCOUPLE (THERMOCOUPLES – MEASURING INSTRUMENTS

			C–503				C–1347		

THERMOCOUPLE VACUUM GAGES (MEASURING INSTRUMENTS)

	C–31								

THERMOMETERS (MEASURING INSTRUMENTS)

C–1470						C–1066	C–1067	C–748	
								C–1158	

TIME COUNTERS (MEASURING INSTRUMENTS)

C–510						C–1636	C–1637		

TRANSDUCERS (MEASURING INSTRUMENTS)

		C–772	C–563		C–225		C–567		C–1469

VOLTMETERS (MEASURING INSTRUMENTS)

						C–1336			C–1419

WEIGHT MEASURING SYSTEMS (MEASURING INSTRUMENTS)

				C–1004	C–1005				

MECHANICAL PROPERTIES

1020	1001	6412	1003	1014	1005	1016	6547	6018	6379
6120	6141	6442	6393	6164	6045	6376	6617	6518	6629
6560	6361	6482	6513	6464	6105	6646	6647	8028	8029
8060	6411	6802	6553	6564	6435	6676	20027	2118	20019
11130	6481	C–1042	22243	8054	8065	6866		20008	22019
22180	6551	C–1592	C–1043	8104	20235	8056		20018	22319
22340	20231				22015	8126		20028	
	22211				22105	C–1516		23328	
	22221				23105			C–1588	
	22241								
	22281								
	23331								

MEDICAL SYSTEMS

								C–1358	C–1359

MELTING

22180	6061		23073	22054	23075	23066	23077	23098	23079
	C–1571		C–1593	23074			23097		
				23084					
				23094					

ARC MELTING (MELTING)

						23086			

INDUCTION MELTING (MELTING)

23080									

VACUUM MELTING (MELTING)

23080		23072				22146			
						23096			

MICROSCOPES

			C–1243						

ELECTRON MICROSCOPE (MICROSCOPES)

	6541	6162	6303	8114	8065	6046	6017	C–1318	6369
			6343			6366		C–1558	
			6353						
			8113						

REMOTE CONTROL MICROSCOPE (MICROSCOPES)									
C-1051									
MILLS									
9040			9033						9039
MIXERS									
					C-55				
MOISTURE CONTENT									
				C-984			C-987	C-988	
							C-1027		
MOLYBDENUM									
6130	6131		C-1513	23094	6865		C-1507		
				C-1514					
MOLYBDENUM ALLOYS									
		C-1542					C-1507	C-1508	23109
MONITORING									
C-680	C-221		C-213	C-674	C-215	C-176	C-1057	23268	23169
C-1180	C-341		C-733	C-704	C-1055	C-196		C-218	C-219
	C-1011			C-1264		C-676			C-509
				C-1324		C-1056			
						C-1436			
HEALTH SAFETY MONITORS (MONITORING)									
	C-11				C-595				C-509
RADIATION MONITORING (MONITORING)									
			C-933		C-935	C-1266			
TEMPERATURE MONITORS (MONITORING)									
				C-674					
MOTORS									
		C-832				23226		C-1228	
		C-1292				C-1276			
A.C. HIGH VOLTAGE MOTORS (MOTORS)									
		C-1472				C-136			
ELECTRIC MOTORS (MOTORS)									

								C–598	

INDUCTION MOTORS (MOTORS)

	C–131	C–132							

NEUTRON DIFUSSION

					23045				

NEUTRON FLUX

	23061			23044		23256			

NEUTRON RADIOGRAPHY

			C–583						

NEUTRONS

C–920	C–921		C–1263	C–584				23138	
								23248	

FAST NEUTRONS (NEUTRONS)

					23045				

THERMAL NEUTRONS (NEUTRONS)

					23045				

NICKEL

20300	6351	20202	6673	20514	20255	8106	20007	23068	6329
23070		22232		23094	C–105	C–1516	20117		6849
							23087		20299
									20319

NICKEL ALLOYS

		20122	20013	20154	C–115	23106	20507	20188	23109
		20532	20623		C–1045	C–126			C–1159
		C–1342	C–653		C–1345	C–1346			
			C–1043		C–1445	C–1446			

INCOLOY ALLOYS (NICKEL ALLOYS)

				C–1344	C–1345				

INCONEL ALLOYS (NICKEL ALLOYS)

			C–1343		C–1345				

NIMONIC ALLOYS (NICKEL ALLOYS)

					C–65	C–126			

NIOBIUM

				C–574					
				C–1514					

NITROGEN

6390			6023	6724	6385	6026	22257	6618	6149
6410			6323	6824	6475	6346	23087		6809
6890			23083	6884	6615	6516			22189
22260				22204	6635	22166			
23310				23094					

NON DESTRUCTIVE TESTING

1010	1001	1012	1013	1004	1005	1006	1007	1028	1039
1020	1011	1042	1103	1024	1015	1016	1037	1098	1069
1030	1031	1072	1123	1064	1025	1026	1107	1108	1149
1130	1041	1112	1193	1084	1055	1036	1127	1138	1189
1140	1141	1122	8033	1104	1105	1066	1137	1148	23349
23310	23311	4072	20623	1124	1115	23346	C–667	23348	C–319
C–320	C–321	23222	23013	22054	1145		C–1297		C–749
C–360	C–611	C–1622			1185				

418

ACOUSTIC EMISSION (NON DESTRUCTIVE TESTING)

1050	1061				1075		1007	1088	
	8041						C–167		

EDDY CURRENT TESTING (NON DESTRUCTIVE TESTING)

1080	1031	1031	1003	1154	1005	1036	1007	1048	1009
1100	1081	1042	1013		1105	1096	1057	C–1298	1079
1110	1101	1052	1063		1145	1186	1187		23269
1190	1121	1082	1133		C–1065				
20620	23271	1132	1153						
23270		1142	C–1053						
C–1060		1182							
		C–1052							

IN SERVICE INSPECTION (NON DESTRUCTIVE TESTING)

C–810	C–811				23105	C–756	C–177	C–808	
							C–757		

NON DESTRUCTIVE TESTING INSPECTION (NON DESTRUCTIVE TESTING)

		1182				23206		C–8	C–9
		C–72							C–809
		C–1302							C–1299

ULTRASONIC TESTING (NON DESTRUCTIVE TESTING)

1190	1181	C–1302	C–1173	1184	23305	C–756	C–1177	C–1178	23239
23110				C–1174	C–1175	C–596		C–1298	
						C–1176			

X RAY ANALYSIS (NON DESTRUCTIVE TESTING)

1120	1031		1033	1094	1055				
C–1300	1041		1183	1104					

NON METALLIC INCLUSIONS

22030	11231	22022	22003	22054	22015	22006	22047	22008	22019
22040	22251	22262	22013	22184		22026	22327	22238	22209
	22281		22023	23084				22338	
			22053						
			22193						

NOZZLE

		8012		23354	23105	C–1186	23247	C–1188	
				C–1224	C 1185				

NUCLEAR FISSION

	23031								

NUCLEAR MEDICINE

		C–672	C–1063	C–1064	C–935				C–509
		C–1572		C–1414					

NUCLEAR POWER PROJECTS

							23187		

NUCLEAR TECHNOLOGY

		1072	1083	20234					1149
				23134					

NUCLEAR TRAINING

						C–276			

OILS INSULATING (OILS)

C–40									

OXIDES

	23251	23252	C–973						C–959

OXIDATION										
	6580	6061 6411	6472 23092	6443 6813	6354	22345	6196 6406 22346		6848 23108	6439
DEOXIDATION (OXIDATION)										
	6410 23080	6451							6508	6149
OXIDATION–REDUCTION (OXIDATION)										
									23098	
OXYGEN										
					23074	23075 23085	23096			22189 23079
PACKAGING										
		C–341		C–313	C–314	C–315	C–316	C–317		
PACKING MATERIALS (PACKAGING)										
			23142					C–1597		
RACKS (PACKAGING)										
								C–317	C–319	
PAINTS										
	C–120	C–121			C–124	23145 C–125 C–955		C–1037		C–119
PATENTS										
			23012	23003			23056	C–1567	23058	23059
PATENT SYSTEM (PATENTS)										
							23006	23007		
PELLETS			4072 23012				4046			23139
PENETRANTS										
										23309
PENSTOCKS										
									C–548	
PERFORMANCE TESTING										
				23013	23014					

PETROLEUM

				C–1644			20077		

PHOTOCELLS

				C–334	C–1105				

PHOTOGRAPHY

			C–283						

PHYSICAL PROPERTIES

	6521	C–1042	22243	4034	6105	4016		4058	4019
	20691	C–1592	C–1043		20195				22019

PIPELINES

23350	23241	1192						C–628	

PIPES

9080	23241	23352	363	C–784	23215	C–476	23307	C–1148	C–189
23200	23301	C–402	C–783	C–1284	C–1325	C–506	C–837	C–1198	C–1299
23240	C–401	C–1622		C–1294		C–1256	C–1197		C–1589
C–400	C–941			C–1594		C–1386	C–1397		
C–560	C–1041								
C–1200	C–1201								
	C–1571								

PIPE FITTINGS (PIPES)

C–1200					C–55				
C–1570					C–1325				

PIPE SUPPORTS (PIPES)

	C–41		C–833	C–834	C–835				C–39

PLASTICS

C–1460	23301	C–942			C–1045	C–996	C–1597	C–1028	

CORROSION RESISTANT PLASTCS (PLASTICS)

					C–55				

PLATES

22180	8021	8022	C–1533	8014	8005	8026	8017	8038	22229
	8101	8102		8064	22245	8046	8047	8058	
	C–1441	8112		22244	23105	22246		8098	
	C–1531	C–1442				C–1586		8128	
								23348	
								C–1528	
								C–1558	

PLATING

	1141				C–105				

PLATINUM

					23245				

PLUTONIUM

	C–521								23039

POLISHING

						C–646			

POLISHING MACHINES (POLISHING)

C–490			C–13			C–646			
			C–413						
			C–493						

POLYMERS

		C–822	C–823	C–824					
		C–1242	C–1293	C–1294					
		C–1272							

POLLUTION

		23292	23123					C–1048	

POSITIONERS

C–1150								C–378	C–429
								C–428	C–1149
								C–1408	

POTASSIUM

23100									

POWDER METALLURGY

	1141		C–183	C–184	C–185				
					C–1155				

POWDER ALLOYS (POWDER METALLURGY)

								C–168	

POWER PRODUCTION

	23031		C–73			C–446			23149
	C–1251								

POWER STATIONS

23240	C–641	C–642	C–1283	C–714	C–1225		C–627	C–628	23019
C–640				C–1284			C–647	C–708	C–159
C–680							C–1227	C–1278	C–1279
								C–1658	

HYDRAULIC POWER STATIONS (POWER STATIONS)

C–1280	C–1281	C–1282		C–1284		C–716	C–707		C–609
									C–709

NUCLEAR POWER PLANTS (POWER STATIONS)

23170	9081	23112	23103	8214	23005	23256	23057	23108	23289
	23051		23203	23134	23145	23336	23317	23228	C–1599
	23111		23232		23165		C–1657	23258	

THERMAL POWER STATIONS (POWER STATIONS)

	C–711	C–712	C–713	C–714	C–715		C–1217		C–709

POWER SUPPLIES

C–510	C–951			C–674		C–1046		C–948	C–1059
	C–1331					C–1336			C–1419

ALTERNATORS (POWER SUPPLIES)

		C–102					C–717		

SWITCHERS (POWER SUPPLIES)

C–510							C–1567		

TRANSFORMERS (POWER SUPPLIES)

C–510							C–137		

PRESSES

			C–413		C–1155	C–1146		C–1568	

PRESSURE VESSELS AND CONTAINMETS

C–810	23341	23102	23223	8214	23105	23276	8207	C–558	C–559
C–820	C–631	C–12	23343	23174	23345	C–596	23107	C–808	C–819
C–890	C–691	C–892	C–1073	23344	C–365	C–886	C–817		C–1599
C–1440	C–891	C–1072	C–1593	23354	C–1295	C–1386	C–887		
	C–1221	C–1222		C–154	C–1405				
				C–1484	C–1535				

PRESTRESSED CONCRETE PRESSURE VESSELS (PRESSURE VESSELS)

C–470	C–471	C–472	C–473	C–1464	C–1465	23276	23317	C–468	23299
	C–1201						C–467	C–1418	C–469
							C–617		

PRIMARY CIRCUIT COMPONENTS

		C–12					23057	C–628	

PROCESSING

			23123						

PRODUCTION

23250			23113	23114	23145 C–1655	23146		23158 C–1568	C–1599

PROXIMITY

						C–1056		C–1058	

PUMPS

23340 C–80 C–720	23101 23151 C–81 C–721 C–1581	C–2 C–172 C–572 C–1242 C–1542	23123 C–443 C–1073 C–1143 C–1163	C–1144 C–1664	C–55 C–1255 C–1615 C–1665	23106 C–346 C–1216 C–1256 C–1556 C–1616 C–1666	23057 C–777 C–1597 C–1667	C–78 C–628 C–1538	C–719 C–1539

AXIAL FLOW PUMPS (PUMPS)

		C–172			C–75				

CANNED PUMPS (PUMPS)

		C–1292	C–573		C–55				

CENTRIFUGAL PUMPS (PUMPS)

C–180	23151 23201 C–181 C–371 C–1211	C–172 C–182 C–372	C–373	C–374 C–1144	C–55 C–375 C–915	C–76	C–77		C–19

CIRCULATING PUMPS (PUMPS)

C–1400			C–613 C–773		C–575	C–346			

CONDENSATE PUMPS (PUMPS)

								C–628	

CORROSION RESISTANT PUMPS (PUMPS)

					C–55				

DIAPHRAGM PUMPS (PUMPS)

C–500				C–444	C–295 C–575		C–507		C–19

DIFFUSION PUMPS (PUMPS)

						C–616			C–1559

	0	1	2	3	4	5	6	7	8	9
ELECTROMAGNETIC PUMPS (PUMPS)		C–911								
FEEDWATER PUMPS (PUMPS)									C–628	
FLOATING PUMPS (PUMPS)										C–369
GEAR PUMPS (PUMPS)								C–777		
GLANDLESS PUMPS (PUMPS)							C–346			
HIGH PRESSURE PUMPS (PUMPS)	C–370					C–55		C–507		
HORIZONTAL PUMPS (PUMPS)									C–628	
HYDRAULIC PUMPS (PUMPS)			C–1482			C–295	C–126 23226			C–1409
MECHANICAL SEAL PUMPS (PUMPS)				C–573 C–773			C–616			
MIXED FLOW PUMPS (PUMPS)						C–75				C–79
PLUNGER PUMPS (PUMPS)		C–1161							C–148	
RADIAL FLOW PUMPS (PUMPS)						C–75				
SODIUM PUMPS (PUMPS)				23173		C–585			C–628	
SUBMERSIBLE PUMPS (PUMPS)	C–1040						C–346			
VACUUM PUMPS (PUMPS)				C–443	C–904 C–1234	C–175	C–896	C–897	C–898	

VERTICAL PUMPS (PUMPS)

								C–628	

QUALITY CONTROL

	23091	22102	23013	22054	23175	23146			23139
		23082	23353	22084					C–1599
		23222	C–1623	23084					
		23342		C–1594					

QUALITY CONTROL SERVICES

	1191	1192		C–464	C–445				
					C–465				

RADIATION EFFECTS

8020	8101	8062	8063	8064	8105	8006	8017	8008	8049
8110	8121	8112	8103	8104	8115	8046	8047	8048	
8120		8132	8133	8134		8106	8107	8118	
23200		23202				8116			
						8126			

RADIATION SAFETY EQUIPMENT

23170	23171	23002	C–793	C–1414				C–788	23169
C–790	C–791	C–792	C–1273						C–509
	C–1271								
	C–1331								

426

RADIATORS

								C–1068	C–1069

RADIACTIVE MATERIALS

						23316			

RADIOACTIVE TRANSPORT

	C–1181					C–6	C–7		C–789
						C–726			

RADIOACTIVE WASTES

				C–724					C–789

RADIOACTIVITY

				C–1264	C–1265				

RADIOCHEMISTRY

							C–277		

RADIOGRAPHY

C–250	C–251	C–252	C–253	C–254	23305	C–216	C–217	C–248	C–249

C–390	C–391	C–392	C–393	C–384	C–385	C–256	C–257	C–258	C–259
				C–394	C–395	C–386	C–387	C–388	C–389
						C–396	C–397	C–398	C–399

GAMMA RADIOGRAPHY (RADIOGRAPHY)

C–1170	C–1171							C–1168	C–1169

INDUSTRIAL RADIOGRAPHY (RADIOGRAPHY)

								C–458	

REACTORS

C–1390	23031	C–672		23044		23076	23257	C–228	23019
	23061	C–1472		C–954					23089
									C–229
									C–709
									C–1379

NUCLEAR REACTORS (REACTORS)

1150	1011	1112	1083	1084	9075	1136	23137	8058	23109
20420	20421	20422	20423	1144	20425	1146		20338	
	23021		23003	20424	23105	10116		23048	
			23243	23274	23145	20346			

AGR (REACTORS)

									23229

BWR (REACTORS)

23320	C–161			23014	C–15	C–16	23047	C–798	23039
	C–231			C–14		C–796	C–797		
	C–1101								

CANDU REACTORS (REACTORS)

			23053						

FBR (REACTORS)

C–910	9081						23127	C–178	C–1599
	C–1391						23167		

GAS COOLED REACTORS (REACTORS)

		23112					20467		20349
									C–1519
									C–1599

GAS COOLED FAST BREEDER REACTORS (REACTORS)

C–340					C–355	23166			

428

					C–485	C–486			
RELIABILITY									
		23272	23013 23273	23274 C–1154	23275				
REMOTE HANDLING EQUIPMENT									
		C–812 C–1152				C–806	C–807	C–888 C–1148	C–509 C–889
RESEARCH ORGANIZATIONS									
	C–11	C–672		C–84 C–614					23009
RESINS									
					C–955	C–956	C–957	C–958	
REVIEW PAPERS									
22050	22021 22281 22311		23053 23093	22254 22294	22015	22276	22027 22147 22267 23107 23237	8118 22228 22338 23088 23208 23268	20529 22259 22329
RIGS									
SODIUM RIGS (RIGS)									
				C–354					
RINGS									
C–420	C–421		C–353				C–1597	C–1598	C–419
RODS									
		23062		C–974 C–1044	C–1245		C–1507 C–1597		23139
ROLLING									
22070 22110		22082	22073 22113	22084 22244	22095 22255	9046 22246 22256		22078 22248	
COLD ROLLING (ROLLING)									
22100	22071		9033 22073	22074		9036	22077 22087	9038	9039
CONTINUOUS ROLLING (ROLLING)									

			9042							
HOT ROLLING (ROLLING)		9041								
ROLLS (ROLLING)			22072				9046 22076			
WARM ROLLING (ROLLING)										9029
ROOFS					C–514					
RUBBERS			C–982							
SAFETY	23170 C–260	23311	23002 23262	23243 23273	C–1534	23335 C–5 C–1475		23257	23228	23169
SCREENS						C–475				
SCREWS	C–830								C–1608	
SEALS					C–804	C–1315 C–1415	C–1316 C–1416	C–1597	C–1598	
SEISMIC EFFECTS						23295				
SEPARATORS							C–26 C–496		C–1538	
SERVOMECHANISMS	C–150	C–151		C–813	C–814					C–149
SHEETS		C–1021			C–994 C–1044	C–1245 C– 485	C–1026	C–1507 C–1597	C–1028 C–1178	9009
SHIELDING										

			6543	C–1094		6556	C–1107	6318	6319 6649

SODIUM

					23175				

SOLIDIFICATION

		6032		23094			6007		

SOLUBILITY

							23087		

SOUND

	6491 C–601			C–914			23117	23178	

SPECIFICATIONS

22180			23013	9064 22204 C–694			C–657 C–1567		

SPECTROSCOPY

								1188	

STABILIZING

	C–1251								

STANDARD

9080 23190 23350	23191 23201 23211 23341 23351	23212 23352	363 23193 23223 23343 23353	23344 23354	23215 23335 23345	23186 23196 23226 23346	23197 23257 23347	23188 23348	23199 23349

STARTERS

							C–1567		

STATISTICS

23070					1185			8108	

STEAM REHEATERS

	C–1201						C–27		

STEELMAKING

	1091 6601 C–1651		6033 C–1593	6044 22084 23084	6195 23095	22036 23086	6097 23097 23137	6518	23089

STEELS CASTINGS (STEELS)

						C–1156			
						C–1526			
						C–1586			
	C–1241		C–183	C–184	C–185		C–1157		

STRUCTURAL STEELS (STEELS)

11130	2001	20802	20373	20034	C–1655	20016			
22050	20141		20793			20046			

TITANIUM STEELS (STEELS)

23070									

TOOL STEELS (STEELS)

			C–183						

STEELWORK

BOF PROCESS (STEELMAKING)

				23064				23098	22269

SKF PROCESS (STEELMAKING)

				23064					

STEELS

9080	1181	8102	8033	8134	8005	22066	8007	22058	22019
22180	9081	22072	8103	8214	8135	22206	22027	22238	22209
22220	22081	22082	8113	9064	22015	22226	22067	22338	23069
22290	22231	22202	8133	22014	22025	22256	22147	23108	C–1579
22310	22281	22222	22013	22024	22085	22346	22197	23208	C–1649
23350	23001	22262	22053	22054	22255	23206	22247	C–498	
C–160	23351	22312	22083	22254	22345	23346	22257	C–1578	
C–1530	C–1521	22322	22123	22284	22265	C–1486	23347		
C–1590		23102	22193	22314	22285		C–1527		
		23222	23093	23204	23055		C–1587		
		C–532	23223	23344	23105				
		C–1622	23343	23064	23205				
			C–1533	C–84	23215				
				C–1484	23205				
				C–1584	23305				
					23345				
					C–1245				
					C–1655				

AUSTENITIC STEELS (STEELS)

	23001	23092		23064	20135	1186	20797	C–1518	23109
		23222		23094			C–1517		

BORON STEELS (STEELS)

				C–494	C–495				

CONSTRUCTIONAL STEELS (STEELS)

					23085				

LOW ALLOY STEELS (STEELS)

11130	20001		20013				20157	20118	
	20191							20178	
								22208	

CARBON STEELS (LOW ALLOY STEELS – STEELS)

1010	1001	1012	20013	8114	1005	20096	1007	20008	20679
11130	1011	1022	20023	20054	1015	20136	20517	20068	20799
20680	20251	20202	20173	20134	20035	20406	20657	20178	
		20882	20223	20174	20525		20697	20228	
			20883				20857	20858	
							20887		

CHROMIUM STEELS (LOW ALLOY STEELS–STEELS)

23070	1001	C–1042		23064	23085			20178	
				23074					
				C–1044					

435

CHROMIUM MOLYBDENUM STEELS (LOW ALLOY STEELS–STEELS)

	23331	C–1042	8023			8106		23328	

CHROMIUM NICKEL STEELS (LOW ALLOY STEELS–STEELS)

23070		C–1042		C–1044					23079
									23089
									23109
									C–1159
									C–1229

LOW CARBON STEELS (LOW ALLOY STEELS–STEELS)

22030	22211	22232	22213	22194	22165	22146	22237	23088	22029
22070	22241	22322	22223	22224	22215	22166	22297		22069
22090	22321	23072	22233	22324	23075	22286			22129
22170		23082	22313	22344	23085	22316			22239
22280			23073	23084		23086			22279
23080			23083			23096			22319
									22339
									22069
									23089

FORGED STEELS (STEELS)

			C–183	C–184	C–185				C–1229

NICKEL STEELS (STEELS)

23070									

STAINLESS STEELS (STEELS)

23070	23071	1182	23063	9004	9065	1186	9077	9078	9029
23080	23091	23072	23073	23064	23065	9036	23067	23068	9079
23270	C–451	23082	23083	23084	23075	9076	23077	23088	23079
C–1540	C–1531	23332	23173	23094	23085	23066	23087	23098	23089
C–1580		23352	C–783	C–204	C–65	23076	23097	C–348	C–489
		C–452	C–1043	C–784	C–205	23086	23137	C–488	C–1159
		C–1522	C–1313	C–1044	C–945	23096	23207	C–1518	C–1529
		C–1582	C–1583	C–1314	C–1045	23106	C–487	C–1528	C–1649
			C–1623	C–1444	C–1445	23326	C–1317	C–1568	
				C–1524	C–1485	C–26	C–1517	C–1586	
				C–1594	C–1515	C–126			
					C–1575	C–206			

STEELWORK

20360	23091								

STRENGTH TESTING

						C–26			

STRESS

8040	6531	6422	6643	6154	8015		6647	6358	8019
8100	8051	8102	8123	8024			8037	6638	
			22213	20794					
			22323						

STRESS CONCENTRATION (STRESS)

8060	8041		8003	23104	20795			8108	

STRESS ANALYSIS

C–890	C–1041			C–24					20629
				C–1324					23339

STRUCTURES

			C–533	C–534			23347	23278	

SUPPORTS

							C–187		

SURFACE

	23231		22343		23135	22066	22077		
	23241				23145	22076			

SWITCHES (ELECTRIC USE)

C–1620	C–651	C–743	C–764						C–1459

SWITCHES (LIQUID LEVEL USE)

C–1480	C–1481								C–1479

SWITCHGEARS

	C–1461	C–1472	C–133	C–134	C–135		C–137	C–138	
			C–1253		C–705				
					C–1365				

SYNCHROS USE SERVOMECHANISMS

TANKS

			C–1293			C–956	C–957	C–958	
								C–1538	

TANTALUM

C–1590			20013	C–1514					

TELLURIUM

				C–574					

TEMPERATURE

6070	6391		6353			6416			23209
C–1620	23241								
C–1630									

HIGH TEMPERATURE (TEMPERATURE)

			6393		23115	6326	6047		

TEMPERING

		6082			C–1125	C–1096	6537		6639
							C–1107		C–1129

TESTING

6120	23061	8042	23103		23295	23206	23047	8038	
6130		23142				23226	23217	8098	
8030						23276		23278	
8100						23296		23298	
23070									
23100									

TESTING MACHINES

		C–682		C–1604	23295		C–127		

CONCRETE TESTING (TESTING MACHINES)

						C–126	23297		

UNIVERSAL (TESTING MACHINES)

						C-126			

TESTING LABORATORIES

		C-322		C-1044					C-319
		C-922							

THERMAL ELECTRIC UNITS

		C-952	C-953						

THERMAL EXPANSION

		23012							

THERMOANALYZER

			C-403	C-404	C-405	C-406			C-409

THICKNESS

C-1000	C-1001	1002	1183	1184	C-1065	1186			1189
C-1020			C-1003	C-994		C-1016	23107	9038	23049
C-1300			C-1023	C-1024		C-1026	C-1007	C-1018	

THORIUM

									23139

TIN

				C-574					

TITANIUM

23070	22241	C-1582	C-1593		C-1585		23077	C-1588	
C-1590									

TITANIUM ALLOYS

			C-1043	C-574	C-1045		C-1097	C-918	
			C-1443					C-1588	

TITRATORS

C-410									

TORQUE

						C-356	C-1667		23149

TRAINING

	C-1101					C-796			

TRANSFORMERS

6160	6061	6102	6103	6004	6095	6006	6067	C-1228	6079
6310	6011	6352	6293	6794		6306	6167		6309

C–1250	6491 23121	C–1262 C–1472	6363						C–1249

TRANSMITTERS

C–680 C–1470	C–1	C–852 C–1142		C–1624			C–1337	C–748 C–1628	C–1469

TRAPS

			C–1223	C–1224					

TROUGHS

C–960				C–994					

TUBES

9020 9040 23270 C–1050 C–1580	1181 9001 9041 9081 23211 23271 C–1611	9042 23062 C–1502 C–1512 C–1532 C–1582 C–1592 C–1622	363 1193 9033 C–1443 C–1573 C–1623	23144 C–1044 C–1444 C–1524 C–1574 C–1584	9075 23135 23215 C–1045 C–1245 C–1445	9026 9076 23046 23056 C–1446 C–1576 C–1626	1187 9077 C–1447	1188 9038 23208 C–1238 C–1548 C–1578	9009 9029 9039 9079 C–749 C–1079 C–1239 C–1579 C–1589

FLEXIBLE TUBES (TUBES)

C–1080	C–1081						C–1077	C–1078	C–1079

PHOTOTUBES (TUBES)

		C–1572			C–1105	C–1496			

SPIRAL TUBES (TUBES)

C–1560		C–1572							

STAINLESS TUBES (TUBES)

C–1530	9001	C–1532	C–1523	23144 C–1524 C–1594	C–1525		C–1577		9069

TUBES –ELECTRONIC (TUBES)

CATHODE RAY TUBES (TUBES–ELECTRONIC)

					C–1105	C–1496			

PHOTOMULTIPLIERS (TUBES–ELECTRONIC)

					C–1105				

TUBING

1190	23271	1182	23103	C–204	C–65	1186	23137	C–188	1189
9080		C–1622	C–653	C–574	C–205	C–126	C–377	C–208	C–69
C–1020			C–783	C–784	C–785	C–186	C–1077	C–818	C–189
			C–923	C–974	C–945	C–206	C–1597	C–918	C–919
			C–1313			C–1016			
			C–1583						

CONNECTORS (TUBING)

	C–111					C–106			

TUNGSTEN ALLOYS

		C–1512						C–168	

TURBINES

C–840	C–141	C–1472	23103			C–846	C–827	23338	C–839
	C–841		C–83			C–1056	C–847	C–628	
	C–1211					C–1216	C–1207		

GAS TURBINES (TURBINES)

C–340	23051						23127	23148	23129
							C–827	C–1428	

STEAM TURBINES (TURBINES)

	23051	23232		C–94	C–85	C–86	23227	23148	C–1209
	C–81			C–1204		C–346		C–88	
						C–1146		C–158	

TURBINES BLADES (TURBINES)

						23146			

TURBOALTERNATORS

							C–87		

TURBOGENERATORS

							C–137	C–828	C–159
									C–829

ULTRASONICS

			1193	C–1184		23306		1188	
								23308	
								23348	
								C–118	

UNITED KINGDOM

		23112							

ULTRA HIGH VACUUM SYSTEMS (VACUUM SYSTEMS–VACUUM)

	C–1321			C–1554					

VACUUM TREATMENT (VACUUM SYSTEMS–VACUUM)

						23086			

VALVES

23060	C–551	C–342	C–333	23014	C–175	C–126	23197	C–268	C–109
C–110		C–522	C–543	C–304	C–305	C–416	C–307	C–428	C–379
C–1540		C–542	C–553	C–554	C–555	C–556	C–377	C–1338	C–429
C–1570		C–552		C–734	C–745	C–616	C–417		C–549
		C–942		C–1224	C–1285	C–746	C–547		
		C–1402		C–1534		C–1146	C–1247		
				C–1664		C–1216			
						C–1286			

ACTUATORS (VALVES)

C–1090		C–522	C–1103	C–1104	C–825	C–826	C–507	23228	C–309
		C–1082			C–1275		C–1337	C–508	C–1289
		C–1102						C–1338	
								C–1628	

AIR VALVES (VALVES)

		C–942			C–745				

BALL VALVES (VALVES)

C–190	C–301	C–522	C–1083		C–195	C–296	C–297	C–198	C–299
C–550		C–942			C–1085	C–306	C–507	C–298	C–1089
C–1290		C–1082			C–1275	C–376	C–1087	C–308	C–1189
C–1570							C–1407	C–508	
								C–1338	

BELLOWS VALVES (VALVES)

C–190		C–342			C–425	C–426	C–197		C–379
C–1570					C–745				

BRONZE VALVES (VALVES)

						C–746	C–747		

BUTTERFLY VALVES

C–440	C–431	C–32	C–433	C–434	C–295	C–436	C–437	C–438	C–439
	C–441	C–432		C–1274	C–435		C–507	C–508	C–1559
		C–442			C–1275		C–547	C–1338	
		C–522							

CAP VALVES (VALVES)

									C–379

C–955 C–958

WARNING SYSTEMS

C–761 C–767

ALARM RELAYS (WARNING SYSTEMS)

C–1

ELECTRONIC ALARMS (WARNING SYSTEMS)

C–674

WASTES

23123

WATER TREATMENT

23141 23151 C–73 C–803 C–1073 C–564 C–55 C–607 C–628 C–1219 C–1599

COLING WATER SYSTEMS (WATER TREATMENT)

23163

HEAVY WATER (WATER TREATMENT)

23250 C–1232 C–1657

WASTE WATER RECYCLE SYSTEM (WATER TREATMENT)

C–28 C–78 C–708

WEAR

C–115 20848

WELDED JOINTS

1002 20042 1193 20013 23104 20135 1019 1109

WELDING

11130 23350 C–1300 23351 C–831 11132 23102 C–162 C–362 C–1302 23223 C–1623 23104 23105 23215 C–1595 23207 C–378 C–818 C–1588 C–1299 C–1649

ARC WELDING (WELDING)

23060 C–1270 23352 C–1649

	22251								
COLD (WORKING)									
22240	22221	22222			9075 22075	22256	9077		9079 22259
X RAY DIFFRACTION									
				C–684	22345				
X RAY SPECTROGRAPHS									
						C–26			
ZINC ALLOYS									
									C–289
ZIRCALOY									
22230	8121	C–1622	C–1313	C–1044 C–1444	23015 C–1045			23208	23109
ZIRCONIUM									
C–1590			C–1043 C–1423	C–1044 C–1254 C–1424 C–1444	C–1045 C–1425	C–1446		C–918	C–919
ZIRCONIUM ALLOYS									
				C–1574 C–1584	23015			23208	

ANEXO III - INDICE DE AUTORES

ANEXO IV - RESUMENES

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SOCHASKY R.A.

Reactor loops at Chalk River
AECL - 1273 1961
This report describes broadly the 9 in-reactor loops and their components, located in and around the NRX a and NRU reactors at Chalk River. First an introduction and general description is given of the loops and their function, supplementd with a table outlining some loop specifications and nime simplified flow sheets, one for each individual loop. Descriptions are given of the two categories, the main loop circuit and the auxiliary components inturn. These components in part are comprised of the main loop pumps, the test section, loop heaters, loop coolers, delayed-neutron monitors, surge tanks, Dowtherm coolers, loop piping.
Photographs, drawings and tables are included to provide a clearer understanding of the descriptive literature and includes some specirications of the more important components in each loop.

* 363

AMERICAN WELDING SOCIETY N.Y.

Standards for qualification of welding procedures and welders for piping, and tubing.
AWS D 10.9-69 72 pp.
This standard provides three different levels of welding procedure and welder qualification for joining pipe, tube and components. The three levels are called Acceptance Requirements 1,2 and 3 and are hereafter abbreviated AR-1, AR-2 respectively AR-1 is the highest level of qualification, followed by AR-2 and AR-3 in that order. The differences among the three levels of qualification lie in the type of tests and the acceptance requirements for the sample welds. This document is divided into three sections, Section I covers general requirements, Section II describes welding procedure qualification, and Section III covers welder qualification.

* 1181

MALRIN J.

Progress with the ultrasonic testing of small tubes for the nuclear industry.
C.E.A., 12 colloque de métallurgie, Saclay, 1968
An impróved method for the detection of longitudinal internal defects in small seamless steel tubes in described. Although conventional teating by trans verse scanning can be used for good quality tube, an additional testing process with greater efficiency is recommended flat internal defects, not found by the conventional test, were detected by the apparatus which is also sensitive to internal splits, internal hollows, external grinding, eccentricity in the walls, and shock deformations.

* 1182

BUSSE T.H. and BEYER N.S.

Pulsed eddy-current inspection of thin walled reactor fuel tubing.
Material evaluation oct., 1970, 28, (10), 228-236
Approximately 137000 ft of SS fuel jacket tubing required for the Experimental Breeder Reactor II was succesfully inspected by eddy-current techniques. Tubing containing discontinuities exceeg 10% of the 0.009-in wall thickness had to be reliably rejected. System response was statistically correl ated to natural flaw characteristics, resulting in a dependable practical test. The procedure provided a realistic and a valuable insight into testing-equipment capability and tubing quality. The eddy-current equipment is discussed, however emphasis is placed on inspection technique. Specific items discussed include inspection resulys and statistical evaluation, inspection contidence and practical considerations.

1183

D'ADLER-RACZ J.

NDT with X rays of parts with large variations in wall thickness.
Technica, 21 Aug., 1970, 19, (17), 1417-1419
The factors influencing image sharpeness and contrast in radiography are discussed and data given relating image quality to tube loading and thickness of steel penetrated. The use of Cu and Pb filters to improve contrast is described and examples are given.

* 1184

EVANS D. J.

NDT in the field
Chem, eng. Progress, sept. 1970, 66, (9), 66-69
Field applications of ultrasonic testing in the petroleum and petrochemical industries consists of flaw detection in new equipment such as piping, pressure vessels and welded seams and maintenance tests in the plant during operation or shut-down periods. A continuous scan method is used for testing steel or alloy plates for internal laminations and segregations. Shear waves are used for weld examinations, while ultrasonic thickness measurements help determine corrosion loss, and cracking. New transducer designs permit meassurements a at up to 1200° F. (650° C).

1185

KAHL H.

NDT: random testing, defect quota and extent of testing, ZIS Mitt., Aug. 1970, 12,(8), 1014–1021 (in German)
A statistical approach to NDT is discussed and it is shown how it is possible to make use of probability calculations, the results

of random testing, the defect quota, and the particular degree or extent of testing required in order to achieve the defined quality of a particular component are discussed. Test requirements of welded joints are listed and methods for determining the defect quota are described. Statistical quality control techniques are discussed.

* 1186

VOZENILEK F.

Long duration contact–less measurement of thickness variations in the austenitic steel tubing of the Primary circuits in the Czechoslovak reaktor VVR–S C.E.A., 12 colloque de métallurgie, Saclay, 1968
A method for determining thickness variations in austenitic steel tubing used in the cooling circuit of a nuclear reactor is described. It is based on the excitation of eddy currents in the tube and the measurement of electrical conductivity. A reduction in tube thickness after 4 years operation was found.

* 1187

FOSTER F.

Electromagnetic methods with extreme defect resolution for NDT of reactor tubes.
C.E.A., 12 colloque de metallurgie, Saclay, 1968.
A method for inspecting reactor components by means of eddy current is described. Cracks, inclusions and other discontinuities can be detected. Small diameter and thin walled tubes can be inspected by rotating eddy–current probes on the inside and outside of the tube.
An accurate method for measuring the ferrite content of SS reactor tubes is also discussed.

* 1188

Quality control in tube manufacture
Chem. process eng. nov. 1969, 50, (11), 85
The spectrographic, ultrasonic and fluorescence methods used in the continuous control of the entire tubemaking process (from pig iron production to the finished tube) at the Corby works of the British Steel Corp. are outlined. Additional inspection techniques before despatch are mentioned.

*** 1189**

POOLE H. W.

Nondestructive testing of small metal tubing
Mater. Eval., feb., 1970, 28, (2), 40A–46A
Recommendations for ultrasonic, dye penetrant, magnetic particle testing and eddy current testing of small tubing are given and a table lists equipment costs, skill requirements, speed of testing, and defects revealed for these methods plus radiographic and hydrostatic techniques. The use of ultrasonic testing as a production dimension measuring tool is illustrated by wall thickness measurements on critical tubing.

*** 1190**

RYDER J. Jr.

Nondestructive testing of small–diameter, stainless steel fuel clad tubing.
Mater. Evaluation. mar., 1970. 28. 67–71
Discusses the techniques used to inspect 304 and 316 stainless steel fuel cladding for defects Descriptions are given of the three different testers used to inspect tubing.
They are a sinusoidal eddy–current tester, an ultrasonic pulse–echo tester and an ultrasonic tester that uses a send–receive system of transducers. Micrographs strip charts and statistical data obtained from the inspection of 20.000ft tubing are presented.

*** 1191**

ANDRE C.

Welds defined for quality control
Weld. des. fabr. feb., 43, (2), 60–61
Weld quality control can be improved by developing a method for classifying welds according to a degree of quality and then defining limits for inspection. Three classes are recommended, encompassing critical or highly stressed joints, medium–stresses joints, and low stressed joints and routine welds. A table lists class acceptance limits for 'structural' discontinuities such as porosity, inclusions, cracks, incomplete fusion undercut, burnthrough, craters and surface slag.

*** 1192**

BELL D. W. and SNOWSILL B. A.

Quality control in pipeline construction
Chem. Process Eng., Nov., 1969, (50), (11), 91–92
Causes of pipeline failure, and quality control and materials selection for this prevention are rev.
The use of higher–strength Nb or V controlled rolled, pearlite reduced steels is mentioned, and examples are given to faults arising from plant and operation deficiencies.
The desirability of inspecting suppliers plants and processed, and extending inspection and control procedures into the pipelaying stage, is emphasized.

*** 1193**

ALBERTINI C., JUNG J., MONTAGNANI M. and VERZELETTI G.

A correlation of NDT with DT of zry/Steel Welded joints for reactor pressure tubes
Mater. Evaluation, Sept., 1969, 27, (9), 185–192
Coextruded, swaged and explosion–welded zry/steel tube joints were tested with an ultrasonic thorough transmission technique which gave a map of welded zones with varying degrees of bombed and unbonded areas. These results were checked with destructive testing (tensile testing and microscopic examination) in order to establish a correlation if possible. Microscopic examination showed a good agreement with ultrasonic data.
On the coextruded and swaged joints, the ultrasonically bonded zones gave values of mechanical strength varying in a wide cange due the presence on intermetallic bonds, on explosive–welded joints, constant values of mechanical strength were obtained in good agreement with ultrasonic testing.

8033

CHOCKIE L. J.

Industry cooperative Program on Heavy Section Steels.
4th Annual Information Meeting.
HSSTP. March 31–April 1, 1970 Paper Nº 28

Industry cooperative program on heavy section steels Industry, with cooperation by all major suppliers and manufacturers, is participating in a program under the Pressure Vessel Resarch Committee, to answer the question "What are the properties and

how effective are inspection techniques for heavy section steels and weldments? ". The first task, on properties and the variations in properties, is being accomplished by testing specimens representing all parts and components in nuclear vessels.
Properties are being measured thorough out the length and breadth of the material and from many heats.
The second task concentrates on the nondestructive examination of specially prepared samples of welds and plates to develop procedures that can be used to obtain consistent results, and as well as describing flaws in terms of size, position, and orientation. Procedures are complete enough that others can duplicate the results.

* 8199

FOGLEMAN, E. L.

Industry cooperative program on materials properties.
Oak Ridge Nat. Lab., Tenn. sin paginar
Presentado en: Heavy section steel tech. program 5th annual information meeting. March 1971. Paper no. 30.

8207

LUBAHN J. D.

Design criteria for heavy section structures Fracture, Proc. second Tewkesbury symp. Fac. Eng. Univ. Melbourne, 1969, 101–118 (in english)
A programme of investigation is presented for design against brittle fracture in structures using heavy sections, in particular pressure vessels. The programme components are discussed in detail within the following framework; (1) material procurement ment and documentation, (II) assessment of current materials capabilities, (III) improvement of capabilities, and (IV) demonstration of final capabilities i.e. full scale tests. Attention is paid to the expense of the tests and the economic advantages of reducing safety factor.

* 8214

VEEN, M.C. VAN

Manufacture of large steel pressure vessels for nuclear power stations. The Rotterdam Dockyard Co. paginación varia.
This paper will be limited to those nuclear pressure vessels that have been (and are being) built by the author's company, viz. steel pressure vessels for watercooled nuclear steam-suppley systems (pressurized water reactors, boiling water reactors, and pressurized heavy water reactors).
First, data will be presented to illustrate the most important characteristies of these nuclear vessels.
Some of these characteristics, such as design pressure and temperature, internal diameter and height, location and size of nozzle penetrations, are specified by the builder of the reactor system. Other data, such as the choice of the steel quality with nechanical characteristics, wall thicknesses, flange and nozzle dimensions,

are generally the supplier's responsibility. Fabrication of nuclear pressure vessels, in general, not only involves the actual manufacturing operations, such as welding and machining, but also includes design and stress analysis, material selection, and quality control in the delivery contract.

9001

TUBE INVESTMENT STAINLESS TUBES LTD.

Tube investment stainless tubes technical data.
12 1/4 x 9 3/4 in. Loose leaf manual. Warley, Worcs.
1969: T1 Stainless Tubes Ltd.

9004

STAINLESS STEEL DEVELOPMENT ASSOCIATION

Introducing stainless steel
5 3/4 x 8 1/4 in. 20. Illustrated London (1970) The Association

* 9009

KOVAL, A.T.

Force conditions of tube extrusion. (Stal in Engl., Nº 12, 1969, p. 1077-1079).
The kinematic and force parameters of tube extrusion were determined analytically and compared with the processes of bar and sheet extrusion. Under specific conditions (with sufficiently low coefficient of friction) formulae derived for the cases of bar and sheet extrusion can be utilized for the forces in tube extrusion. The dependence of the mean pressure on the die in indirect extrusion and the height of the plastic zone on the relative dimensions is presented.

* 9020

ZHUKOVSKII B.D., ZIL'BERSHTEIN L.I., YANKOVSKII V.M., SHKABATUR K.I. and SHAITAN L.I.

Improving quality of samll and medium diameter electric weld tubes. (Stal in Engl., Nº 6. 1969, p. 583-584).
A comparison of electric resistance weld and high-frequency weld tube showing the advantages of the latter in respect of weld stability, dimensional accuracy, and surface finish. Satisfactory methods of removing the weld bead in the weld line or external to the mill should be developed to extend the field of application of welded tube. Elimination of strip material defects of steel melting or rolling origin will enable high-frequency weld tube to be more widely applied.

* 9026

SPIVAKOVSKII L.I. ET AL.

Economics of tube manufacture in USSR.
(Stal in Engl. Nº 3, 1969, p. 334-336).

* 9029

TUSHKOV P.M.

Economic effectiveness of warm rolling stainless steel tubes. (Stal in Engl., Nº 2, 1969, p. 232-234).
The use of a warm rolling technique, instead of cold rolling, to produce Kh 18N 10T steel tubes makes it possible to increase the output of cold rolling (KhPT) milis; the length and transverse cross-sectional dimensions of the blanks for the tube drawing mill can be increased and one drawing cycle can be eliminated. This provides considerable savings as regards pay, and the loss of metal is reduced. The variations in the figures under individual headings, and for individual shops, have been investigated. Warm rolling has been used at the works since 1961.

* 9033

SHAIKEVICH S.A.

Increasing the effectiveness of utilization of mills for cold rolling tubes. (Stal in Engl., Nº 9, 1970, p. 721-723)

*** 9036**

LITVINENKO D.A.

Cold-rolled stainless steel. (Stal in Engl., N° 6, 1970, p. 480-481)

*** 9038**

VATKIN Ya. L., KUCHERENKO V.R., KHAUSTOV G.I. and D'YAKOV Yu. V.

Decreasing wall-thickness variations of cold-rolled tubes. (Stal in Engl., N° 6, 1970, p. 466-467).
Trials showed that in order to decrease variations in the wall thickness of cold-rolled tubes the tube diameter must be decreased intensively in intermediate passes on mandrels with a large taper. Reduction of the induced wall thickness variation is achieved in the last (finishing) pass when rolling on mandrels with a small taper. The use of mandrels with a taper of 0.035 and 0.02 is recommended for the intermediate and finishing passes, respectively.

*** 9039**

NOSAL' V.V., VERDEREVSKII V.A., MOROZOV A.A., KOZLOV B.N. PICHUGIN G.P.

Improving the efficiency of tube cold-rolling mills.
(Stal in Engl., N° 5, 1970, p. 388-391)

*** 9040**

DANILOV F.A.

Improving a tube-rolling unit with continuous mill
(Stal in Engl., N° 4, 1970, p. 294-297)
Improving the construction of the rapid-heating compartment furnaces, increasing the degree of deformation in the continuous mill, and reconstruction of the sizing and reducing mill enabled a substantial increase in the productivity of the 30-102 unit of Pervoural'sk new tubeworks to be achieved. The investigations showed the possibility of increasing the dimensional accuracy of the tubes after the continuous mill.

*** 9041**

KASHIRSKII G.A.

Prospects for using continuous cast metal as tube blanks (stal in Engl., N° 3, 1970, p. 237-238)
The first results of experiments into the production of hot-rolled tubes from continuous cast blanks were discussed at a session of the tube production section of the USSR Ministry of ferrous metallurgy Scientific and technical council. The advantages were noted (higher production of first grade tubes rolled in automatic mills, reduced consumption of metal when tubes are rolled in pilger mills). Recommendations were adopted regarding the expediting of further research, primarily at the Rustavi and Novo Tula steelworks.

*** 9042**

TSELIKOV A.I., GULYAEV G.I., SEIFULIN G.K., DANILOV F.A., NODEV E.O., MARKOV V.P.

Development of the continuous rolling of tubes in the USSR. (stal in Engl., N° 3, 1970, p. 235-237)
The 30-102 continuous tube-rolling unit of Pervoural'sk new tubeworks is the most highly perfected of all similar units existing in world practice. The productive capacity of the unit at present exceeds the designed capacity (430 thou t of tubes/y). Suitable improvements have enabled tubes 27 m long to be obtained after the continuous rolling mill. The metal consumption coefficient on the 30-102 unit amounted to 1.112 in 1968; this index is much better than on similar units produced by the firms Innocenti and Demag. The construction of the new continuous tube-rolling units has enabled a higher tempo of growth to be achieved in our country in the production of hot-rolled tubes with diameters of 30-146 mm.

*** 9046**

SHEVAKIN Yu. F., MATVEEV B.N., BIBIK G.A., KARPOV G.A., TERESCHENKO A.D., UMERENSKOV V.N., KUPERSHTEIN E.A., SIMONOV S.K.

Rational pass design of pilger polls for rolling thickwalled tubes. (Stal in Engl. N° 1, 1970, p. 53-54).
It was shown that optimum results in rolling thickwalled tubes in the rotary forge are not obtained unless the passes in, the pilger rolls are designed particularly for rolling such tubes. The roll-pass parameters are calculated and the results illustrated by an example.

9064

FIRTH BROWN LTD.

Steel specifications
120 x 85 mm. 231. Sheffield. 1971: Firth Brown Ltd..

*** 9065**

BEVERLY B.H. Jr. and MYERS L.P.

What's new in special stainless steels.
Metal Progr. 101 (1972): 2,54-64,66,70-72
You can get a quick update on what's available in special stainless steels from the following Forum and Data Sheet. The Forum is made up of 16 short articles that are application-oriented. Here are the grades discussed: Custom 450, Type 439, Croloy 16-6 PH. USAmet, p. 60; 416 MF, 416 MH, 416 MX, and 4 MX, CA6NM, E-Brite 26-1, PH-55A; CSM 414, BG-42, and 21-6-9. The three-page Data Shell, covers the more than 160 grades.

*** 9069**

TI STAINLESS TUBES LTD.

TI Stainless-tubes, technical data.
1969

9075

RICHTER H. and KLEIBELER H.J.

Tube materials in nuclear reactor construction Schweiz Arch., Nov., 1969, 35. (11), 375-380 (in G.)
Alloys used for reactor fuel cans, heat exchanger tubes and pressure tubes in various types of nuclear reactor are discussed 14 ref.

9076

CHAMAYOU G.

The cold working of stainless steel tubes-I
Formage traitements métaux, mar., 1970, (13), 35–44
Tube sizes, which are readily available, are listed
The basic forming processes are briefly described such as rolling, fixed plug drawing, moving mandrels, floating plug and tube sinking, also the forming of square tubes.

9077
CHAMAGOU G. and DUVAL H.

The cold working of stainless steel tubes. II-Cold bending.
Formage, Traitments Metaux, may. 1970, (15), 43–48–52
The basic formulae for tube bending are given. Two factors influence the form of the tube bend, these are the ratios of tube dia. to wall thickness and min. bend radius to tube dia. Results for various types of bending technique are presented graphically and a "difficulty" factor is discussed. A list of the main defects in tube bends is given with list of the possible causes.

9078
STAINLESS STEEL EXTRUSIONS
Stainless steel, 1969, (12), 9-11
Billet temp. for extrusion of stainless steel are usually 1100-1200°C and glass or graphite are generally used as lubricant. A high speed is essentially and speeds more than 15ft/sec are recommended in order to hold very close tolerances over the entire length of an extruded section or tube. A suitable die material is a 9 o/oW steel, or a 4 1/4o/oW steel contg. additions of Cr, V, Mo, The use of martensitic steels for extrusions is limited to heat resisting applications. Complex shapes can be held to ± 0,030 in. or better when a cold drawing operation is included.

9079
CHAMAYOU G., and DUVAL H.

The cold working of stainless steel tubes-III
Formage traitements Métaux, June 1970, (16) 49–56.
Examples of shaping operations which can be applied tubes are given including end forming operations, fluting, coil forming and bending. Newer techniques such as flow turning, high energy forming methods and bend forming by rolling, are also discussed.

* 9080
AMERICAN SOCIETY FOR TESTING AND MATERIALS, PHILADELPHIA., PA.

Annual book ASTM Standards, 1970, pte. 1 Steel piping, tubing and fittings.

* 9081
OGURAS S., SASAKI K., SUZUKI J., and DEGUCHI H.

Manufacturing of steel and alloy tubes for nuclear power plants.
Sumitomo Search, may., 1970, (3), 57-71 (in english).
Alloys for use in the newest nuclear power plants, including a 300 MW reactor of the fast breeder type are detailed. Examples are: stainless steel cladding tubes, large dia, austenitic stainless steel seamless pipes for cooling water, 75: 15 Ni-Cr alloy tubes for steam generation, stainless steel tubes for driving mechanisms and heavy wall C-steel pipes for steam and feed water pipes. Types, specifications, uses and special properties of 15 alloys are tabulated. Flow sheets of procesess are presented. Equipment described and ilustrated includes presses, welders, heat treatment, testing and inspection.

*10.116
OFFICE OF THE ASSISTANT GENERAL MANAGER FOR REACTORS

Nuclear Reactors Built, Being Built, or Planned in the United States, 1971.
This compilation contains unclassified information about facilities built, being built, or planned in the United States for domestic use or export as of June 30, 1971, which are capable of sustaining a nuclear chain reaction. Information is presented in five parts, each of which is categorized by primary function or purpose. The major parts, namely, civilian, military, production, and export, as well as such categories as power and propulsion, are self-explanatory.

*11.128
STOUT R. D., MACHMIER P. M. and QUATTRONE R.

Effects of impurities on properties of high-strength steel weld metal.
Welding J., Nov. 1970, 49, (11), 521-530
The thereshold level of gaseous impurities at which degradation of mechanical properties in HY-130 weld metal ocurred was studied for specimens prepared by inert gas shielded W are or metal are welding.
It was found that the weld metal was readily contaminated with N or 0 when were present in small amounts in the shielding gas. High purity welds in I inch plates with a 3% Ni-Mn-Cr-Mo filler metal or a 5% Ni-Cr-Mo wire developed satisfactory tensile strength and ductility and showed excellent notch toughness when deposited by the metal are or W are process. Nitrogen produced a marked and progressive notch embrittlement. Small additions of Al, V, Ti or Nb raised yield strength but lowered notch toughness. The 3% Ni alloy was strongly embrittled by 0 contamination whilethe 5% Ni alloy showed little effect up to 100 ppm 0. Keyhole restraint tests showed the 3% Ni metal was much more susceptible to H-induced delayed cracking then the 5% Ni metal. Electromicroscopy showed that the embrittlement due to 0 was related tothe formation of SiO_2 particles in the matrix which increased in size and number as the 0 was increased. 11 ref.

*11.129
GROVE E. L., LOSEKE W. A. and GORDON E. S.

Development of a portable direct reading spectrometer to monitor oxygen-hydrogen containing contaminants in gas W-Are process shields.
Welding J., Nov. 1970, 49 (11), 538-544.
The presence of atmospheric contaminants in the shielding gas, on the metal surface and dissolved in the metal or trapped in inclusions during the gas-tungsten-are-welding of Al alloys can be detected with a new portable direct-reading spectrometer. The instrument is designed to operate under adverse optical conditions, i. e. very short are lengths, optical planes other than 90° and with a source that does not remain in a fixed optical position in space. Its design, calibration and performance are described in detail. 7 ref.

11.130

Some effects of welding on the mechanical properties of structural steels.
Inst. of Minig and Metallurgy: Proc. Ninth Commowealth Min. Met. Congress 1969, Physical Fabrication Metallurgy, 1970, 4, 53-62
The thermal and mechanical strains which occur during welding can change the properties in the parent plate near to the weld. Existing information on changes in fracture toughness near welds in outlined, with particular ref. to the weld-strain-embrittled region of C steels and precipitation-embrittlement regions in low alloy steels. The effects of thermal stress-relieving treatments on properties and theproblem of cracking near the weld during the treatment are also discussed. 29. ref.

11.131

AMATO I.

The brazing of nuclear components.
Met. Italiana (Atti Notizie) oct. 1970, 25, (10) 339-343.
Details are given of procedures for brazing with commercial H, and vacuum-and induction-brazing of complex components in stainless steel H-brazing is carried out at 925-1065°Cusing preplaced rings of Ni-13% Cr-10% of melting point 890° C vacuum brazing uses Nicrobraz-50 at a vacuum of 10-4 torr, and induction brazing uses the Ni-Cr-P alloy with a flux.

11.132

BRAITHWAITE A. B. M.

Engineering design and its relationship to welding Inst. of minig and metallurgy, Proc. Ninth Commonwealth Min. Met. Congress 1969: Physical Fabrication Metallurgy, 1970, 4, 39-52, discussion 63-67.
The engineering aspects of welding are considered with particular ref. to mining and handling equipment. The fatigue of welded structures techniques for improving fatigue strength, and methods for calculating fatigue life are discussed. The choice of materials for welding the heat treatment of welded structures are outlined.
Service failures illustrate how incorrect detail design can affect performance.

* 11.133

TIG WELDING THE LUNAR MODULE

Weld, Eng. Nov. 1970, 55, (11) 58, 62-64.
Most of the lunar module was fabricated from Al alloy with 2219 used exclusively in the ascent stage in chemically milled panels, machined longerons and other parts Components were joined by TIG welding under carefully controlled conditions, then subjected to critical hydrostatic inmersion and internal pressure tests.

* 23.001

SAMANS, C. H.

Selecao de acos para equipamento de refinaria de petroleo. (Conf. proferida durante 0 24 Cong. Anual de AMB, Sao Paulo, Julio 1969).
A selecao de acos para reservatorios e tubulacoes em refinaria de petróleo é determinada pela combinacao mais economica das tensoes admissiveis especificadas e a capacidade de resistir a degradacao sob condicoes operacionais. A temperatura e um fator importante a ser considerado na selecao, porque ela afeta tanto a resistencia mecanica como a resistencia a corrosao. As temperaturas de operacao de refinarias podem varias desde —45° C, ou menos, até 650° C, ou mais, dependendo dos processos especificos usados. 0 hidrogenio degrada muitos tipos de acos naquela faixa de temperaturas, alem do que, autros mecanismos tornam-se ativos em altas temperaturas. Os acos ferriticos, abaixo e em temperaturas atmosféricas, podem sofrer transicao para fragilidade ao entalhe, e os perigos causados por este fenomeno devem ser considerados. Em virtude de os acos resistirem muito pouco a corrosao em presenca de condemsacao aguosa, o uso de filmes inibidores de corrosao ser ventajoso. De 345° C ate 650° C, os acos ferriticos contendo ate 9% de cromo e 1% de molibdenio resistem muitas formas de degradacao, com sucesso. Os acos inoxidaveis ferriticos de alto cromo apresentam poucas ventagens. Acima de 650° C, e para condicoes corrosivas severas em baixas temperaturas, os acos inoxidaveis austeniticos deven ser usados.

* 23.002

LONDON. BRITISH STANDARDS INSTITUTION

Draft British Standards general principles for sampling airbone radioactive materials.
DC 72/44470, 1973
The potential hazard from breating airborne radioactive materials must be evaluated and controlled through measurements of the levels and nature of the airborne radioactive materials. In zones occupied, or to be occupied, by workers, the levels of airborne radioactive materials must be determined and compared with the applicable control level to ensure that workers are not exposed to concentrations exceeding those considered safe. Levels necessitating improved facility design, insolation of source or contamination, control of exposure time, or the wearing of approved respirators may thus be identified.

* 23.003

WHITTAKER S.J. and STANLEY J.

Method and apparatus for fuelling a pressurised nuclear reactor. Atomic Energy of Canada. Canadian Patent Nº 891193, Class. 359-32, 1972
This invention relates to a method of and apparatus for fuelling a pressurised nuclear reactor.
It has already been proposed to fuel a pressurised nuclear reactor by connecting in a fluid-tight manner a fuelling machine casing to a fuel channel, equalising the pressure within the casing, opening a valve sealing the fuel channel, connecting a hauling device to a spent fuel stringer within the fuel channel, hauling the spent fuel stringer into the casing, inserting a fresh fuel stringer within the fuel channel, closing the valve, and removing the casing from the fuel channel.

23.004

LEWIS W.B.

The Heavy Water Reactor for Power
AECL 319 (report DL-25, 49 pp., 1956)

*** 23.005**

U.S. ATOMIC ENERGY COMMISSION

The nuciear industry. 1971
199 p. (WASH 1174-71)
The nuclear industry continued to grow in 1971, a year which reflected an increasing level of orders for nuclear power plants. There also was increasing evidence that the industry is reaching maturity, especially in the use of light water reactor technology.
In his first speech as AEC Chairman, Dr. James R. Schlesinger told the industry:
"The development and the expected growth of this industry are simpley remarkable. What other industry can look forward with the same degree of confidence to a growth rate of roughly 15 o/o per annum. The future is spectacular —the ultimate future. The pace of achievement, however, will depend heavily on two provisos: first, provision of a safe, reliable product; second, achievement of public confidence in that product. Satisfying these provisos will be a demanding task. But it can be done, if we recognize that it is imperative to provide the determination, the resources, and the organization to meet that challenge....
"It is the responsibility of the Atomic Energy Commission vigorously to develop new technical options and to bring those options to the point of commercial application.
It is not the responsibility of the Atomic Energy Commission to solve industry's problems which may crop up in the course of commercial explotation.
That is industry's responsibility, to be settled among industry, Congress, and the public. The AEC's role is a more limited one, primarily to perform as a referee serving the public interest. Imight add that it is to industry's long-run advantage that the public has high confidence that the AEC will appropiately perform its role in this regard.... "1/
The growth of the nuclear industry was highlighted in 1971 by orders for nuclear electric power units at a level substantially above 1970 and at a higher level than in any year since 1967.

*** 23.006**

SCHERER F.M.

Nordhaus' theory of optimal patent life a geometric reinterpretation.
The American Economic Rev.. 62, (3), June 1972, p. 422
For more than a century the patent system has been studied with remarkable care by economists, Yet only recently, in a contribution by William Nordhaus, has formal economic theory been brought to bear successfully on the central policy issue of the patent system-how much protection should be accorded inventors and innovators. This article extends Nordhaus' pioneering work and correct what in some cases is a significant interpretational error. Nordhaus' original presentation was largely algebraic, but certain problems he left unsolved can be tackled more directly through the geometric approach taken here. This node of attack has the fringe benefit of making what in the original paper was a rather forbidding tangle of mathematical notation more comprehensible intuitively.

*** 23.007**

NORDHAUS W.D.

The optimun life of a patent: reply. The American Economic Rev. 62, (3), June 1972, p. 428.
In his geometric discussion of the economies of patents F.M. Scherer has clarified many of the results and pointed to some problems. His discussion is confined to the "pure" theory. I wish in this reply to point out some problems with the pure theory and suggest that the implications are rather different from those drawn in Scherer's article.

*** 23.009**

ASHANINA A.

Sources of financing and the structure of expenditures of scientific research organization.
Problems of Economics. 14, (6), Oct. 1971, p. 75

*** 23.010**

PRESCOTT E.C.

Adaptive decision rules for macroeconomic planning.
Western Economic J.9, (4), Dec. 1971, p. 369

*** 23.011**

ALAGH Y.K., SUBRAHMANIAN, K.K., KASHYAP S.P.

Interregional industrial structure in a developing economy: a conceptual frame with a case study.
J. of Regional Sc. 11. (3). Dec. 1971
This paper examines the regional spread of the Indian industrial structure and suggests that, apart from the relatively diversified regions linked with the metropolitan cities of Calcutta, Bombay, and Madras, industrialization in the other regions consists of easily identifiable clusters or sets of a few interrelated industries. Historically, this phenomenon has been explained by the commercialization of Indian agriculture in the nineteenth century leading to the development of raw material and plantation based industries. The industralization process was gradual because the economy was left open in the international context. (See Gadgil (8), Malenbaum (18), and Thorner (22).) Diversification of the national industrial economy started taking place in the last two decades. To the extent that the recent industrial projects have been located in areas outside the regions adjoining the traditional industrial metropolis, the spread effects within the region have been poor and the impact of the diversification of the national economy on regional diversification has been limited.
The type of interregional industrial structure being described lends itself to analysis by both regional input-output techniques (with block diagonal 'regional tables) and conventional economic base studies. Since such an approach has obvious relevance to multiregional developing economies in general, we have attempted in this paper a comparative assessment of the two types of techniques, the main conceptual arguments being then proved empirically with Indian data' The paper further explores the implications of the structural analysis for the construction of national industrial planning models which specifically incorporate the interregional aspect.

*** 23.012**

TARASUK W. R.

Nuclear fuel fabrication
Canadian Gen. El. Co, Ltd.
Canadian Patent 891194

*** 23.013**

DOMER H., HARTZ K., and TRUMPFHELLER R.

The technology and economy of the quality control of large reactor components.

Atomwirtschaft Atomtechnik. 17, (9/10), Sept. 1972, p. 524

23.014

OAK RIDGE NATIONAL LABORATORY, TENN

Selection and procurement of pressure relief valves for light-water-cooled nuclear reactor system.
ORNL-TM-3782, June 1972. 99 p.

* 23.015

DALGAARD S.B.

The corrosion resistance of Zr-Nb-and Zr-Nb-Sn alloys in high-temperature water and steam.
AECL-993. 1960
An alloy of reactor-grade sponge zirconium-2.5 wt. o/o niobium was exposed to water and steam at high temperature. The corrosion was twice that of Zircaloy-2 while hidrogen pickup was found to be equal to that of Zircaloy-2. Ternary additions of tin to this alloy in che range 0.5-1.5 had no effect on the corrosion resistance in water at 315°C up to 100 days. At higher temperatures, tin increased the corrosion, the effect varying with temperature. Heat treatment of the alloys was shown to affect corrosion resistance.

* 23.016

NEWCOMBE H.H.

Radiation-induced instabilities in streptomyces.
AECL-35, (J. of general nicrobiology. 9 (1), Aug. 1953
A variety of heritable changes affecting colony morphology and colour are induced in a Streptomyces sp. by exposure of the spores to ultraviolet and gamma rays. Most of the changes are associated with instabilities which give rise to further variation during colony growth and spore formation. The instabilities persist indefinitely in most lines of descent and give rise to characteristic proportions of new variant types each having its own pattern of instability. The ultraviolet dose effect curve shows the familiar peak and decline found for mutations in many other organisms. The present changes however, differ from the gene mutations previously studied in that they can be induced with much greater frerquencies (30-60 o/o of the colonies being affected), and that gamma rays are as effectuve or more so than ultraviolet irradiation. This suggests that the initial changes and perhaps subsequent ones as well, might be more of the nature of the chromosomal rearrangements, rather than of the gene mutations, of higher organisms. Similar instabilities arise spontaneously but with a much lower frequency.

* 23.017

LEWIS W.B.

Canadian power development-future possibilities.
AECL-131 (Report DL-15), 1954

* 23.018

LEWIS W.B.

Economics aspects of nuclear power.
AECL-165 (Report DL-16) 1955

* 23.019

LAURENCE G.C.

Atomic power reactors and their fuels.
AECL-175 (Chemistry in Canada, May. 1955)
The author mentions some of the basic principies of converting nuclear energy to electrical energy, and describes features in the design and operation of power reactors, the choice of materials in their construction and the requirements for fuel.

* 23020

LEWIS W. B.

Possibilities of Generating Atomic Electric Power at competitive Rates (Report DL-17, 23 pp., 1955.

* 23.021

HORSMAN J. C.

Atomic Power Reactors and their Fuels (Chem in Can. 7, 48-52, June, 1955) AECL - 179.
The author, in this paper, amplifies the general account of nuclear reactors and their fuels given in Part 1, referring in particular to the practical aspects and the manner in which fuels might be used. Mr. Horsman is head, nuclear engineering branch, Atomic Energy of Canada Limited, Chalk River.

23.022

LEWIS W.B.

Atomic Energy a Source of Future Power— Its Impact on Industry.
Report DL-18, 10 PP, 1955. AECL 180

23.023

LEWIS W.B.

An Atomic Power Proposal
(Report DR-18, 14 pp. 1951, declassified 1955). AECL 186)

* 23.024

DAVIS J.

Electric Power in Canada. Regional Forecasts in Relation to Nuclear Power Possibilities. Paper A/Conf. 8/P/3 in Proc. Intl. Conf. Peaceful Uses Atomic Energy 1, 166-171 1956. AECL 202.

* 23025

LEWIS W. B.

Some Economic Aspects of Nuclear Fuel Cycles. Paper A/Conf. 8/P/4 in Proc. Int. Conf. Peaceful Uses Atomic Energy **3**, 3—13, 1956. AECL 203

23026

HURST D. G.

Experiments on Some Characteristics of the NRX Reactor.
Part I—Methods and Prolonged Fuel Irradiation. Paper A/Conf. 8/P/5 in Proc. Int. Conf. Peaceful Uses Atomic Energy 5, 111—118, 1956; also slightly revised and combined with 205 in Prog. in Nuclear Energy, Ser, 2, **1**, 1—48, 1956. AECL 204

WARD A. G. 23027

Experiments on Some Characteristics of the NRX Reactor.
Part II – Temperature and Tranient Poison Effects. Paper A/Conf. 8/P/6 in Proc. Int. Conf. Peaceful Uses Atomic Energy 5, 119–124, 1956; also slightly revised and combined with 204 in Prog. in Nuclear Energy, Ser. 2, **1**, 1–48, 1956. AECL 205

DAVIS J. and LEWIS W. B. 23028

An Economic Forecast of the Role of Nuclear Power in Canada. Proc. Int. Conf. Peaceful Uses Atomic Energy 1, 346–353, 1956; also in Can. Chem. Processing **39**, (10), 65–80, 1959. AECL 210

ATOMIC ENERGY OF CANADA LIMITED NRX REACTOR STAFF 23029

NRX Reactor reseach Facilities
Report IOP–3, 20 pp., 1955. AECL 215

GREENWOOD J. W. 23030

Catalogue of Nuclears Reactors
Report CRR–590, 52 pp, 1965 AECL 220

GILBERT F. W. * 23031

Problems in Producing Power from Nuclear Fission (Eng. L. **38**, 1204–1206, 1955) AECL 238
Showing the conservation of neutrons is a basic problem in reactor design, the author enumerates the various fissionable fuels available. Pointing out that the choice of the type of reactor is the first decision, he lists the various types of reactor, giving their respective advantages and shortcomings.
Methods of feeding the fuel into the reactor are discussed, as well as some of the problems involved in assuring safe operation.

SMITH H. A. 23032

The Preliminary Designs for NPD (Chalk River Report, 25 pp., 1955). AECL 240

BENNETT W. J. 23033

Canada's Nuclear Power Development Programme (13 pp., 1955) AECL 242

LEWIS W. B. 23034

Reactor Design and Technology Presented at the U.N. Geneva Conference on the Peaceful Uses of Atomic Energy, August 1955 (Report DL–20, 16 pp., 1955). AECL 252

BENNETT W. J. 23035

The Atomic Energy Programme in Canada (14 pp., 1955) AECL 254

LEWIS W. B. * 23036

Atomic Energy 1955– Public Lecture at the Royal Military College of Canada, Kingeton, Ontario, on November 10, 1955. (Report DL–21, 13 pp., 1955) AECL 263

RUNNALLS O.J.C. and BOUCHER R.R. 23037

The Crystal Structure of β–$PuSi_2$ (Acta Cryst. **8**, 592, 1955) AECL 264

BUNNALLS O.J.C. 23038

The Crystal Structures of Some Intermetallic Compounds of Plutonium (Can. J. Chem. **34**, 133–145, 1956)
AECL 267

LEWIS W. B. * 23039

Attainable burn–up of uranium with plutonium recycling, with special reference to the ANL 1000 MW heavy water boiling reactor of Geneva paper P/495. AECL–285
(Report DR38) 1956
A method of calculeting the attainable burn–up of uranium is developed which readily takes into account any departures from the ideal of returning all the plutonium.
The analysis applicable only to the equilibrium condition when a steady state of recycling has been attained. It is shown that whereas an optimum assignment of parameter was made for starting up the ANL 1000 MW D_2O boiling reactor with natural uranium, a greater burn–up of natural uranium would be attainable by reducing the resonance escape factor from 0.8364 to about 0.70. This, however, necessitates carrying a greater proportion of fissile material throughout the fuel cycle.
Without this enrichment the attainable burnup is estimated as 30,000 megawatt days per tonne, using the best data available on the properties of the plutonium isotopes. With enrichment and a reduction of the resonance escape factor, an attainable burn–up of 45,000 megawatt days per tonne would be predicted.
The methods used are given with a high degree of precision so that other cases may readily be analysed.

LEWIS W. B. 23040

Atoms for Peace–Canada Goes to Geneva (Queen's Guarterly **63**, 84–96, 1956) AECL 300

BENNETT W. J. 23041

The Atomic Energy Programme in Canada (10 pp., 1956)
AECL 302

BABBIT J. D., DAUPHINEE T.M., ARMSTRONG L.D. and PERIA W. 23.043

Thermal Conductivity of Metals at High Temperatures, II. Thermal Conductivity of Uranium: a Preliminary Study (Report CRR-438, 37 pp., 1949, reprinted 1956) AECL 326

* 23.044

BOYD A. W. and WHITTON J. L.

Determination of neutron flux by measurements of capture gamma rays. AECL-332 (CRDC-637) 1956
It has been foundl possible to measure the variation of Thermal neutron flux with height in the air annulus in the graphite reflector of the NRX reactor by measuring the intensity of gamma rays emitted on neutron capture from an absorber in this position in the reactor. The apparatus used is described and the values obtained are compared with a measurement of thermal neutron flux made by a cobalt wire activation method in the same position. The variation in relative neutron flux for different heavy water levels in the NRX calandria is shown.

* 23.045

WALLACE P. R. and LE CAINE J.

Elementary approximations in the theory of neutron diffusion.
AECL 336 (Report MT-12) 1956
This report presents in systematic form solutions of problems of neutron diffusion in a single medium, both with and without multiplication, on the basis of elementary theory. The stationary state diffusion equation with capture is assumed for the diffusion of thermal neutrons and the diffusion equation of the time-dependent type, without capture, for the diffusion of non-thermal neutrons. The stationary neutron densities are derived for various shapes of the medium an various source distributions. The problems are treated in the following sequence: due to acurces of thermal neutrons (ii) nonthermal neutrons due to of fast neutrons. (iii) thermal neutrons due to sources of fast neutrons, without and with multiplication. The problem of multiplying systems under critical conditions in the absence of primary sources is treated in a final section. The material is arranged according to: (a) type of problem (b) shape of medium (c) distribution of sources. Graphs are given to illustrate some of the more important distributions.

23.046

MOXON D.

SLIP: a dynamics programme for the thermal hydraulic behaviour of boiling loops.
AEEW-R-448 Aug. 1968 50p.
SLIP is a dynamics programme (in Fortran) for solving the thermal-hydraulic equations describing an electrically heated rig. The heater may be a single tube cooled from within and insulated from the atmosphere externally, ot it may be a bundle of heater rods each cooled on the outer surface. The axial power distribution is arbitrary. The hydraulic circuit consists of the heated section, a number of risers in series, a single-phase dowcomer containing a pump and a single phase bypass across the test-section. The system may be disturbed by imposing variations on power, inlet sub-cooling, inlet velocity or pump pressure head. Output includes axial distributions of heat of heat flux, void fraction, coolant density, dryout margin, as well as loop pressure losses An optional extra is a Fourier analysis of certain items of output enabling a calculated cyclic response to be represented in terms of the various harmonics.

23.047

FUJISAKI Y. and KAGAWA T.

High pressure heat-transfer tests on BWR cores
Toshiba Rebyu, 23; 1332-7, oct. 1968
A high-pressure heat-transfer test loop was constructed to determine the maximum heat flux allowable in BWR core, and data on burn-out heat flux were recorded for 4-rod, 5-rod and annular tubes test sections. The ranges of variables investigated were as follows: pressure, 1,0 to 90 Kg. cm^2 abs., mass velocity, 1.7×10^6 to 11.0×10^6 Kg/m^2h, exit steam, 2 to 27%, and heat flux, 6.5×10^6 $Kcal/m^2h$ or below. The heated lengths of the test sections were 300 to 450 mm. the outside diameter, both 10 mm. Investigation was also made on the method of increasing burn-out heat flux by using an orifice as a mixing promoter of two-phase flow.

23.048

WORLEY N.G., TAYLOR A.J. and PRASHER C.L.

Heat exchanger useful in nuclear reactor system U.S. Patent 3.393. 664 July 23, 1968. Priority date Nov. 25, 1963, Great Britain.
A steam generator and superheating plant for a nuclear reactor are described. The forced flow boiler consists of serially connected steam and superheat sections of multiple variable-length pipes. A controlled flow of liquid coolant runs parallel to the steam inlet and has an intermediate connection in the steam generator (Offic. Gaz).

23.049

BERGLES A.E., ROOS J.P. and BOURNE J. G.

Investigation of boiling flow Regimes and critical heat flux.
Final Summary Report N° 797 (NYO-3304-13) July 1968. Contract AT (30-1)-3304. 174p.
An investigation of boiling flow regimes and critical heat flox was conducted. The experimen tal facility consisted of a water loop and a recirculating steam loop supplying electrically heated test sections. The steam loop was found to be a practical and economical method of increasing the capacity of the facility. Film thickness and critical heat flux measurements established that obtained with two-phase inlet conditions were comparable to those obtained with single-phase inlet conditions, provided that the annular mixer was properly adjusted and the test section was sufficiently long. The instrumentation developed for study of the flow structure included a traversing electrical probe, for determination of the general flow regime and measurement of the thickness of the annular liquid film and a traversing isokinetic sampling probe, for examination of core entrainment in annular flow. Detailed flow regime information was obtained for boiling water flowing vertically upward in circular tubes of 0.4 and 0.8 in diameter with lengths varying from 2 to 8 feet. Inlet conditions were subcooled, pressures were 500 to 1000 psia. and mass velocities ranges from 0.2×10^6 to 4.0×10^6 1bm/h r ft^2. The following flow regime boundaries were identified: bubble, slug, froth, and spray annular. The flow regime boundaries were found to be significantly altered by changes in pressure, tube length, tube diameter, and inlet temperature. For the conditions tested, the CHF locus does not exhibit any unusual behavior when the various flow regime boundaries (bubble, froth, and spray annular) are crossed. Measurements of film thickness were made for a wide range of conditions in the annular flow regime. At lower quality the adiabatic film thickness is considerably above that predicted by

semi-empirical models, due to entrained vapor. With the exception of very high mass velocities, the film thickness proceeds smoothly to zero as the CHF condition is approached. In view of the direct relation of film thickness to the CHF condition, the electrical probe can be utilized as a burnout protection device. Under certain conditions, oscillating behavior was noted within the heated test section. The oscilations were considered to be acoustical in character, and a model was formulated which yields a reasonable prediction of the threshold and frequency of oscillation. The electrical probe was further demonstrated to be a valuable diagnostic tool for investigatin the flow structure in a rod bundle. Detailed flow regime and film thickness measurements were made in several subchannels of a four-rod bundle. (auth).

*** 23.050**

WHITMAN M. J., TARDIFF A. N, and HOFFMAN P. L.

U.S. civilian nuclear power cost-benefit analysis. Fourth United Nations Int. Conf., Geneva, 1971 A/ Conf/ P/072.2

Three reactor types were selected for consideration in this analysis: a LWR, a LMFBR and a HTGR. Parameters used were: electricity demand, uranium cost, fossil fuel costs, projected power plant capital cost, and the introduction date of the breeder.

The conclusions quantifies the benefits and a number of other significant benefits between economic, technological and industrial coupling between LWR and LMBFR.

*** 23.051**

EHRENTREICH J. and PANTLEON M.

European atomic industry and its market

Atomwirschaft Atomt., 14,45-52 Jan, 1969

Saturated steam turbines for nuclear power plants are described. Turbine design data for each of the power reactor throughout Europe are tabulated. Corrosion-erosion effects and erosion on the low pressure side of the turbine are discussed. Requirements for saturated steam turbines are tabulated as a function of power and condenser pressure. Effects of load on the turbines are considered Gas turbines for high temperature gas cooled power plants are discussed. A list is given of turbine manufacturers located in: Germany, Belgium, France, Italy and the Netherlands.

*** 23.052**

U. S. ATOMIC ENERGY COMISSION. DIVISION OF REACTOR DEVELOPMENT AND TECHNOLOGY.

Updated (1970) Cost-Benefit analysis of the U.S. Breeder reactor program. USAEC, 1972, 56 p. (WASH-1184)

The Updated Cost-Benefit Analysis of the U.S. Breeder Reactor Program bears out the conclusions of the 1968 Study but with considerably more emphasis.

The benefits of the breeder as measured in terms of savings to the Nation's power customers have increased markedly in the current study. The breeder will not only stabilize the cost of electricity, but will also conserve uranium resources and reduce the amount of uranium separative work capacity required. While the benefits are sensitive to power demand, they remain substantial even at the lowest of the projected demands. The relative capital cost of the LMFBR is an important factor, and the LMFBR power plant designers should keep costs firmly in mind in order to assure that reliable and dependable LMFBR power plants can be built at minimum cost.

The combined effect of the chages in the power economy since 1968 is to increase the 7% discounted benefits of the breeder by over 100% from $ 9.1 billion for the base case of the 1968 Study to $ 21.5 billion for the base case of the updated Study. Of the $ 12.4 billion increase in benefits, $ 6.7 billion is due to the higher energy demand; $ 1.2 billion is due to the higher separative work charge; and $ 7.1 billion is due to the higher fossil fuel costs, higher capital costs, and computer program changes. These increases ~~are increases~~ are partially offset by a $ 2.6 billion decrease due to the twoyear slippage in introducing the LMFBR.

23.053

GRAY J. L., LEWIS W. B. and HAYWOOD L. R.

Candu reactors to 1980 and in the long term.

Sectional meeting of the world power conference, Transaction, Tokyo, 16-20 october 1966 vol. III Tokyo, Japanese national committee, World power conference, 1966, AECL 2486, ppf 1487-97 of the 15 th.

The technical acomplishments and the general power reactor position in Canada are reviewed, and predictions are made for the period 60 1980. The role of CANDU reactors in the longer term when their near-breeder capability and flexibility of fuelling promises to meet any problem of fuel resources and to retain a competitive position is examined. Four fuel cycles appropiate to different costs of natural uranium and fuel reprocessing are discussed.

23.054

ZAJIC V.

High pressure reactor water loop.

Jad. Energ., 15:1-10 Jan. 1969 (in czech.)

In 1966 a high pressure reactor water-loop with the at mosphere of CO2 at 65 atm. was set into operation on the WWR-S reactor in the Institute of Nuclear Research for the investigation of pressurized water systems under radiation. It is intended to be applied to the research of corrosion of materials used in the heavy water circuits of HWGRC power reactors being developed in Cz to the research of physical properties and functions of heavy-water circuits in a two phase system (water-CO2) to the investigation of radiolysis and purification of circulating water, to the development of necessary measuring and control devices, of dosimetric systems and to examination of descontamination methods efficiency. With respect to parameters of h-w circuits in the HWGCR types of power reactors, the equipment of this water loop is provided to operate at temp. up to 120°C. There is a hermetic circulating pump and tight servomotoric fittings. All circuits are made of 18Cr8Ni stainless steel, packings of Al and of PTFE. Detailed data on the loop parameter are presented.

23.055

HAUSER G. S.

Cold forming techniques-and how applications could be expanded by more suitable steels.

Mechanical working of steel, vol. 3, 1966, 18-23

Broader applications of modern cold forming methods to the production of steel parts (valves, output shafts) is impeded by a number of problems. Among these are: lubrication, lack of ductillity as affected by mill variables such as segregation, seams, etc. and low tool life in view of the heavy deformation forces exerted. Reviews current cold forming methods, and their limitations. Some example of work pieces failures, where ductility of the material being deformed was insufficient to undergo the strains imposed are cited.

23.056

ROBIM M.

Improvements in and relating to a heat exchanger British paten 1.144.297. 1969 Priority France 1966 A single-walled heat exchanger adapted to limit welds in contact with both water and sodium is described. Liquid sodium flows through conduits in which are also tubes of smaller section in which water circulates. The tubes for liquid sodium have closed ends but, innert tubes are coupled. The heat exchanger is fabricated in modules which are connected in parallel to common inlet and outlet collectors.

DALDRUP H., PANTLEON M. *** 23.057**

European atomic industry and its market. III. Heat exchanger, pumps and valves for nuclear energy installations.
Atomwirschaft, 13: 544-7 (Nov. 1968)
Principal data are listed for the steam equipment and primary circuits of European nuclear power plants. Europeans firms which supply the various pumps motors and heat exchangers are tabulated.

23.058

SULZER BROTHERS LTD.

Heat exchangers.
Britisch patent 1.135.433 Dec. 4, 1968 Priority date Jan. 21, 1965, Switzerland.

23.059

SULZER BROTHERS LTD.

Improvements in and relating to heat exchangers British patent 1.146.012 Mar. 1969. Priority date 1965 Switzerland.
A heat exchanger for the exchange of heat between two mediums is described. The heat exchanger is located in a flow path of one of the mediums such as the coolant in a reactor. The heat exchanger consists of a number of parallel-connected heat exchange units placed side by side with gaps between adjacent units. Each unit includes at least one flow passage for one medium with the coolant medium flowing around the other. Baffles are spaced to restrict the flow of the coolant so that the pressure of the two mediums at adjacent locations are the same.

23.060

BRINER H.

Submerged-arc double-electrode welding in the construction of valves.
ZIS mitt., sept. 1968, 10, (9), 105-15 (in german) The submerged-arc-double-electrode welding (building-up welding) process is brietly described with particular ref. to the circuit used, distribution of the arc and the depth of fusion. The technique is used to weld non-rusting, wear-resistant steel gaskets on plates or disos and inside housings of valves. Construction of the welding appartus required and some results of welding plates and gaskets inside housing are presented. Important factors for succeful welding, including electrode dia. ratio and inter-electrode angle are discussed.

23.061

FRANCIS W. C. and GRIEBENOW M. L.

Proposed heat transfer experiments with direct application to testing reactors.
Apr. 25, 1960, contract AT (10-1)-205. 39p.
An experimental program designed to obtain engineering information directly applicable to the coolings of testing reactors using subcooled water is described. The purpose of the study is to increase the heat removal efficiency in testing reactors, to evaluate new fuel element designs capable of operating at higher power densities, to determine through kinetic studies the effect of hydraulic and/or power transients, and to develop correlations for specific channels, describing the different modes of heat transfer. The nucleate boiling mechanism will be emphasized in order to achieve the higher heat transfer inherent in this mode of cooling. To insure safe operation, it is necesary to evaluate the extent of possible flow redistribution, the burnout point, the entrance to film boiling and the possibility of physical meltdown. The proposed experiments will be conducted in an existing 200 KW electrically heated loop designed to simulate a constant pressure drop system. A small re-entrant loop will be inserted in a reactitivy measurement facility to determine the effect of nuclare boiling on reactivity. If the results of the out-of-pile work are favorable, preliminary in-pile tests in the nucleate boiling region will be conducted using a spectatly loaded (highly fueled) test element. The direct result of all of these tests will be to determine quantitavely the benefits, feasibility and margin of safety in operating test reactors in nucleate boiling. If these data indicate that this mode of reactor operation is attractive and practical, consideration will be given to the performance of such a test using one of the test reactors. Results obtained should allow an increase in the power density (and an associated increase in neutron flux), a reduction in operating pressure and or a reduction in the coolant flow rate Investigation are included to prove that existing safety (required as a result of the hot spot-hot channel analysis) can be reduced without undue hazard to the reactors. This should allow less restrictive fuel loading, reduced manufacturing tolerance on the fuel elements and reduced production costs. This phase of the program should allow reduced operating restrictions on the reactors and on the experiments thus saving time and money spent in "safe-guarding" (P.C.K.)

23.062

OSMACHKIN V. S.

Specific characteristcs of heat transfer in reactors cooled by incompressible fluids.
Proc. Int. Conf. Peaceful Used At. Energy, 3rd, Geneva, 1964, 8: 128-39 (1965) 34p.
The results of a theoretical study of specific features of heat exchan-

ger processes in the channels of non-compressible liquid-cooled reactors are presented. The possibilities of extending. Prandt's hypothesis about turbulent transfer coefficients to arbitrary flows are discussed. Approximate equations for rate and temperature pulsations in an arbitrary liquid flow are derived from formulas written as integral equations describing the transfer rate and temperature pulsation components. A mathematical analysis of mixing lengths introduced by Prandtl is presented. The problem of stabilized heat transfer and hydraulic resistance in the reactor channels is considered. The approximation of the turbulent viscosity coefficient is used to calculate stabilized heat transfer and hydraulic resistance in tubes and for streamline flows parallel to rod bundles. The results of calculations in a groad range of Reynolds and Prandtl numbers are in good agreement with the available experimental data. The use of the hydraulic diameter for heat transfer and hydraulic resistance calculations is shown to be invalid for the case of streamline flows parallel to bundles of rods. A new method is suggested for determining the equivalent diameter of rod bundles which makes it possible to apply the tube flow formulas for calculating the heat transfer and hydraulic resistance coefficients in in rod bundles. Calculations of heat transfer in circular tubes in the initial thermal region and in the sinesection thermal loop are presented. Relaxation length values for the temperature curve are given which help determine heat transfer for an arbitrary thermal loop. The problems of critical thermal loads during surface boiling of heat-transfer agents in the reactor channels and the mechanism responsible for a heat-exchange critical point are discussed. An analytical expression is developed for critical thermal loads for tube flows below boiling point. The equation derived agress well with the experimental data. (auth).

23.063

Cr recovery improved in Stainless Refining.
Iron Age, 8 june 1972, 209, (23), 59-60/in english/ Two new refining methods both improve Cr recovery during the production of Stainless Steel. The vacuum-refining process and injectiong O below the metal surface under reduced pressure.

23.064

Steelmaking in the Teeming Aisle.
33 Mag. Metals Prod. Feb. 1970, 8, (2), 53-61/ in english Two new processes, both of which make steel in the teeming aisle or on the tapping side of the surface, give the melt shop considerably more flexibility in steel refining. Both processes can be integrated into existing electric arc BOF or openhearth shops and employ accurate weighing which allows production of a specific weight of one grade of steel, regardless of furnace size. In the SKF process, steel is refined in a ladle of austenitic stainless steel in the teeming aisle, incluiding degassing, decarburization and heating stages. An induction stirring process used in the ladle controls four basic characteristics of steel: H concentration; inclusion content; and mechanical properties. The second process in based on spot heating steel with an electron beam. The electronbeam furnace produces superclean steel and proponents claim that it can produce straight Cr stainless steel that possess all of the attributes of Cr-N° grades without th use scareNi.

23.065

CHOULET R. J., DEATH F. S. and DOKKEN R. N.

Argon-Oxigen refining of stainless steel.
Can. Met. Quart., Apro. June, 1971, 10, (2), 129-136/in english.
A summary of the two-year old Ar/0 process for refining stainless steel is presented and includes topics such as the laboratory research and development; commercial scale development leading to the first operating plant at Joslyn operation of the process; and factors affecting process economics. Significant savings are reported resulting from the reduction in furnace time and temp., reduced electrode consumption and longer refractory life. Average Cr and total metallic recovery of 96-98% are cited.

23.066

AOD: Significant Advance in Stainless Steelmaking' 33 Mag. Met. Prod., June 1972, 10, (6), 40-45/in english.
The Ar-0 decarburization process is a duplexing operation in which a stainless steel heat is melted down in an electric furnace, then transferred to a separate refining vessel in which the melt is decarburized by blowing with an Ar-0 micture. The technique produces very low decarburizing. Increases in furnace productivity are more than enough to offset the added cost of the AOD vessel and refining operation.

23.067

KOONTZ CH. and MORITZ D. E.

Operation of 50-Ton Argon-Oxygen Vessel at Eastern Stainless Steel Co.
Iron Steel Eng. Dec. 1971, 48, (12), 65-70/in english/ More than 700 heats of stainless steel have been processed in a duplex system consisting of an arc melting furnace and an Ar-O vessel for decarburizing and finishing. Initial problems with premature failure of the tuyeres in the O-Ar vessel have been reduced by keeping heat times to a min. and carefully controlling starting temp., starting Si and max. blow temp. The duplex process is simple and flexible and maintenance of the Ar-O vessel is minimal.

23.068

BUZEK Z., BENDA M. and KRAL J.

The Possibilities of Using Ar and Ar-O Mixtures During the Production of Stainless Steel.
Sbornik V.S.B. Ostrave, 1968, Hutnicka/, 14, (3) 269-273/in Czech/
The possibilities of lowering of Cr losses in Fe-Cr-Ni-C melts during the decarburization of the bath with mixture of O and Ar were studied. Cr losses during decarburization of the bath at 1630-1700°C with mixtures of O and Ar were lowest when only O was used. The same phenomenon was observed in Ni.

23.069

IRVING R. R.

"Argon-Oxygen" Bring New Life to Stainless.
Iron Age, 11 Nov. 1971, 208, (20), 61-63/in english/ Good results with the Ar-O injection process are reported by seven U.S. speciality steelmakers and two British companies. The process not only reduces production cost for standard stainless grades, but is adaptable to introduction of gaseous N into the steel rather than use of more expensive nitrided ferroalloys. Nickel-base alloys (Hastelloys) are also being produced.

23.070

KRASNORYADTSEV N. N. and LEVIN A. M.

Loss of Ti from the Stream of Molten Stainless Steel on Contact with air.
Steel in the USSR, Aug. 1971, 1, (8), 633-635/ in english/ Changes taking place in the composition of a jet of molten Cr-Ni-Ti steel as a result of its contact with air during refining and casting processes were studied. Thus contact with air led to the loss of a considerable proportion of the Ti, the loss being proportional to the length or the square root of the period of contact. The general validity of this law was confirmed by a series of test based on a statistical experimental -planning techniques.

23.071

Argon-Oxigen process for Stainless Steel refining-Union Carbide.
Steel International, 1969, mayo/junio, pag. 118-120/ in english/.

Se analiza tiempos, temp. y composición química de tres corridas. Además se compara el nuevo método (Ar-O) con la práctica convencional de refinado para la obtención de ELC stainless steel.

23.073

A Vacuum Refining Process for Low-Carbon Stainless Steels Tecn. Met., May-June 1971, 26, (184), 53-55/ en español/ The "Paravac" process which produces stainless steels with C 0.02%, without using O or inert gas, is described. Charges of up to 10.000 kg are melted in a special induction furnace fitted with a vacuum hood and alloy losses are negligible. Details of the furnace construction are given.

23.074

BARMOTIN I. P., CHEREMNYKH B. H., FILATOV S. K., GERASIMOV YU. V. and KAS. YANOVA A. G.

Blowing of High-Cr-Steel Melts with Argon in Vacuum. Stal', Aug. 1971, (8), 721-722 /in Russian.
A technique for the intensive decarburization of a high-Cr stainless steel by blowing the melt with Ar in vacuum is described. The resultant C content may be reduced to 0.03% or lower in this way. The efficiency of the process increases with rising temp. and with increasing O content (in the form of oxides present in the metal and slag). Simple vacuum treatment unaccompanied by Ar blowing produces far less marked results.

23.075

MAZANEK T.

Melting Processes in Vacuum and Oxygen Converters for Stainless Steel with Low Carbon Content.
Hutnik (Katowice), Feb. 1971, 38, (2), 100-103/in Polish/ This is a review of the production of modern acid-resistant steels. A requirement for such steels is a low C content, even below 0.02%. A list of operational conditions under which acid-resisting steel is produced in an O converter is given.

23.076

CHOULET R.J., ELLIS J.D. and SACCOMANO J.M.

Making Stainless Steel in the Argon-Oxygen Reactor at Joslyn.
J. Metals, Feb. 1969, 21, (2), 59-64/ in english/ A new duplex Ar-O decarb. process takes the C removal, Cr recovery and finishing operations away from the arc furnace and transfer them to the reaction vessel. Grades produced to date include 303, 303 Pb, 340 340, 340 L, 305, 308, 309, 310, 316, 316 L, 317 L, 410, 416, 430, 17-4 PH and 17-7 PH. Arc furnace tap-to-tap time has been reduced to 3 hr. Chromium oxidation during C removal in reactor processing verages 46 lb/ton of steel produced, regardless of starting Cr and final C contents. Total Si to finish the heats after C removal averages 32 lb/ton of steel. Almost all the Cr required has come from scrap of low-cost, high-C ferrochronium.

23.077

KASNORYADFSEV N. N., KONOVALOV K.N., LEVIN A.M., PASCHENKO V. E. and VERSHININ V. I.

Production of Stainless Steel Without Flushing the Slag and With Double Reladling.
Steel in the USSR, Aug. 1971, 1, (8), 631-632 / in english / A new technology for the productions of stainless steel is described. In this process, instead of running off the slag, the metal is first cast with the slag into an intermediate ladle; the metal is subsequently passed to another ladle in which alloying with Ti takes place. In this way the over-all period of melting is reduced and economies are achieved in relation to the use of ferro-Cr, metallic Mn, and ferro-Ti. A more stable percentage of Ti in the resultant material is also ensured.

23.078

Molten Steel Lanced with Inert Gases in the Ladle, Stal in English, june 1969, (6), 558 / in english.

23.079

KATS L. N. and YASKEVICH A. A.

Behaviour of Nitrogen in the remelting of Nitrogen-Contaiging Stainless Steel with Oxygen Blowing. Izvest. V.U.Z., Chernaya Met., 1970, (11), 73-76 / in Russian, The behaviour of dissolved N in the remelting of Cr-Ni stainless steel by an O-blowing process is considered. At the initial instant of melting the N content is close to equilibrium. After the O-blowing process the N content remaing is independent of the original amount of N present it is appreciably lower than the equilibrium content at the temp. of the process. The amount of oxidized C in the system affects the final N content. The final N content is also sensitive to the proportion of Cr in the steel.

23.080

GERASIMOV YU. V. et al.

Production of Low-Carbon Stainless in the Ladle with Argon Flushing.
Stal', Sept. 1970, (9), 801-802 / in Russian / The factors which

affect the production of stainless steels 000 Kh 17 N 13 M2, and 000 Kh 16 N 15 M3 with >0.03% C in electric arc furnaces were examined with particular reference to the conditions of holding time, deoxidation, and desulphurization. A technique was developed consisting of deep decarburization by O in the furnace, deox.dacion by Al at 1750-1800°alloying with ferro-Cr and Ar-flushing in the ladle at 0.3-0.6 m3/t steel for 10-15 min. The quality of the resultant steel, rolled into plate and strip, was comparable with that of vacuum-induction-melted products, whilst the production time was cut by 20-30% and considerable savings in power consumpltionwere achieved.

23.081

COPPER L. and LANDIN B.

The ASEA-SKF Ladle Furnace
Can. Met. Quart., Apro. June 1971, 10, (2), 121-128 / in english.
The flexibility of the ladle-furnace process is discussed and examples of its adaptibility to specialized refining techniques, such as desulphurizing to extremely low values and decarburizing under vacuum, are outlined. Installations range in capacity from 22 to 155 tons and are being use in plants making stainless, bearing and tools, as well as plain C steels, where ingot quality is of prime consideration.

23.083

ZEZULOVA M.

New tendencies in the development of stainless steels of extremely low carbon content.
(CSVTS, Steels for the Chemical and Power Industries, Proc. Conf., Tatranska Lomnica, 24-27 Oct. 1967, Sekce IV, Paper 27, PP. 16 (in Ger).
Stainless steels of extremely low carbon content, for instance below 0.03% require additional alloying as their strength properties are, for many purposes, insufficient. Such additions are N, Si and Mn, the latter particularly in respect of a better utilization of the nitrogen and its solubility limit, i.e.Mn improves the hot workability The results reported are of a preliminary nature.

23.084

KAS' YANOV A. G., TUREVICH YU G., MARKELOV A. I., SIDOROV N. V., GERASIMOV YU. V., KHASIN G. A., CHISTYAKOV S. L., POLYAKOV YU. V. and LEBEDEVA B. N.

The quality of low-carbon stainless steel (Metallurg., 1970, 15, (5) 17-19((in Rus.)
A method has been developed for making stainless steel containing < 0.03% C in open arc furnaces, applying metal electrodes (instead of graphite) or by blowing Ar through the melt in the ladle. The products were compared with analogous melts made in a vacuum induction furnaces. The melts were tested for non-metallic inclusions, φ —phase and mechanical and corrosion properties. The specimens were found to satisfy the official standards.

23.085

SAMARIN A. M., POLYAKOV A. YU. and POBEGAILO V. M.

Development of the principles involved in the refining of stainless, low-carbon, chromium constructional steels in the oxygen converter (A.N. SSSR. Metally, 1970, (6), 21-26) (In Rus.)
A method is evolved for refining stainless and other low-carbon, chromiun steels in the oxygen converter, which has many advantages over the refining of low-carbon steels in electric-arc furnaces, and makes it possible to extend the use of oxygen converters to the fields of high-quality steel, a most important factor in modern grading practice.

POST C. B., LEINBACH R. C. JR. and SULLIVAN M. D.
23.086

Stainless Steelmaking utilizing vacuum-treatment. III (Ind. Heat., 1969, 36, Nov., 2185-2194)
Combined basic arc melting and vacuum degassing methods for making extra low carbon stainless steels are described and problems related to this technique are discussed. Heat log comparisons of virgin air melt ELC and degassed ELC heats are shown and typical analysis before and after degassing by this method are tabulated.

23.087

COSMA D.

Study of the solubility of nitrogen in molten stainless steel alloyed with chromium, manganese, nickel and nitrogen.
Arch. Eisenh., 1970, 41, Feb., 195., 195-199 (In Ger.)
The solubility of N_2 in a high-alloy steel was studied in a 50-kg high-frequency induction furnace at 1600°C and a N_2 pressure of 0.79 atm. The N solubility in relations to temp. the interaction parameter and the free enthalpy of solution were derived. The solubility of N_2 decreases between 1540 and 1740°C with increasing temp. This indicates an exothermal reaction. Neither C nor Ni affect the N_2 solubility, but Cr and Mn do. The free standard enthalpy of solution of N_2 was found to be-12.15 kcal/mole at 1600°C (12 refs.).

23.088

OPPENHEIM R.

Recent developments in the field of chemically stable steels.
(CSVTS, Steels for the Chemical and Power Industries, Proc. Conf., Tatranska Lomnica. 24-27 Oct. 1967, Sekce IV, Paper 37, pp. 16) (In Ger.)
A review of the trends in the development and improvement of stainless steels is presented. Standardization of these steels is discussed and the development of low carbon steels. with <0.03% C is considered. Steels resistant to nitric acid and urea mentioned. (1o refs.).

23.089

KEPKA M.

On the production of low carbon chrome-nickel steels. (hunik, 1970, 20, (8), 286-288) (In Cz.)
The method of making stainless steel using the argon-oxygen reactor, as practised by the Joslyn Stainless Seel Co is evaluated and discussed with similar processes in other countries, including results obtained in this field recently in Czechoslovakia. The Joslyn method is assessed favourably.

23.091

GNORICH and YUN

Stainless steel-even better quality
Sie und Wir, 1971, (7), 29-32 (In Ger)
This deais with a now vacuum refining process applied during the manufacture of stainless steels at the South Westphalian Steelworks at Geisweid. The new method is compared with the old, and the design and operation of the plant are briefly described.

23.092

SINGNORELLI G.

Oxidation of austenitic stainless steels. Note I: Pnysico-chemical aspects.
(Calore, 1971, Nov., 477-490) (In Ital).
Physico-chemical basic principles are given for the metallurgist who whishes to apply a theoretical treatment to the oxidation of metalic materials.

23.093

BARR. R. Q.

A review of factorss affecting the selection of steels for refining and petro-chemical applications. (Climax Molybdenum Co. A review of factors affecting the selection of steels for refining and petrochemical applications. (1971), pp. 56 pamphiet).
Steels commonly used in refinery and petrochemical equipmentare defined and described; metallurgical, chemical, and mechanical factors are discussed.

23.094

OMSEN A. and ELIASSON L.

Distribution of nitrogen during solidification of a 17.5 Cr-13 Ni-2.8 Mo stainless steels (JISI 1971, 209, Oct. 830-833).
The distribution of nitrogen during solidification of an austenitic stainless steel With 0.02%C, 17,5%Cr, 13% Ni, 2.8%Mo and varying amounts of nitrogen has been studied. Through a thermodynamic approach the solubitily of nitrogen in the melt and in the first solidified delta ferrite was calculated and tested by studying the structure of a number of laboratory ingots. By estimating the segregations, correlations were found between the nitrogen content, the resulting amount of austenite, and precipitates in the interdendritic regions. Two types of eutectic were observed; the carlier reported X0phase eutectic and a M6X eutectic with a melting point of 1280° ± 20°C.

23.095

COLIN J.

Techniques used for making stainless steels in 1968 (C.D.S. Circ. 1969, 26, (7-8), 1823-1934) (In Fr.) The latest developments in bulk stainless steel production at a number of steelworks are reviewed. The techniques considered are production in air, production in the electric arc furnace and production in the LD furnace. It is claimed that electric arc furnace manufacture no longer shows any marked superiority over LD manufacture. Although the balance today is slightly in favour of the electric arc, this will probably not be so in a few years.

23.096

SHALIMOV A. G., OKOROKOV G. N., TULIN N. A., KHALYAKIN I. V., POZDEEV N. P. and YUNAKOV V. M.

The Vacuum-Melting of Low-Carbon Stainless Steel (Stal' (in Engl.) 1969, (8), 718-720) In Rus/ English Ts NT1ChM, jointly with Chelvabinsk metallurgical works, has developed a technology for producing very low-carbon stainless steel, type 000 kh 18N12, in a 0.5-tonne vacuum induction furnace, with thorough decarburization directly in the furnace, by means of surface blowing (or deep inyection) with oxygen, which enables charge materials of normal commercial quality to be used, for example Khr 000 (Fkh010) Fe-Cr instead of aluminothermic metallic Cr, and to produce a cheaper metal of better quality, with a lower nitrogen content (0.020 to 0.021%).

23.097

ARDITO V. P. and SHAW R. B.

Stainless steel melting by two low cost processes. Part. II: The AVR (Allecheny Vacuum refining) process. (AISI, 80th, General meeting, 25 May, 1972, pp. 20-41). A process of producing stainless steel ingots by vacuum decarburization and refining is decribed. Electric arc furnaces are utilized strictly as melting units and all refining is carried out in a separate vacuum facility. A detailed description of the vacuum equipment as well as the vacuum process is presented. The use of lowest cost raw materials and improved and metallic yields allow the AVR process to produce lowe cost stainless ingots than the conventional ar furnace.

23.098

CARLSON R. F. and SHAW R. B.

Stainless steel melting by two low cost processes. Part-I The BOF (AISI, 80th General meeting. 25 may., 1972, pp. 19)
A method of producing stainless steel in a BOF furnace by utilizing cupola hot metal with scrap and ferroalloys is decribed. An oxidation-reduction technique is discussed. The important factors include starting and finishing temp. reduction slag chemistry, and slagmetal mixing are described in detail. The use of this process has resulted in lower cost stainless ingo ts than by the conventional electric arc furnace practice.

23.099

SCHACK A.

Industrial heat transfer
Book-german, 1970, pp 464
In this treatise on heat transfer theory and practice, in addition to dimensionless numbers, formulas are presented in the dimensional form so that they are inmediately applicable. Heat transfer by conduction (uniform and variable heat flow), convection (laminar and turbulent flow, theories of heat transfer by convection), the measurement of heat transfer by convection in free flow, forced

flow of gases, liquids, reacting systems, oil, liquid salts and metals, dust, etc., heat transfer by condensing vapors, the design of heat exchangers (clasification of heat exchangers, regenerators), The, secondary heating surface, heat transfer in industrial heating, and pressure loss in tubes are presented in detail. The application of the theory of heat transfer is illustrated by numerical examples. Thermal properties (heat conduction, specific heats, viscocities, Prandlt numbers, emissivities) are tabulated.

23.100

PHILLIPS S. M.

Some alkali metal corrosion effects in a Rankine Cycle test loop.
TMS paper selection N° F69-1, Metallurgical Soc. AIME 1969, pp 19 (pamphlet). A two loop Li boiling K facility was constructed and tested to simulate the major elements and working fluids of a two ñoo , nuclear, turboplant concept of interest for spacecraft propulsion. During initial testing the Co 1% Zr loop was operated for approx. 100 h at K temp. up to 1900°F (925°C) with a Yt hot trap in the Li loop and a Zr hot trap in tye K loop. This operation produced no observable corrosion in the K loop and nominal. corrosion in the Li loop despite high impurity levels in the Li. No dissimilar metal mass transfer was observed as a result of the hot traps. 12 ref.

23.101

FONTANA M. G.

Selecting construction materials for pumps. Chem, eng. progress, may, 1970, 66, (5), 65-72. The eight common classifications of corrosion failures are all applicable to pumps They are uniform corrosion two-metal corrosion (a galvanic compatibility table is given for dissimilar metals used in pumps, valve trim and piping), crevice corrosion, pitting, intergranular corrosion, selective leaching, corrosion fatigue and erosion corrosion. Environmetal factors (pH, temp. and electrical potential) affecting erosion corrosion are discussed for castings of low-C steel. 18-8 Stainless Steel and 18-8 Mo Stainless Steel and Durimet 20Cr-Ni-Cu-Mo alloy. Other tropics discussed include the effect of enviromental changes and impuritues on pump performance interchangeability and standardization of pump dimensions, the advantages of nonmetallics vs. metallic construction material, acceptable corrosion rates and quality control.

*** 23.102**

NICHOLS R. W.

Welding for nuclear nuclear power
Welding, Sept. 1969, 37, (9), 344-351
A survey is made of some special requirements for the nuclear power industry and typical examples of welding are described. The effects of neutron irradiation, and of chemical and thermal environments are considered, and welding problems associated with nuclear steels pressure vessels, heat exchangers; and steam generating heavy-water reactors are discussed.

23.103

KORNBICHLER H.

Materials construction, fabrication and testing of nuclear and conventional power stations, effects of the choice of materials.
Miit Verein. Grosskesselbetriber, Dec., 1969, 49, (6), 375-384 (in german).
The various types of power stations are described and structural materials for the steam generatiors, turbines tubing and other app lications are discussed in relation to their operational requirements. Details are given of fabrication techniques, welding, cladding, etc., of the various materials. Methods used to test pressure vessel and reactor componentes, tubing, shielding, weld seams, etc., are described.

23.104

THIESSEN W.

Welded construction of plant with particular reference to heat exchangers.
Chemie Ing. Technik, 29, May. 1970, 42, (11), 751-756 (in german)
The design of welded joints in the body and between tubes plates to avoid excessive stress concentration is discussed as is also the welding of dissimilar metals e. g. Cu/steel, carbon steel/austenitic steel. Failures due to stress corrosion cracking and other causes are illustrated.

23.105

CHOCKIE L. J. and KARSON C. F.

Industry cooperative program on heavy section steels. TMS paper selection Ni A68-47, Met. Soc. AIME 1968.
Pressure vessel technology, LL-Materials and fabrication 1969,1005 1016. The industry cooperative program on heavy section steels is being carried out under the auspices of the pressure, vessel research committee of the welding research council by the leading companies involved in the design and fabrication of pressure vessels for nuclear reactors. The objective of the program is to determine the mechanical properties of heavy section steel plates, weldments, forgings and castings, and to determine effective flaw inspection techniques. Test specimens are being taken from actual production plates for nuclear contract by utilizing nozzle-cut-outs, crop ends and extra material ordered especially for this work. Also included is a comprehensive study of in-service inspection techniques.

*** 23.106**

WARRING R. H.

Chemical pump or process pump.
Pump, Jan. 1970, (1970-40), 12-16
Suitable metals and alloys for pH ranges and erosive corrosive conditions involved in pumping acids, alkalis, brines, and sea-and mineral waters are indicated.
Applicabilities of stainless steel and high-Ni alloys are particularly discussed and behaviour data for Hastelloy and Langalloy are tabulated. Non-metalic liners are also considerared.

23.107

RAGHAVAN K. V.

Pressure vessel design
Chem. Process Eng., Oct. 1970, 51 (10), 81-90
A review, with special ref. to design of pressure vessels for the

chemical and nuclear— power industries. Aspects presented and discussed include wall thickness and its determination, failure criteria and their application, fatigue and thermal stresses, safety factors, creep, high pressure service, prestressing, multilayer construction, overlay welding, and materials selection and testing.

23.108

CUTTICA G., GASPARINI R. and IOANNILLI E.

Experience on the materials used in nuclear power plants Energia nucleare, aug. 1970, 17 (8), 469-480 (in I,). Embrittlement of steel under irradiation and various instances of material degradation as result t of fatigue, oxidation, or corrosion phenomena experienced by an italian undertaking in the operation of its nuclear power stations, are described.

23.109

DRESSLER G., RUHLE M. and WESTPHAL H.

Structural materials for nuclear reactors.
Metallgesellschaft Rev. Activities, 1970, (13), 41-49. A detailed description of various alloys (Zircaloys, austenitic Cr-Ni steels, Ni, V, Mo, Cr alloys) used in the construction of nuclear reactors is presented.

* 23.110

MORGNER W.

Ultrasonic testing of valve cones.
Techn. Hochschule Magdebur 5. Werkstoffprufertagung, 1966.
A method was developed for testing valve cones by placing a test probe on their flat circular ends. Core segregation, coarse-grain structure, and surface cracks were succesfully detected.

* 23.111

POLLIART A. J.

Special considerations in construction of nuclear power plants in developing countries. "Bid evaluation and implementation of nuclear power projects", IAEA-151, p. 269-284

* 23.112

JOSS J. O.

Implementation of certain nuclear power plants projects in the United Kingdom. "Bid-evaluation and implementation of nuclear power projects', IAEA-151. p. 331-348. The original UK nuclear power programme was to be a comparatively modest one of some 1500-2000 MW of installed capacity, based on twin-reactor power stations in which each reactor would have an output of 75-100 MWE. Before it started, this programme was overtaken by events. Two major factors changes the whole direction of the UK effort. Firstly, as might have been foressen, when the newly formed design organisations looked into the design and optimisation of gas-cooled reactors based on the Calder Hall concept, it was found that the only barto increasing output above the Calder Hall level of SOMWE per reactor was the limit dictated by prudence in extrapolation in a single step. Secondly, regardless of relative economics, the UK moved into a period when a serious shortage of coal was predicted, and all electricity generation at that time was based on coals as a fuel The decision was thus made to undertake the relatively large programme of 5000MW, consisting of two-reactor stations as before but with reactor outputs in the range of 125MWE initially, probably increasing to 200MWE or so later on. In all, the programme would be committed over a period of about 5 years.

* 23.113

BECKMANN M. et al

Alternative approaches to the estimation of production functions and of technical change. Int. economic rev. 13 (1) Feb. 1972, p. 33-52
The Aggregate Production Function is one of the basic tools in the modern theory of economic growth. In recent years the increased interest in this subject has brought forth two types of improvement in the specification of the aggregate production function. First, the form of the production function has been noticeably extended from the constant elasticity of substitution functions (CES(1) to variable elasticity of substitution functions, such as the linear elasticity of substitution function (17), the production function which combines CES and Cobb-Douglas functions (9) and (4), the production function in which the elasticity of derived demand is constant (CEDD) (14) and (15), etc. Secondly, the problems of specifying and meassuring the types of technical progress that are consistent with a given form of the production have been elucidated. For instance, in a theoretical paper (16) the present authors have studied extensively the implications of various types of "neutral" technical progress that result from the invariant relationships between pairs of important economic variables. Subsequently we have estimated production functions and technical progress on the basis of linear and lo-linear invariant relationships between pairs of these variables (3) The purpose of the present paper is to extend the scope of the above mentioned papers. We proceed by dropping the two-variable restriction and allowing general multivariate analysis among subsets of production variables. In particular, alternative specifications of production functions and of technical progress will be obtained by specifying linear relationships between rates of change of such production variables as labor-capital ratio, output-capital ratio, wage rate, interest rate, marginal rate of substitution, and profit share. A general differential equation is derived from the linear combination of all these variables. Its solution yields a new class of production functions which includes the CES, Cobb-Douglas and their combination as special cases and for which technical changes is factor augmenting. This new class of production functions may appropriately be called the "log-linear production functions".

* 23.114

BARANSON J.

Automatización de la industria en los países en desarrollo. Finanzas y desarrollo 8 (4) Dic. 1971., p. 10-18. El incentivo que ofrece la automatización estriba en que su eficiencia permite la producción en serie de materiales, elementos y productos finales. La automatización es característica de las economías altamente industrializadas. ¿Cuál es la mejor forma de adaptarla a los países menos industralizados?

* 23.115

BILLARD F. et al

Filtre a haute temperature pour l'epuration des gaz d'incinerateur CEA, Centre d'Etudes Nucleaires de Fontenay-aux' Roses. 1969 7. p. (CEA-N-1070).

On donne la description d'un filtre régénérable, permettant la filtration a chaud des gaz d'incinérateur Ce filtre est composé de bougies de toile métallique sur lesquelles on dépose, par pulverisation pneumatique, des fibres d'amiante qui constituent le médium filtrant. Sa caractéristique de fonctionnement réside dans le fait que les imbrulés provenant de l'incinérateur, et en particulier, le noir de production. Le colmatage est ainsi tres réduit et on prévoit une durée de fonctionnement, entre deux operations de regeneration, de plusieurs containes d'heures. Ce filtre a été expérimenté sur une maquette a échelle réduite, puis en exploitation industrielle de longue durée sur une installation pilote d'une capacité de 20 kg/h. On décrit l'installation et on expose les résultats obtenus.

* 23.116

BRUEL & KJAER, NAERUM, DENMARK

Use of the multiplexer/demultiplexer type 5699 with the digital event recorder type 7502
8 p. (Application notes 13-013)

The Multiplexer/Demultiplexer Type 5699 was designed and built to operate with the Digital Event Type 7502. When used with the 5699, the 7502 can simultaneously record several channels at a time, each channel being in exact synchronism with the rest. One channel at a time may then be demultiplexed and Played Back to any data receiving equipment normally compatible with the 7502. The standard 5699 is an eight Channel Multiplexer/Demultiplexer, and it is this instrument which is discribed in this document. However, it has been designed with flexibility in mind, and may of its features may be modified to suit an individual customer's requirements. The modifications possible are described. Also described is an Impact Test Instrumentation System for Crash Recordings, consisting of a Digital Event Recorder Type 7502 and a Multiplexer/Demultiplexer Type 5699 specially modified such that it meets the Society of Automotive Engineers (SAE). Recomendation J 211a. This system can record 16 class 600 or 8 class 1000 channels of information.

* 23.117

SORENSEN O. M. et al

Three-dimensional output from third-octave frequency analysis. Brüel & Kjaer, Naerum, Denmark. 10p. (Applications notes 12-120)

Speech is a complex pressure wave which propagates at the speed of sound from the mouth of the speaker to the ear of the listener. The listener intercepts the pressure pattern, and his ear makes a continuous assessment of amplitude and frequency to derive the intelligence. This intelligence has three dimensions: amplitude, frequency, and duration. The pressure patern in speech can be analyzed in engineering terms by slicing it laterally and describing each slice in terms of its frequency content and averaged sound pressure. This is the method described here for 3-dimensional speech plotting. A word or phrase is continuously analyzed in third-octave bands to obtain the frequency and amplitude parameters. The third-octave amplitude levels are transferred to a computer memory at 40 regularly-spaced time intervals to obtain the time dimension. Forty stored spectra are then plotted in isometric projection to give a pictorial representation in three dimensions.

* 23.118

BRUEL & KJAER, NAERUM, DENMARK

Multi channel industrial monitor type 5558 for gas pump station. 12. p. (Application notes 12-076).

* 23.119

UPTON R.

Systems for seismic investigations using the digital event recorder type 7502.
Brüel & Kjaer, Naerum, Denmark. 10p. (Application notes 12-243)

One of the features of the Digital Event Recorder Type 7502 is its ability to capture and resolve frequencies which are as low as 0.01 Hz (the reciprocal of the maximum Sweep Time obtainable using its internal clock).

This makes it an ideal instrument to use in systems which are for Seismic investigations. Even lower frequencies can be captured if an external clock is used Further, because of the huge range of frequency transformations available on the 7502, the captured low frequencies can be transformed upwards into, the range of conventional measuring and analysis equipment in a single steep.

This application Note looks at some systems in which this feature of the 7502 can be put to use. These particular systems have been put together with seismic investigations in mind. However, only a change of transducer and preamplifier is necessary to make them equally suitable for the capture of other low frequency signals.

* 23.120

RANDALL R. B.

High speed narrow band analysis with digital output. Brüel & Kjaer Naerum, Denmark. 14 p. (Application notes 12-192).

* 23.121

GRONDAHL A. and UPTON R.

The fast fourier transform and the use of the computer type 7504 and the digital event recorder type as a fast fourier transform analyzer.
Brüel & Kjaer, Naerum, Denmark. 14 p. (Applicationmotes 12-244).

The idea of the Fast Fourier Transform (FFT) first appeared in 1965. It provides an algorithm wihich gives a far faster computation of the Discrete Fourier Transform than was previously possible, and has created for it a complete new range of applications where its use was previously thought impracticable. This Application Note starts off with a brief look at the philosophy behind FFT, and then goes on to describe a practical application of it using a Computer Type 7504 and a Digital Event Recorder Type 7502 as a single channel FFT Analyzer.

* 23.122

HOPE P. W. and OLESEN H. P.

Pipe vibrations and pressure detection.
Brüel & Kjaer, Naerum, Denmark. 9 p. (Application notes 13-069)

*** 23.123**

BLOWS D. G. and DAVIES R. J.

An integrated shipboard waste treatment plant.
Marine Media Management, Mark Lane. 1973.
Int. marine and shipping conf., London June 1973.
The advantages of an integrated shipboard waste treatment plant are discussed in relation to increasing international concern over pollution and possible future legislation. A treatmen system is outlined in which the basic concept is the preparation of solid wastes into a form suitable for pumping to a shipboard incinerator for final volume reduction to a sterile ash. The system is capable of integration with sewage plant in order to dispose of sludges.
Although many of the items of equipment required for the system are currently available, it has been found necessary to develop an incinerator of practicable size for this specific duty. Aland-based prototype incinerator togheter with the associated preparation equipment is being installed. The design and current development programme for this plant is described.
The object of this programme is to develop a marine incinerator capable of accepting the prepared solid wastes together with sludges and waste oils. It is envisaged that these waste oils shall comprise the primary source of fuel, and the extension of this equipment for furning tonnage quantities of tankes sludges appears feasible.

*** 23.124**

HALL C.

Champtree says: "Metallic mortars for safety and economy Metals for nuclear energy, Section 2nd of American Metal Market, June 20 1973.

*** 23.125**

HALL C.

Primary shield options for nuclear power reactor constructors.

*** 23.126**

FORTESCUE P.

The case for gas cooling.
Gulf General Atomic, San Diego, Calif. Publ. en: Power engineering.

*** 23.127**

FORTESCUE P.

A reactor strategy: FBR's and HTGR's
Nuclear news. Apr. 1972
A large number of reports and papers have been published on the practical and economic potential of the fast breeder for large-scale electric power production.
However, the scope of these studies has been, to a large extent, circumscribed by the inmediate objective of specific comparison with other particular power reactor types.
The broader implications of the introduction of the fast breeder, including the consequences of its optimal employment with other reactor types, have received much less attention and, again, the Emphasis of such studies as have been made, has been more on this or that system in competition, rather than on mutually advantageous combinations of reactor types. Furthermore, these studies, although offering predictions for longterm planning, have thus far largely ignored potential for individual design progress, and also the consequences of many qualitative but nonetheless important design constraints. For example, the advent of the gas turbine, the impact of environmental restrictions, and the whole question of relative plant reliability and maintainability are often left out.
The objective of this article is to relate these considerations more particularly to three areas of gas reactor technology-the HTGR, the GCFR, and the gas turbine-and, most importantly, to draw attention to the mutual benefit to be derived from the concurrent deployment of all these developments in the power generation field.

*** 23.128**

SCHWARTZ A. S. et al

High temperature gas-cooled reactor development outside the USA-a manufacture's view.
Gulf General Atomic, San Diego. 5 p. Presentado en: American power conf. Chicago, May. 1973

*** 23.129**

FORTESCUE P. and STEWART H. B.

Gulf looks at HTGR's role in breeder era.
Gulf General Atomic, San Diego. Electric light and power March 1973, sin paginar.
Gulf suggests that fast breeder reactors might best be used as fuel factories for high temperature gas-cooled reactors (HTGRs) driving closes cycle gas turbines. The argument focuses on the GRGR's conversion ratio and a claimed capital cost advantage for the gas turbine system.

*** 23.130**

GOODJOHN A. J. and SWAN K. E.

The large high temperature gas— cooled reactor power plant.
Gulf General Atomic, San Diego. Aware, Febr. 1973, sin paginar.

23.131

FORTESCUE P.

Gas turbines and nuclear power
Gulf General Atomic, San Diego. Combustion, Dec. 1972, sin paginar.

*** 23.132**

QUADE R. N.

High temperature gas—cooled reactors for process heat Gulf General Atomic, San Diego. Power enginnering, Apr. 1973, sin paginar.

*** 23.133**

TOUCHARD F. A.

Nuclear power stations and pressurized water reactors. Framatome, Coubevoie, 1973, 20 p. (Rev. 1).

*** 23.134**

DOUGLAS UNITED NUCLEAR INC.; NUCLEAR SYSTEMS CONSULTANTS DIV., WASHINGTON

Douglas United Inc.; nuclear comsultants systems with 27 years of nuclear experience to serve you, sin paginar (NSC–64).
The Nuclear Systems Consultants division of Douglas United Nuclear offers expert assistance in most phases of nuclear technology, including nuclear plant design, construction, operation and maintenance. Because of long practical experience in the nuclear industry, our staff, which includes over 200 professional people, brings to this role a unique combination of technical and engineering expertise and down-to-earth, practical operating and maintenance know how.

*** 23.135**

WALL A. J.

Extended surface tubes. Clayton Dewandre, Lincoln.
Chemical Process Engineering, 48 (8) Aug. 1967.
Manufacture of extend surface tube using wire loops has for many years been directed at gas, mainly air, coolers for engine or electrical components. Scope for the tube has widened as the theoretical and practical understanding of its use has grown. This article, describing these developments, may serve to bring it to the attention of some chemical engineers hitherto unfamiliar with it.

*** 23.136**

TVERBERG J. C.

Stainless Steel fuel cladding for fast breeder reactors.
Nuclear eng. int. Dec. 1972.

*** 23.137**

SCHARFSTEIN L. R. and WIESE D. H.

Processing stainless steel tubing for nuclear reactors. Metal progress, march 1972.
Miles of type 316 stainless steel tubing will be used for fuel cladding in a fast test reactor now nearing the construction stage. Tight surface quality and dimensional specifications call for meticulous fabrication and testing practices. Type 316 is used because it resists molten sodium and nuclear fuel al 1.050 F, the reactor's operating temperature.

***23.138**

GALLAGHER W. J.

Isotopic neutron source assay systems: their advantages and disadvantages.
Nuclear materials management, July 1972, p. 7-9
An active assay system is defined as one that acts upon a nuclear sample to induce a measurable reaction. In contrast, passive systems (such as the gamma spectrometer) do not influence the sample, but measure the radiation naturally emitted by it instead.
As a result of U.S.A. E.C. sponsored programs within the past two years, a new class of nuclear measurement instruments has been developed: active assay systems using isotopic neutron sources. These systems, although certainly not a panacea for nuclear assay problems, promise to ald in the resolution of many of them..

*** 23.139**

KENDRICK H. et al

High precision nondestructive assay of TH-U fuel particles and rods.
Gulf Radiation Tech., San Diego. 1971. (Gulf-RT-A10819) 17 p.
A commercially available nondestructive assay unit has been used for quality control measurements of the ranium-235 and thorium content of fuel particles and fuel rods for Gulf General Atomic's Ft. St. Vrain high temperature gas-cooled reactor. The measurement system, ISAS, utilizes neutron induces fission and a multipledetector fast coincidence technique for detection of the fissions. Measurements are made with two neutron spectra to obtain the data necessary for determination of the uranium-285 and thorium separately. For each production batch of fuel particles or rods, about 2 kg of fuel containing from 10 to 70 g of uranium-235 is measured in a fixed geometry to determine the fissile and fertile assay of the batch. The precision of each determination is about 0.4% for uranium and 1% for thorium.

*** 23.140**

KUNESCH A. M.

Mechanical draught cooling towers.
Inst. of chem. eng., symposium on industrial cooling, London Dec. 1970, paper no 2. 14 p.
A brief history of the early –pre 1940– development of the forced draught tower; post-war developments induced draught designs; post-war tower construction materials-timber, reinforced concrete-problems of fan drive equipment and developments. Relative cost of timber packaged towers from 1950 to 1970 and the effect of the introduction of glass fibre, reinforced plastic and subsequently plastic packings. Comparative costs for the supply of make-up water from various sources. An appraisal of the relative merits of natural and mechanical draught towers over a twelve month cycle, and the ability of multi-cell mechanical draught installations to limit the fluctuation of recooled temperature with wet bulb temperature by selective control of fan motors, combining the operational merits of natural draught and mechanical draught towers. A survey and series of tests carried out on 10 different cooling towers after some years of operation indicates that incorrect use and insufficient maintenance of distribution systems can cause a considerable reduction in cooling tower capability.

*** 23141**

NELLER J. R.

Cooling tower applications in water manegenent and total water concepts.
Cooling Water Ass. 1972. 10. p. y fig.
Water management, although practiced in certain areas of industry, is not always fully provided for in the planning of a new project. This paper outlines in general the necessity for a full appreciation of the problems in water re-use and the potential role cooling and water treatment towers and their design engineers ean play in the conservation of what is an essential element in industry, as of course it is for life itself.

*** 23.142**

FILM COOLIKG TOWERS, SURREY

A large scale test cooling tower for FCT. Refrigeration and air condit., June 1970.
A test cooling tower erected by Film Cooling Towers (1925) Ltd. at Boston Lincs, and put into operation at the end of April, is claimed to be the biggest privately-owned test unit in Europe.
Built at a cost of about £ 25,000, it is sited at the Boston premises of an associate company, Calders and Grandidge Ltd., of Walton-on Thames, Surrey, who are major suppliers of timber components to FCT.
Main purpose of the tower is to provide a facility for testing different types, shapes and sizes of cooling tower packing and packing materials.
The tower, which can be operated in crossflow and counterflow configurations, has a capacity at maximum operating head of 100.000 gallons per hour, with a maximum heat rate of 15.000,000 Btu's/hr.

*** 23.143**

KUNESCH A. M. and NELLER J. R.

Taking the steam out rising water costs.
Process eng., March 1972

*** 23.144**

GWATKINS J. G.

Precision tubes
Eng., mat, and'des, March 1972
It should be made clear from the outset that this article refers mainly to the considerable group of highly alloyed iron base metals broadly known as stainless, produced for a market requiring diameters below 1.1/4. Precision in a tube is extended to include increased control of metallurgical and mechanical properties, finished dimensions, surface finish, and internal and external surface and interface defect levels.
There are two basic ways of producing precision tubes: either as seamless through the bored billet, hot extrusion, cold pilger reduce, or cold draw bench route; or by forming from strip and welding with the tungsten inert gas arc process. A third and much lesser used process is to bore a bar, cold pilger reduce, and bench draw; but this produces seamless tube with low eccentricity of bore to outside diameter.
A speciality tube mill will be able today to work in as many as sixty different alloys from one or other of the two principal ways of producing a tube.

*** 23.145**

FEDERATED PAINTS LTD., GLASGOW

From glass balls to nuclear paints.
Paint manufacture, Dec. 1963
The origins of Federated Paints Ltd. date back to about 180 uears ago, this company being a direct descendant of one of Scotland's first paint manufacturing concerns. Always in the forefront of technical progress in the field of anticorrosive paints and primers, Federated Paints Ltd. is now a big U.K. producer of surface coatings specially formulated for use in nuclear reactors and power stations.

*** 23.146**

DONCASTERS MONK BRIDGE LTD., LEEDS

Precision forged turbine and compressor blades.
Aircraft eng., Sept. 1972
Among Design Concepts, the turbine-blade is one of the most difficult to translate into accurate dimensional fact. Shape, often the material, the standard of accuracy that must be achieved, and in a bull manufacturing grogramme, the quantities that are required, all create not merely initial, but continuing problems. Blade production is, indeed, a complex and continuous exercise in quality control.

*** 23.147**

MOON J.

Gas turbine blades-precise manufacture assures dependability. Doncasters Monk Bridge, Leeds. Diesel and gas tubine prog., April 1973.

*** 23.148**

JONES T. B.

Design, operating experience and development potential of main propulsion epicyclic gears.
Atals Works, Worcestershire. Trans. Inst. of Marine Eng. 84 (15) 1972, p. 465-498.
The paper examines six years operating experience of epicyclic gears for steam turbine main propulsion. The phenomenal rate of growth in the use of such gears since they first entered service towards the end of 1965 has, in some cases been accompanied by difficulties. The lessons learned and the steps taken to overcome the difficulties which have been encountered are described. Mention is made of some unanswered questions and comment is made on the factors likely to affect the future of high power epicyclic gears, not only for steam turbine, but also gas tubine and Diesel main propulsion.

*** 23.149**

JONES T. P.

Fifteen years development of high-power apicyclic gears. Atlas Works, Worcestershire, Trans. Inst. of Marine Eng., 79 (8), 1967, p. 273-303.
Much progress has been made during the last fifteen years in the development of high-power epicyclic gears for many different applications. In the main this development has led to their use for very much higher powers in both speed-reducing and speed-increasing applications. Also they have become increasingly used in low-speed high-torque applications. Both of these developments have naturally led to increases in size. Two major developments described in some detail are: 1) the adoption of such gearing for use in very large ship' main propulsion with shaft horsepowers up to 30.000 and individual apicyclic gears up to 15.000 horse-power; 2) its use in variable ratio applications with stepless variation within prescribed limits.
The sucess of Stoeckicht gearing has led to the development of other co-axial drives, not onty of the epicyclic type, but also multi-layshaft gears. These other developments are not described in the paper, but it is the author's hope that reference will be made to all of them, as part of the discussion.

* 23.150

HOWE D. P.

Power station circulating water pumps.
Allen Gwynnes Pumps, Redford. Reprinted from APEX (3) Dec. 1969, 15 p.

* 23.151

DIGBY D. H.

Waterworks pumps.
Allen Gwynnes, Bedford, Reprinted from Allen eng. rev. (58) Nov. 1965, 13 p. (AGP-6123-A).
When it is considered that in estimating the potential demand for water in a given area, a consumption of from 30 to 40 gallons is allowed for each person per day and that this quantity is likely to rise as the standard of living improves, it can be realised that the demand for waterworks pumping plant is also likely to continue into the foreseeable future.
From the time since centrifugal pumps were first, introduced in the 1840s, Allen Gwynnes have played a leading part in the development of water pumping schemes as they are known today. Until recent years, this Company was known under the two separate names of W. H. Alien Sons & Co. Ltd. and Gwynnes Pumps Ltd. Substantial investment in research and testing equipment at Bedford ensures that this long-established service to the water industry will continue.
In the past, water for any locality was obtained from the nearest source of supply, If the water came from wells or borehales, it could usually be pumped direc to the distribution mains, perhaps with only an injection of chlorine. Today, however, with the increased demands, water has to be abastracted from rivers which

could usually be pumped direct to the distribution mains, perhaps with only ani injection of chlorine. Today, however, with the increased demands, water has to be abastracted from rivers which already may be contaminated and needs a great deal of treatment in settling tanks and filters to remove debris, and also the addition of chemicals to ensure a clean and wholesome supply, Ideally a, treatment works for such puposes would be situated on a sloping site so that the water would flow by gravity through the process. If such a site is not available, additional pumping is necessary. Whatever the source of water-borehole, well, river or reservoir, and wherever the delivery point, there is a suitable combination of Allen Gwynnes plant to meet any requirement, such is the extent of the range of pumps, primer movers and associated equipment, and the experience upon which the range has been built. It can be seen that waterworks provide many different applications for various types and forms of pumps which are described in subsequen paragraphs.

* 23.152

MARPLES E. B.

Introduction to the theory os surge.
Allen Gwynnes Pumps, Lincoln, Allen eng. rev. (39) Octu. 1958 6 p.

* 23.153

WOODWARD R. A. C.

Some practical aspects of pressure surge control. Allen Gwynnes Pumps, Lincoln. Allen eng. rev. (55) Oct. p. 7-10

* 23.154

GUPPY A. W.

Choosing a pump.
Allen Gwynnes, Pump, Lincoln. Allen eng. rev. (35) July 1955, 8 p.

* 23.155

BREWER D.

Vortices in pump sumps.
Allen Gwynnes Pumps, Lincoln. Allen Eng. rev. (37) March 1957, 8 p.

* 23.156

REEVES D. T.

Deterioration of a centrifugal pump in service. Allen Gwynnes Pump, Lincoln. Allen eng. rev. (42) Nov. 1960. 4 p.

* 23.157

FREEMAN J.

Model tests as an aid to improved sump design. Allen Gwynnes Pump. Lincoln. Allen eng. rev. (45) Nov. 1961, 7 p.

* 23.158

VALENTINE A. C.

Total energy, the combined production of industrial electric power and process heat.
APE, Bedford. 13 p.
Total Energy is a very fashionable expression recently imported from the United States of America under the guise of a revolutionary new concept. Homewer, as far as industrial plants are concerned, it is only the "in" way of expressing a very old concept, namely, the combined production of electric power and process heat by the optimum use of the available heat from a single fuel supply. These types of plants are playing a leading part in reducing production costs in many industries, particularly in paper and board mills, sugar factories, food factories, breweries, distilleries, chemical works, oil refineries, textile mills, dyeworks, steelworks, etc.

* 23.159

SINGLETON J. A.

Electrical starting characteristics
Allen Gwynnes Pumps, Bedfor, Reprinted from APEX (9) March 1972, p.2-10.

* 23.160

GUPPY A. W.

Hydraulic starting charicteristics.
Allen Gwynnes Pumps. Bedford. Reprinted from Allen eng. rev. (43) March 1961, p. 11-13

*** 23.161**

TERRY J. B.

Land drainage pumps.
Allen Gwynnes, Lincoln. 31 p.

*** 23.162**

WOOD A. C.

Bonding methods for dry film lubricants, a guide for design engineers.
Eng. mat. and des., July 1971
In spite of the great efforts made in recent years to educate enginners and technicians in the new science of tribology far too many designers still think of lubrication in terms of the oil can and the grease gun. Miracles of design complexity are performed to make a bearing run on oil when a simpler, more robust and even safer design employing a dry film lubricant would give more efficient service. For dry films to be used to maximum advantage it is necessary for the designer to have at his finger tips full technical data about the types of film available, their suitability for different uses and coating methods. For full use to be made of dry film lubrication it is essential that the designer includes lubrication at the drawing board stage, and does not leave this important subject to be inserted as an afterthought when the design is complete. One aspect of dry film lubrication which has had far less attention than it deserves is the bonding methods used to hold the coatings on to the rubbing surfaces, and this article reviews some of the more important and latest methods.

*** 23.163**

AHLSTROM M. and RYLANDER L.

The central cooling concept.
Chem processing. Dec. 1971, sin paginar
The cooling water system of a plant normally consists of a number of heat exchangers cooling a product of any kind by means of cooling water which is often corrosive and polluted. This means that corrosion and fouling ean occur at almost any place in the plant. The idea of using a central cooler is to collect all risks of corrosion and fouling in one heat exchanger, cooling pure internal water by means of raw water. The pure water then cools the process heat exchangers. The problem is how to select a central cooler that is resistant to corrosion, difficult to foul up but easy to clean and maintain. Plat type heat exchangers offer these advantages and this system.

*** 23.164**

MARRIOTT J.

Where and how to use plate heat exchangers.
Cham eng. April 1971
The special characteristics of plate heat exchangers make them ideally suited for specific applications in the chemical process industries. Here are performance, cost and fouling data, to help you in evaluating this equipment.

*** 23.165**

BARRATT R. O. et al

High integrity sodium steam generator.
ASME Publication. 1973. 8 p. (73-Pw-14)
The high capital investment cost of present and future nuclear power plants dictates the need for high reliability of the individual components. The objective of this paper is to present a sodium-heated steam generator for the LMFBR demonstration plant with improved integrity of the sodium-water pressure boundary and reduced dependence on the large capacity energy refief system. This is accomplished by a quality assured design and the additional lines of de fense to prevent multiple tube failures.

*** 23.166**

DEE J. B.

Gas-cooled fast breeder reactor disings.
ASME Publication. 1970. 11 p. (71-NE-2)
Various studies of gas-cooled fast breeder reactor (GCFR) systems with both steam-and gas-turbine cycles have been performed in Europe and the United States for about 10 years. Design studies and cost estimates of a 1000-MW (e) GCFR plant were performed by Gulf General Atomic Co. (CGA) from 1965 to 1968 for a group of U.S. utilities (East Central Nuclear Group) and also for the Alternate Coolant Fast Breeder Reactor Task Force of the U. S. Atomic. Energy Commission More recently, GGA has designed a 300-MW (e) GCFR Demonstration Plant under the sponsorship of a group of U. S. utilities and has performed safetu studies for this system. The authors discuss this 300-MW (e) plant with an indirect steam cycle safety features of the plant, and some recent studies of performance of large GCFR plants.

*** 23.167**

BARRATT R. et al

Selection of steam generator for the proposed 350-Mw (e) demonstration plant.
ASME Publication. 1970. 8 p. (71-NE-5)
The paper deals with the selection of the steam generators for the proposed 350-MW (e) fast breeder reactor reactor demonstration plant. Justification for the cycle is presented along with a definition of the functional requirements. Design criteria are established. Concepts are selected on the basis of that which will most satisfactorily meet the specified requirements, with reliability placed ahead of capital cost. In-service maintenance capability also had a significant influence on the selection.

*** 23.168**

STEVENS W. D. et al

Steam generator development for a proposed 350 MWe liquid metal fast breeder reactor demonstration plant.
ASME Publication. 1971. 13 p. (71-WA/BE-6)
This paper summarizes development work conducted in support of the sodium heates steam generator for a proposed L heated demonstration plant. Thermal performance and process tests of

multiple-tube models of the evaporator and superheater at plant design sodium and steam conditions were completed, tube weld-joint development was accomplished, and decarburization rates and changes in strength of chrome-molybdenum alloys in sodium were measured. Experiments and analyses were done to assess sodium/water reaction effects associated with possible tube leaks, and shell-side flow and tube vibration characteristics were tested using full-scale water flow models of the evaporator and superheater.

*** 23.169**

WACHSMANN F.

Organization, methods and results of personnel monitoring in the Federal Republic of Germany.
Int. Atomic Energy Agency, Vienna. 1968. p. 407-423. (SM-114/2)
Organization, Methods and Results of Personnel Monitoring in the Federal Republic of Germany. The "First Radiation Protection Ordinance" in the Federal Republic of Germany prescribes continuous measurement of the doses of all personnel working with nuclear radiation, but a monitoring obligation does not yet exist for X-rays. Approximately 30.000 persons are, nevertheless, being monitored monthly with film dosimeters at present. These measurements are performed by six monitoring agencies recognized by the state. For measuring β - γ - and X-rays, a badge with 5 filters, functioning on the filter-analytical principle, is used. This dose double film from Agfa-Gevaert allows doses to be ascertained within limits of approximately 30 mR to 1000 R. The advantage of this method is that with its help one can ascertain, besides the dose, the kind of radiation and the radiation energy, the radiation incidence direction, the kind of exposure, possible contamination with radioactive dust and so on. This knowledge is required for correct estimation of the radiation load of the monitored personnel and to avoid a radiation hazard in the future. The neutron badge designed for nuclear plants and accelerators contains, besides the dose-double film, a Kodak nuclear-track film for measurement of fast neutrons, a cadmium filter for measurement of thermal neutrons, an activation pack (S and Au) for measurement of higher neutron doses and a glass dosimeter as a long-term dosimeter for γ - radiation The last mentioned are only evaluated in the event of catastrophes. For measuring the doses to hands, finger rings with dosedouble films or recently with thermoluminescence dosimeters with LIF, are used These controls, which have already been performed for the last 18 years, fortunately show a decrease in the medium doses and in excessive doses generally.

*** 23.170**

WACHSMANN F.

Radiation protection in nuclear power plants.
Kerntechnik, isotopentechnik und chemie, 10 (8/9) 1968 p. 456-461.
The scope of radiation protection in nuclear power plants embraces in essence the following tasks (see also (1,2)): 1. Influence on radiation protection problems and safety in the construction of nuclear power plants;
2. routine radiation measurements during the operation of nuclear power plants;
3. organization of radiation protection measures.
All the above tasks raise a number of complex questions, which will be discussed individually further down in order to gain a general view of the problems facing the radiation physicist in the construction and the operation of nuclear power plants. It is of course impossible, within the framework of this paper, to discuss these questions in full detail. In what follows, the overall problems are tehefore discussed only in general terms with, whenever possible, references to detailed published data for those who wish to study these problems in greater detail.

*** 23.171**

WACHSMANN F.

Die überwachung der personendosis.
Der radiologe, 4 (11) Nov. 1964, p. 359-362.
Zur Strahlenschutzüberwachung beruflich mit ionisierenden Strahlungen Arbeitender kommen direkt anzeigende.
Taschendosimeter und als unlöschbare. Dosimeter zur Zeit vor allem Filmdosimeter in Frage. Es werden die verschiedenen filmdosimetrischen Verfahren und ihre wesentlichsteni Eigenschaften, wie Mess bereich, Energieabhängigkeit, Fading, Messung von Betastrahlen sowie thermischen und schnellen Neutronen und die Vorteile der in Deutschland benützten filteranalytischen Methode erläuter. Es werder Hinweise für die praktische Durchführung der Strahlenchutzüberwachung und die mit ihr erzielten Ergebnisse, gegeben.

*** 23.172**

INSTITUT FUR STRAHLENSCHUTZ, NEUHERBERG

Zusammenfassung über die dosimetrischen möglichkeiten der "neutronen-plakette" als - und neutronendosimeter 8 p. y fig. 1968.

*** 23.173**

FAKKEL R. H.

Sodium pump development.
Int. Atomic Energy Agency, Vienna, 1970. p. 343-374 (IAEA-SM-130/23).
Research and development work on liquid sodium pumps in the Netherlands is described. Due to the high operating temperature, emphasis is laid upon the right choice of constructional material: this is a special cast of AISI 304-type stainless steel, with narrowed limits for nickel (for good weldability) and chromium (to prevent sigma-phase formation). Other typical problem areas are: shaft-seal development, hydrostatic sodium-lubricated bearings, choice of a single suction impeller, fit for cavitation-free operations under conditions of a low available NPSH. Two pumps have been built, both of the free-surface, vertical, one-stage type. The first is an experimental pump of small capacity (280 m^3/h) and high speed. Valuable experience has been gathered relating to the construction material, the material used for hard-facing the grooved hydrostatic bearings, and the shaft seals, for which a visco-type was devoloped. A larger pump, with a capacity of 5000 m^3/h has been designed and built according to SNR-specification. This is a full-scale prototype pump for the SNR. Commissioning is due in October 1970 in the Interatom pump test facility in Germany. By careful designing, sustained by hydraulical experiments, the impeller wheels operate extremely well, i. e. without causing cavitation, under conditions of a low system NPSH. Measuring techniques were developed to determine the occurrence of cavitation (by means of adding acrylic resin to the impeller wheel). Test rigs for determining the optimum design for the grooved hydrostatic bearing, for the right choice of hardfacing materials (stallites and cermets) and for viscoseals have been erected and are in operation.

*** 23.174**

BOER G. A. and DE HES M.

Hybrid simulation of steam generating system of a LMFBR with control loops.
British Nuclear Energy Soc., Conf. on Boiler Dynamics and Control in Nuclear Power Stations. 1973. p. 6. 1-6. 7
The mathematical relations describing the dynamic behaviour of the steam generating system of a LMFBR have been programmed for a hybrid computer. Details of the computer model and the heat-transfer relations are given as well as the calculation procedure. A suitable control scheme for the plant has been developed. The responses of the plant on load changes and a reactor scram are given.

*** 23.175**

BLIECK T. de

Methods of inspection adapted to new construction details in highly stressed pressure vessels.
Lecture held in Petten on October the 3rd. 1969 on the occasion of the Conference on "Research Sodium cooled fast breeder reactors"

under the auspices of the Netherlands Atoomforum at The Hague and in co-operation with NAF, KIVI and TNO-RCN-Neratoom. Publication by kind permission of the publishers of "Atoomenergie".
New, less known construction details in highly stressed pressure vessels require adapted methods of inspection. Therefore, the object of this article is, to elucidate the reason for the advanced methods of inspection..
When considering the 50 MW sodium component test facility, it may be assumed that almost all welds of all structural parts can be inspected in the conventional manner, with the exception of the sodium/sodium heat exchanger and the steamgenerator. As to the pressure vessel, known methods are applicable but they cannot be be applied to the tube/tube sheet connections.
As the inspection techniques of the sodium/sodium heat exchanger do not differ much from the inspection techniques for the steamgenerator and as said apparatus is the most complex one because of its length and choice of material, only this last-mentioned apparatus will be discussed hereafter.

*** 23.176**

KERVERN G. Y.

Industrial production of nuclear grade materials. Pechiney Ugine Kulhmann.
sin paginar.
The new Pechiney Ugine Kuhlmann Group intends to carry on the tradition of the three companies from which it was formed, by offering to nuclear undertakings advanced technological services, backed up by a wide-ranging international infraestructure.

*** 23.177**

MARSH D.

Introduction to sound and vibration measurements.
Brüel & Kjaer, Naerum, Dinamarca. ORBIT Panorama of advanced electronics, 4 (3-7) March-Sept. 1969, 30 p.

*** 23.178**

BRUEL & KJAER, NAERUM, DINAMARCA

The real time analyzer type 3347 used for: automobile noise testing production quality control, etc.
Applications notes 11-135 11 p.

*** 23.179**

BRUEL & KJAER, NAERUM, DINAMARCA

Imput multiplexing in connection with the real-time analyzer type 3347.
Applications notes 11-139. 16 p.

*** 23.180**

RANDALL R. B.

Frequency analysis of stationary signals recorded on tape loops.
Applications notes 12-036 10 p.

*** 23.181**

BRUEL & KJAER, NAERUM, DINAMARCA

The portable analyzer type 5584-5664.
Applications notes 12-075 5 p.

*** 23.182**

BRUEL & KJAER, NAERUM, DINAMARCA

Instantaneous spectrum, analysis with the real-time third-octave analyzer, edition 2.
Application notes 11-194 11 p.

*** 23.183**

BRUEL & KJAER, NAERUM, DINAMARCA

Power spectraldensity measurements with constant percentage bandwidth frequency analyzers.
Applications notes 11-141. 6 p.

*** 23.184**

RANDALL R. B.

Vibration monitoring for machine protection.
Brüel * Kjaer, Naerum, Dinamarca. Applications notes 12-052. 12 p.

*** 23.185**

NAUDIN P. et al

Etat d'avancement des techniques françaises en matiere de protection thermique pour reacteurs nucléaires.
NUCLEX-72, Oct. 1972, Basel, Séance tech, n°3/10, 14 p.
Recent french research and development works relative to thermal barriers for HTR are briefly described:

- a theoretical and experimental work on the effects of forced and free convection on thermal insulations,
- the experimental loops operating under helium pressure,
- the development of insulations made of metallic grids, mineral wools and ceramics.

23.186
INSTITUTO ARGENTINO DE RACIONALIZACION DE MATERIALES, BUENOS AIRES.

Intercambiadores de calor para la industria del petróleo A 25-1 (IAP).

* 23.187
SURYA RAO V.

Organising nuclear power projects in a developing country.
BID-evaluation and implementation of nuclear power projects, IAEA-151, p. 13-55.
Diversities in the indigenous situations among various countries in South Asia and Far East are discussed Merit of considering unique experiences of one developing country are established-Development of Nuclear Programme in India is traced-Advantages and essentiality of an integrated approach to the Nuclear Power Programme is explained and such an approach inherent in India's programme highlighted-Working set ut for implementing Nuclear Programme in India and its work-ability is discussed-Organisation of Power Projects Engineering Division and the especial tasks of constituent units, with special emphasis on the vital role of quality surveillance during manufacture and methode employed are discussed-A few lessons learnt. during Indian experience in the Nuclear Power Projects are recorded.

* 23.188
INSTITUTO ARGENTINO DE RACIONALIZACION DE MATERIALES, BUENOS AIRES.
Generadores de vapor y calderas de agua caliente A 25-5/62 (IAP).
Nomenclatura y clasificación de sus partes y accesorios (Aprob. 4/62)

* 23.189
ALLEN H. N. G. and JONES T. P.
The application of high-powered epicyclic gearing for industrial and marine used.
W. H. Allen and Sons Co., Worcesthershire. 81. p.

23.190
INSTITUTO ARGENTINO DE RACIONALIZACION DE MATERIALES, BUENOS AIRES.
Generadores de vapor y calderas de agua caliente. A 25-6/62 (IAP).
Nomenclatura del dimensionamiento y cálculo. (Aprob. 4/62).

23.191
INSTITUTO ARGENTINO DE RACIONALIZACION DE MATERIALES, BUENOS AIRES.

Generadores de vapor y calderas. A 25-7/62 (IAP).
Presiones y temperaturas normales (Aprob. 4/62).

23.193
INSTITUTO ARGENTINO DE RACIONALIZACION DE MATERIALES, BUENOS AIRES.

Generadores de vapor y calderas de agua caliente. A 25-8/68 (IAP).
Métodos de ensayo de recepción. (Aprob. 9/68).

* 23.194
MAC MILLAN W. R.

A general guide to the selection of air compressors. Tilghman Wheelabrator Ltd., Compresor Div., Cheshire, sin paginar.

* 23.195
BOWES C. A.

Shipboard vibration monitoring as a diagnostic maintenance tool.
Endevco, Pasadena, Calif. p. C-47-C-50.
The generally poor correlation between the condition of machinery health and hours of operation is a significant problem for time based maintenance systems.
This problem can be overcome with maintenance systems which use knowledge, obtained with instrumentacion, regarding the actual conditions of machinery health.
Knowledge of the vibration characteristic, of a machine is particularly useful in determining its condition, and the instrumentation of a machine to obtain this knowledge is relatively easy and inexpensive. The majority of this paper is concerned with the nature or machinery vibration, where it should be measured, how the raw date should be analyzed, and how the results should be interpreted. A brief discussion of the current trends in vibration instrumentation is given at the conclusion.

23.196
INSTITUTO ARGENTINO DE RACIONALIZACION DE MATERIALES, BUENOS AIRES.

Generadores de vapor y calderas de agua caliente. A 25-9/70 (IAP).
Inspección periódica (Aprob. 12/70).

23.197
INSTITUTO ARGENTINO DE RACIONALIZACION DE MATERIALES, BUENOS AIRES.

Válvulas de bronce fundido para vapor. A 25-11/60 (IAP).
Características generales. (Aprob. 12/60).

* 23.198
GARSHICK A.

Silicone rubber suitable for coaxial cable.
Boston Insulated Wire & Cable, Boston Mass.
Presentado en: 50th annual wire and cable symposium, Atlantic City Dec. 1966.

23.199
INSTITUTO ARGENTINO DE RACIONALIZACION DE MATERIALES, BUENOS AIRES.

Caños para conducción, de alta resistencia. A 25-15/62 (IAP) (Aprob. 12/62).

*** 23.200**

BOSTON INSULATED WIRE AND CABLE., BOSTON

Bostrad 7 insulated wires electrical performance and flame resistance before and after irradiation. 1970 18 p. (Report N° B903A).
The data in this report provides detailed performance characteristics of various insulated wires in response to the needs of the users. It supplements the information provided in BIW Reports N°. B901 and B902 The evaluation of the data presented in this report should be made with the assumption that all of the performance requirements for wire and cable in the containment vessel of a nuclear power plant must be met. The consideration of any specific feature independent of all of the other characteristics can lead to different conclusions. The performance characteristics desired by the individual reviewing this data should be the deciding factor in the selection of materials.
The objective of this report is to study the effects of large doses of radiation on the electrical and flame resistance properties of various materials recommended for nuclear power plant applications.

*** 23.201**

INSTITUTO ARGENTINO DE RACIONALIZACION DE MATERIALES, BUENOS AIRES.

Bombas centrífugas para servicios generales en destilerías A5y-50 (IAP)
Condiciones generales.

*** 23.202**

BOSTON INSULATED WIRE & CABLE, BOSTON

Effect of H_3 BO_3 solution of irradiated rubber wire insulation, 1970.
8 p. (Report N° B904).
It has been estimated that in the event of antiaccident in a nuclear power station, equipment will be showered with a water spray of 0.15 gal./min./Ft^2. This spray could vary in chemical content from a boric acid (H_3 BO_3) solution of ph = 4 to a boric acid solution adjusted to a pH of 10 with sodium hydroxide (Na OH).
It was therefore necessary to evaluate the performance of rubber compounds as insulations and jackets for nuclear cables in the presence of these chemicals.
Since it is possible that cables involved in a accident would previously have received quite high doses of radiation, it was decided to test both unirradiated and irradiated materials to a total integrated dose of 1 x 10^8 rads by an electron beam. In addition, coincident conditions of pressure and temperature are also present in such an accident, so these factors were also introduced into the test.

*** 23.203**

BOSTON INSULATED WIRE & CABLE, BOSTON.

Biw bostrad cables; flame and radiation resistant cables for nuclear power plants. 1969.
35 p. (Report N° B901).
This report presents a specification for cable constructions designed primarly to meet the particular requirements encountered in nuclear power plants with the intention that the cables will serve an installed life of 40 years.
A description of the performance tests applicable to these cables is given. Where standard tests are considered inadequate revised or new procedures are included.
Results of exposing samples of cables to these tests are shown with some comparative data from various constructions. These results show the outstanding performance of BIW BOSTRAD^7 and BOSTRAD^{75} constructions to warrant unquestionable acceptance for installation in the nuclear power plants and in critical environments of fossil-fueled plants.
Finally a tabulation of BIW cable installations is provided.

23.204

Material Selection - Data book - Irons and Steels.
Metal Progress, vol. 104, june, 1973, pp. 5
Alloys for automotive componentes, SAE alloy steels, EX steels, AISI-SAE carbon steels, properties of cold drawn carbon steels, carbon and low-alloy steel castings, properties of carbon and alloy steels, gear steel selection standard and special stainless and high alloy steels, wrought and cast, high strengt steels, tool steels, gray ductile and malleable iron castings, powder metal parts.

*** 23.205**

Process Engineering - Data Book - Heat treating.
Metal Progress, vol. 104, june, 1973, pp. 141.
Iron-carbon equilibrium diagram, hardenability bands for AISI SAE steels, hardenability curves for EX steels, cooling transformation diagram for 88620, development of optimum properties in heat treatable steels, guide for in duction hardening, gas carburizing equilibria.

*** 23.206**

Process Engineering-Testing and Inspection-Data book.
Metal progress, vol. 104, june 1973, pp. 169
Characteristics of NDT methods, hardness conversions for hardened steel, metallographic reagents for irons and steels.

*** 23.207**

Fabrication Technology - Welding and Joining - Data Book.
Metal Progress, vol. 104, june 1973, pp. 205
Constitution diagram for stainless steel weld metal, covered stainless steel electrodes, selection of mild steel covered electrodes for welding stainless and heat-resisting steels, electrodes for welding stainless, heat resisting and carbon steels and other alloys.

23.208

KANGILASKI M.

Metallurgy of Common Cladding and Structural Materials. React. Mater., Fall. 1970. 13, (3), 107-113 (in English).
This review of the metallurgy of structural and cladding materials includes work on: texture, fabrication, properties and corrosion resistance of Zr and its alloys; the effect of cooling rate on the transformation-temp. and room-temp. structure of Zircaloy 2; effects of texture on the mechanical properties of Zircaloy tubing; hydride precipitation in annealed Zircaloy as a function of quenching temp.; the effect of rolling temp. on the texture of Nb-2. 5% Zr; the burst strengt of thin-walled 316 stainless steel tubes at 1100-1300% (595-705°C) as affected by defects; hot hardness, tensile and creep-rupture strength and bend and impact ductility of Fe-Cr-Al-Yt

alloys; precipitation in heat treated Hastelloy N alloys containing Ti, precipitation behavior of Inconel 625 solid solution hardened by Mo and Nb; yield strength, ductile-to-brittle transition temp. and developed steels (13% Cr-6% C and 13% Cr-6% Ni-1.5% Mo-0.06% C for nuclear pressure vessels; notched high-strain behavior of C steel, 2,25% Cr-1% Mo steel and 304 stainless steel at room temp. and 290°C; and load-controlled push-pull and bending low-cycle fatigue tests on A-302B steel performed to investigate low-cycle fatigue deformation behavior. 33 ref. -M.J.R.

* 23.209

BOSTON INSULATED WIRE & CABLE, BOSTON

An investigation of the relative deterioration temperatures and hydrogen chloride evolution of chlorinated jacket compound by means of thermal gravimetric analysis and differential thermal analysis.
4. p. (Report N° B902).
The objective of this investigation to determine the decomposition temperatures and relative amounts of HCl gas evolved from the decomposition of PVC, CSPE, and neoprene. Typical BIW and commercial compounds were used at temperatures from 15°C to 400°C.
The compounds used were:

PVC	Purchased 90° C appliance-wire compound.
Neoprene	BIW-SOX .....heavy-duty neoprene jacket.
CSPE	BIW BOSTRAD[7] heat and radiation-resistant. compound for nuclear power plants.

* 23.210

A. M. F. INTERNATIONAL, CONNECTICUT

Una instalación europea para el enriquecimiento de uranio natural.
p. 276-278.

* 23.211

LONDRES, BRITISH STANDARDS INSTITUTION

Specification for water-tube steam generating plant (including superheaters, reheaters and steed tube economisers).
London, 1969, p. 85 (De su: British standard 1113).
This British Standard applies to the parts of watertube steam generating units subject to internal pressure and similar parts of steam and water heating units used in association with steam generating units. The following types of unit are included:
(1) Water-tube boilers including their integral steel tube economisers and superheaters and all other parts connected to the boiler without the interposition of a shut-off valve.
Water-tube boilers are divided, for the purposes of this British Standard, into the following three classes:
a) Natural circulation boilers, in which the circulation of the water through the tubes is a result of the thermo-syphonie head produced by heating.
b) Forced, assisted or controlled circulation boilers,, in which a pump is used either entirely or partly to promote circulation of the water through the tubes.
c) Once-through forced circulation boilers, in which the feed pump is used to force the flow of water and steam through tubes.

(2) Steam reheaters, receiving steam which has passed through part of a turbine or other primer mover (either integral with the boiler unit or independently fired).
(3) Independently fired steam superheaters.
(4) Integral superheaters separated by a shut-off valve from the boiler
(5) Steel tube economisers separated by a shut-off valve from the boiler (either integral with the boiler or independently fired).

DRAGERWERK L. * 23.212

Federal standard no. 209a; fassung vom aug. 1966; Ubertratung aus dem Amerikanischen.
20 p.
In den letzten Jahren sind viele Bauteile, Geräte und Verfahren immer emph ndlicher geworden. Diese Entwicklung hat eine Reine neuer Bedürfnisse mit sich gebracht, von denen emes die Forderung nach neuen Normen der Reinheit (Sauberkeit) ist. Produktionsenrichtungen, welche die für diesen Reinheitsgrad notwendige Steuerung der Umwelbedingungen ermöglichen, sind unter den Namen "Reine Räume", "Weisse Räume" und "Staubgeschützte Arbeitsplätze" bekannt. Ein Reiner Raum kann daher sein: "Ein Raum, in dem Lufverunreinigungen und-wenn nötig-Temperatur und Lufteuchtigkeit in einem weit grösseren Mass unter Kontrolle gehalten werden, als in Räumen mit herkömmlicher Klimatisierung". Viele Industrieunternenmen, Ausbildungsstätten und staatliche Dienststellen haben zur Verbreitung und zum heutigen Stand der Reinrautechnik beigetragen, ohne dass eine geeignete Normung vorlag. Nun aber hat man die Notwendigkeit der Standardisierung der Begriffe und Abstufungen für dieses Gebiet erkannt.

* 23.215

LONDRES. BRITISH STANDARDS INSTITUTION

Specification for general requirements for the flash welding of steel pipes and tubes for pressure and other high duty applications.
1967. 13. p. (De su: British standard 4204)
This British Standard speciries general requirements for the automatic flash welding of joints between steel pipes and tubes, for pressure and other high duty applications.
Particular attention is drawn to Appendix A, relating to machines suitable for carrying out the work. It is strongly recommended that the plant should conform to these requirements.

23.217

LYSAGHT V. E. and DEBELLIS A.

Hardness Testing Handbook.
1969. P. 141 Met. A., 7104-72 0082 (Book-English) Separate chapters describe equipment, preparations and other aspects of Brinell, Rockwell and microhardness tests and of miscellaneous methods such as scleroscopy, scratch hardness and durometer measurements Applications of the commonly used hardness tests are described for ferrous materials including hardened and tempered steel cast iron, cemented carbides, powdered metal and sheet steel, nonferrous materials such as brass, Al, Zn and Ti and the nonmetallic materials plastic; paint, glass ceramic and rubber. M. J. R.

23.222

HAVERCROFT. W. E.

Nondestructive Testing in Quality Control.
Can. Welder Fabr., Oct. 1970, 61, (10), 10-14, 16 (in English).
Nondestructive testing of welds includes radiography of welds of steel, austenitic steel, cast iron, Al and bronze, ultrasonic methods for rolled materials and fine-grained welds, magnetic particle inspection for surface and subsurface defects in ferromagnetic materials only and liquid penetrants for both magnetic and non-magnetic materials C. A.

23.223

SICHA F.

Evaluation of the Quality of Steels for Welded Structures and Requirements for Testing Them.
Hutnik (Prague), 1970, 20, (10), 378-383 (in Czech).
The requirements of the Czechoslovakian standard for welded steel structures and pressure vessels are compared with those of the most important foreign standards. Methods of evaluating the resistance of metals to brittle fracture and for determining their suitability for welding are listed. V. K.

* 23.226

LONDRES. BRITISH STANDARDS INSTITUTION

Methods of testing hydraulic pumps and motors for hydrostatic power transmission.
London, 1970, 49 p. (De su: British standard 4617).
This standard specifies the methods to be employed in the determination of the performance and efficiency of hydrostatic power units under steady-state conditions.
A hydrostatic power unit is defined as a device for the transmission of energy by means of a pressurized fluid. For the purposes of this standard such units are associated only with continuously rotating shafts. The unit may be tested as a pump, that is with mechanical energy applied to the shaft and hydraulic energy obtained at the fluid connections, or as a motor with hydraulic energy supplied to the fluid connections and mechanical energy obtained at the shaft. Transmission units which combine pump and motor in an integral housing may be tested for performance and efficiency relative to the input and output shafts..
Requirements for test installations and procedures, measurement, and presentation of results are given, and an appendix shows a method of determining the energy balance in a hydraulic unit.

* 23.227

CRAIG H. R. M. and KALDERON D.

Research and development for large steam turbines. GEC Turbine Generators Ltd.
13 p. Presentado en: American power conf., may. 1973, Chicago.
In the selection of material, the authors have aimed to highlight areas related to the specific design background of the Company, which was influenced by the specific economic and technological character of the power supply system in Great Britain and other 50 Hz areas. This has incidentally resulted in a discussion ot work related almost exclusively to high speed turbines for superheated steam cycles.
Development of large, wet-steam turbines for light water reactors also plays a considerable part in the research and development effort. Some of it is a natural extension of the work described above (e. g. material selection and protection against wet steam damage) but some is in so many different areas from those discussed here (e. g. design and performance of reheaters and moisture separators) that it can only be adequately illustrated in a separate paper. It is hoped that the selected topics have successfully illustrated the wide variety of research and development work, skills and facilities that are continuously deployed to ensure constant advancement in steam turbine engineering.

* 23.228

GREGORY B.

Motorized valve actuators for nuclear power plants.
Nuclear eng. int., Aug. 1973, p. 631-633
There is a need to improve the reliability of safety-related nuclear valve systems. Ad hoc modification of valve actuators to suit the environment is a dangerous approach. The design must be fully qualified and actuators must be manufactured within a strict quality assurance programme.

* 23.229

GREENER R.

Fabrication for the AGRs.
Welding and metal fabrication, Apr. 1971, 7 p.
This survey describes the fabrication and erection systems used for the liners and gas baffles for the two-reactors AGR stations at Hinkley Point "B" and Hunterston "B", at present being constructed by Whessoe Ltd. A description of the development and fabrication of the diagrids for these stations is also included, as their design incorporates several new features.
The text is written directly about the Hinkley reactor components. The Hunterston station uses the same design, and the systems used by Whessoe vary only in detail where dictated by variations in the overall construction programme.

* 23.230

COULTAS A. and SAUNDERS E. A. D.

Computer-based heat exchanger design system.
CPE-Heat transfer survey, 1972, sin paginar.

* 23.231

SAUNDERS E. A. D.

Extended surfaces in heat exchangers.
Whessoe, Ltd., Darlington. 8 p. (Publication n° 132)
Publicado en: Power & Works Eng.
The various types of extended surfaces at present available are described and their characteristics explained. The factors affecting efficiency and heat transfer will be considered and some typical applications shown, with brief references also to cost figures.

* 23.232

KALDERON D.

Large steam turbines for conventional and nuclear power stations.
English Electric-AEI Turbine Generators Ltd., Rugby, Ing. CEC. J. OF Sc. and Tech., 38 (1) 1971, 12 p.
Development of the steam turbine over its entire history, apart from the very early pioneering days, has been characterized by an almost continuous succession of relatively small advances and by the absence of any revolutionary discoveries or spectacular improvements in the properties of the construction materials used. In spite of this, truly enormous cumulative advances have been made over relatively short spans of time. This is particularly true of growth of unit size for the period from World War II to the present. However, the rapid advance of steam conditions, inmediately following World War II is now over, the advent of nuclear power having transiently introduced a number of intermediate rather than advanced steam cycles in conjunction with the gas-cooled reactors, and the novel saturated-steam cycles in conjunction with the water-cooled reactors. This article, therefore sets out not to add to what has been published relatively recently on fundamental technological problems of large steam turbines, but to present a range of up-to-date steam turbines typical of the now unified product range of two large but previously independent manufacturers who have relatively recently merged. The complete integration of the two companies offered a highly unusual but welcome opportunity for the crystallization of design judgements and for rationalizations of a variety of different design solutions into ever more mature and lasting approaches.

* 23.233

PRINCENTON GAMMA-TECH, PRINCENTON, N. J.

Timing supplement; a discussion of time resolution with Ge (Li) detectors reprinted from the 1970 edition of our Ge (Li) handbook. 1970. Sin paginar.

* 23.234

IVERSEN K. and SCHELLONG B.

Mechanisiertes schweissen von aluminiumrohren.
Interetom, Friedrich-Ebert-Str., Germ. DVS Bericht, 22, 1971.
Aluminium oder Aluminiumlegierungen werden bevorzugt in der Verpackungs, der Kälte sowie der Flugzeug und Raumfahrtindustrie, in der Kerntechnik-wegen der geringen Neutronenabsorption-und im Haus-und Fahrzeugbau verwendet. Im Apparate und Vakuumanlagenbau ist der Einsatz von Aluminiumlegierungen im Verhältnis zu nichtrostendem Stahl rückläufig. Die Gründe hierfür liegen vor allem in den bisher nur unvollständig gelõsten Schweiss problemen.

* 23.235

MOODY L. E.

A unique measurements concept for use in hostile atmospheres.
Teleflex Inc., North Wales, Penn.
Reprinted from Materials evaluation. v. 31, june 1973.

* 23.236

DAVENPORT C. R.

Suggested specifications for wound cartridge filters in the nuclear industry.
Filterite Corp., Timonium, Maryland, paginaciõn varia.

* 23.237

MILLER C. A.

Review of applications of wound cartridge filters in the nuclear industry.
Filterite Corp., Timonium, Maryl.
Nuclex '66, Int. nuclear industries fair, Sept. 1966, Basle, How wound filter tubes provide controlled particle selection and positive depth filtration for clarifying and polishing liquids and gases.
Flow rate and contaminant removal capabilities.
Applications: Shield Water, pressurized Water Coolant Loop, heat Transfer Fluid, pumpseal Fluid.
Evolution of equipment design: Disposal of complete filter housing, cage design permitting disposal of cage only and retaining housing, basket design permitting disposal of cartridge only.

* 23.238

FREWING J. J.

Shell atomic lubricants.
Shell Int. Petroleum Co., 1967. 27 p. (M. O. R. 201)

* 23.239

DAVIES M.A.S. and LAZENBY B.D.

Continuous level measurements.
Process biochemistry. June 1966, sin paginar.
Many ways of measuring and indicating the levels of liquids, powders, and granular solids are currently available. They vary from detection by ultrasonic and radioactive probes, and detection by capacitance using an inert electrode, to detection by mechanical means using floats and levers. Generally, ultrasonic and radioactive methods are expensive, while purely mechanical methods incur maintenance problems.
Continuous level measurement by capacitance, discussed in this article, suffers from neither of these draw-backs and is not limited by such parameters as hygienic, corrosive or abrasive properties of the materials handled, depth of container, ambient temperature and pressure. Examples of the measurement of level in liquids and solids in some typical biochemical processes are described.

* 23.240

REIK M. K.

Trace heating the oil pipes at Northfleet.power station.
Electrical times, Aug. 1972, p. 23-24
As part of the conversion of Northfleet power station to oil-firing electric trace heating has been used on the oil pipes.

* 23.241

REIK P. H.

Electric surface heating.
ISOPAD Ltd., Hertfordshire, Ing., Insulation, Nov. 1972
The applications of heating tapes are extremely varied from freeze protection of a short length of water pipe to maintaining thousands of metres of phenol pipeline under close temperature control.
Whatever the application, however, the requirements of contractors are basically the same, ie to have an economical and efficient system. Electric heating tapes are probably simpler to installi than any other form of electric trace heating and for this reason also tend to be economical.

*** 23.242**

REIK M. K.

Electric surface heaters.
Pipes and pipelines int., Sept. Oct. 1972. 9 p.

*** 23243**

JOSLIN C. W.

Self-powered neutron detectors.
Nuclear eng. int., May. 1972.
In ten years, the self powered neutron detector has emerged from the laboratory and found extensive application in nuclear power reactors. New detection modes have been added, new emitter materials patented, and uses ranging from power station safety system to LINAC's[1] can be found.

*** 23.244**

HILBORN J. W.

Self-powered neutron detectors for reactor flux monitoring.
Nucleonics, 22 (2) Feb. 1964, p. 69-74.

*** 23.245**

SHIELDS R. B.

A platinum in-core flux detector.
I.E.E.E. Transactions on nuclear sc. 20 (1) 1973, 6 p.
The use of platinum as the emitter in a self-powered flux detector produces a mixed neutron and gamma sensitivity, but typically a higher proportion of prompt response, that is maintainded throughout life, than for earlier types. The detector has high output and a low burnup rate, confirmed by two years of extensive tests at high flux.

*** 23.246**

SAURESCHUTZ-SAKAPHEN GMBH, GLADBECK

Neue strahlenbeständige duroplast-bechichtungswerkestoffe für kernenergie-anlagen.
Werkstoffe und korrosion, 16 (3) 1965, p. 272-273 Mit von der Säureschutz Rheinruhr GmbH. hergestellten Duroplast-Beschichtungswerkstoffen, die unter dem Sammelbegriff, "Sakaphen" bek annt sind, wurden Versuche surchgeführt, um die Eigenschaften dieser Duroplast Beschictungswerkstoffe nach einer Bestrahlung mit einer Dosis von 10^9 rad festzustellen. Es handelt sich dabei um die Säkaphhenproben HR 60 extra T, SI 57 E, HR 60 extra (Schwarz SI 14 EG, SI 14 E, HR 60 extra (oliv) und HR 60. Die Versuche sollten in der Weise durchgeführt werden, dass dieselbe Prüfung an einer bestrahlten und an einer unbestrahlten Probe vorgenommen wird.
Die Bestrahlung wurde im Reaktor Geesthacht der Gesellschaft für Kernenergieverwertung in Schiffbau und Schiffahrt GmbH. vorgenommen.

*** 23.247**

ULTRASONICS LTD., SHIPLEY, ING.

Automation comes to evaporative cooling using sonic nozzles.
Process eng-heat transfer survey, 1973.
High performance sonic nozzles and computerised analysis of gas conditioning permits automation for coding hot effluent gases. Dr. M. J. Ashley explains how this can reduce the size and cost of new systems.

*** 23.248**

DUMAS J-C.

Le bore dans la protection contre les neutrons.
Carbonisation Enterpris et Ceramique, Paris.
L'un des problemes les plus importants posé par l'utilisation de l'énergie nucléaire est celui de la protection contre l'intense rayonnement issu des reacterus atomiques Produits en quantité considérable dans les piles dont ils sont la clef de fonctionnement, les neutrons représentent, a cux sculs, l'une des plus graves difficultés que l'homme devait résoudre pour sa sécurite.
A l'inverse des rayonnements alpha, béta, on gamma, les neutrons, comme leur nom l'indique, ne sont porteurs d'aucune change électrique et, de ce fait, ne subissant aucune interaction électrostatique avex les atomes, traversent impunément les écrans de plomb les plus épais. Seuls des chocs directs avec des noyaux pourraient éventuellement les ralentir ou les abosorber. L'infime dimension d'un atome rapport aux immenses vides nucléaires donne a cette éventualité une rareté qui oblige a l'accumulation d'epaisseurs considérables de matériaux souvent couteaux.
En les classant simplement d'apres leur énergie, on peut discinguer deux types de neutrons: les neutrons rapides, les neutrons lents, et, nonotamment, ceux du régime thermique.
Les neutrons rapides, c'est-a-dire ceux pos-sédant des énergies supérieures a 1.000 e V, ne seront pas envisagés dans cet article. Leur absorption directe présente des problemes complexes et sans grand intéret, puisqu'il est facile de les ralentir par chocs élastiques multiples sur les noyaux de nombre de masse faible. On considere généralement que le passage d'un neutron de 2 MeV a l'énergie thermique nécessite une vingtaine de chocs dans la paraffine, 114 dans le carbone, 86 dans le bérylium (fig. 1)
Notre étude portera donc sur les neutrons lents et surtout sur ceux du type thermique, responsables de la fission dans la plupart des réacteurs.

*** 23.249**

THE LUMMUS COMPANY, BLOOMFIELD, H. J.

400 metric ton per year, heavy water plant for Nacional de Energía Atómica of Argentina.
1972, sin paginar.

*** 23.250**

LEVINS D. M.

Heavy water production-a review of processes.
Australian Atomic Energy Commission, Research Establishment, Lucas Heights. 1970. 38 p. (AACE&TM562) Methods of heavy wate production are examined in detail.
Processes based on chemical exchange have the greatest potential for further development but distillation, electrolytic and chromatographic methods are also discussed.
In the inmediate future most of the world output of heavy water will be produced by hydrogen suphide/water exchange (the GS process) but there is limited scope for further reduction in GS production costs, Recent advances in process development make the armonia hydrogen route an attractive alternative since the energy consumption is less. A variation of the armmonia/hydrogen scheme involving the use of amines as additives to, or substitutes for ammonia also appears promising.
The greatest obstacle to the development of either the ammonia/hydrogen or amine/hydrogen schemes on a large scale is the limitation on the supply of hydrogen Ammonia synthesis gas is currently,

the most plentiful supply available but 1500 tonnes/day of ammonia capacity is needed for each 100 tonnes of heavy water produced annually. Unlimited production could be achieved using an equilibration stage in which hydrogen depleted in deuterium is exchanged with water at high temperature. The economics of this scheme depend on the development of a satisfactory catalyst for water/hydrogen equilibration.
Distillitation of water, methane and hydrogen habe been proposed as economic routes to heavy water production but design studies and experimental data would need to be clarified if optimistic forecasts are to be substantiated.
Processes based on chromatography or selective adsorption have received scant attention in the past.
Many problems would need to be overcome before such processes could be adapted to large scale production of heavy water, but in view of recent advances in plant scale chromatography, they should be re-examined.

*** 23.251**

HEIMKE G.

Oxidkeramische gehäuse.
Deutsche Steinzeug-und Kundtstoffwarenfabrik, Mennheim-Friedrischsfeld. 1972. Publicado en: Keramische zeitschrift 24 (2) 1972.
Composite constructions with Al, O, oxide ceramic insulators and metal parts soldered to them vacuum tight have been used as housings for power electronic components for more than 10 years. From the great variety of types which have been designed, those construction which have lead to the present state in this field and from which future trends might be deduced are particularly mentioned. Attention is also drawn to several housings for special applications in order to demonstrate the large scope of possible solutions for technical problems with ceramic-metal composite constructions.

*** 23.252**

HEIMKE G. and DRESSLER M.

Dioden-und thyristorgehäuse.
Deutsche Steinzeug-und Kunststoffwarenfabrik, Mannheim. 1968. Publicado en: Fachzeitschrift, (22) 1968, p. 3-7.
Until now in solid-state components for heavy-current techniques mainly casings of composite $Al_2\ O_3$ oxide ceramic designs have been adopted as dielectrics together with mechanically supporting parts of hardsoldered metal flanges and lead-in wires. In the article the most important types of these casings are presented, and the important design features are discussed. Special attention is paid to the possibilities for hard-soldered metal-ceramic connections.

*** 23.253**

HEIMKE G.

Keramik-metall-

HEIMKE G.

Keramik-metall-verbindungen.
Deutsche Steinzeug-und Kunststoffwarenfabrik, Mannheim. 1972. Publicado en: Konstruktion elemente methoden. 7 (6) 1972, 7 p.
Die Verwendung des Werkstoffes Keramik im industriellen Bereich hat in den letzen Jahren stetig zugenommen.
Es llegt in der Charackteristik dieses Werkstoffes, dass Verbundkonstrucktionen Keramik-metall in vielen Fällen eine Problemlösung darstellen. Der Beitrag fefasst sich mit den gebotenen Möglich-keiten derartige Werkstoffverbundungen herzustellen.

*** 23.254**

PETANIDES K. and HEIMKE G.

Bestimmung des sauerstoff-permeationskoeffizienten in schläuchen und rohren mit hilfe fester ionenleiter.
Friedrichsfeld, Mannheim. Publicado en: CZ-chemietechnik, 2 (4) 1973, p. 166-168.
Es wird eine Methode zur Bestimmung der Sauerstoff-Permeationskoeffizienten in Schläuchen und Rohren aus verschiedenen Werkstoffen auf elektrochemischem Weg mit Hilfe eines festen Ionenleiters vorgestellt. Die dazu gehörende Apparatur ist kurz beschrieben; Ergebnisse für einige gummielastiche Werkstoffe werden angegeben. Von den untersuchten Materialien hatte bei Raumtemperatur Polyäthylen den kleinsten und Siliconkautschuk den grössten Permeationskoeffizienten für Sauerstoff.

*** 23.255**

HEINKE G., PETANIDES K., and MARINCEK B.

Messen des freien sauerstoffs.
Friedrichsfeld, Mannheim. 1973.
Publicado en:Chemie-anlagen+verfahren, (6) 1973, p. 167–169
Die Wechselwirkungen der Elemente mit Sauerstoff sind in allen Bereichen der Technik und Biologie von grundlegender Bedeutung: in den verbrennjungsprozessen werden aus den Elementen Oxide gebildet, bei der Gewinnung der Metalle aus Erzen wird Sauerstoff entzogen, viele Wärme-und AnlaBbehandlungen sowie Chemische Reaktionen im festen, flüssigen, gasförmigen Zustand führen nor unter ganz bestimmten, genau eizuhaltenden Sauerstoffpartial—drucken zu technisch brauchbaren Ergebnissen. Erst die genaue, schnelle und kontinuierliche Erfassung des Sauerstoffes ermöglicht in vielen Fällen die Steuerung und Optimierung von Prozessen, die meist Redoxvorgänge darstellen oder enthalten. Daraus ergibt sich die groBe Bedeutung der geschilderten MeBtechnik.

*** 23.256**

KEDDAR A. and KARGER J.

Nuclear power plant control and instrumentation.
Publicado en: Atomic energy rev. 11 (2) 1973, p. 377–383
Presentado en: Int. symp., Prague, 22–26, Jan 1973.
A Symposium on Nuclear Power Plant Control and Instrumentation convened in Prague by the International Atomic Energy Agency was the first major scientific meeting on the control and instrumentation further emphasizing the importance of technical development for nuclear power plant control. The attendance at this Symposium of 251 participants, representing 29 countries and six organizations, indicated great interest. A total of 57 papers and two review papers were presented in eight sessions covering the following topics: Nuclear power plant operations: Experience and thoughts for the future. Control of the nuclear power stations with special discussion on application of modern control methods. Techniques of measurements of dynamic characteristics. Systems and equipment reliability Detection of local incidents in sodium—cooled fast reactors. Temperature and flow measurements. Neutron flux measurements. Detection of failed

fuel elements. During the Symposium a panel was held on Co-ordination Necessary from the Conceptual Design Stage of a Control and Instrumentation System to Final Plant Operation. Comments papers concerned with the various topics are reported briefly below.

* 23.257

WITTENBROCK N.G.

Principles and standards of reactor safety.
Publicado en: Atomic energy rev. 11 (2) 1973, p. 369–375
Presentado en: Int. symp., Jülich, Febr. 1973.
The International Atomic Energy Agency has sponsored four previous symposia on nuclear reactor safety. In these earlier simposia the emphasis was placed on hazards evaluation techniques, siting of reactors, containment, and environmental aspects of nuclear power stations.
For this fifth Agency symposium in reactor safety the emphasis was on the engineering aspects of reactor safety. In addition to engineered safety features to minimize the consequences of a reactor accident, particular emphasis was given to information on how to design, build and operate nuclear power plants to give assurance of a very low probability of the occurrence of a reactor accident. Forty papers were presented in nine sessions during the week-long meeting. The tenth session was a panel discussion, which served to summarize the Symposium by answering questions that had been submitted by the participants. The Sumposium was attended by 254 participants from 29 countries and 4 international organizations.
In his opening address in behalf of the Director General of the IAEA Professor Z.L. Wilhelmi emphasized the environmental aspects of nuclear power plants. From the outset ot nuclear power development the designers have recognized the importance of safety in the operation of the plants. The ever-increasing role of nuclear power in meeting the world's energy needs demands an intensification of the effort to improve procedures and to develop techniques to increase reactor safety by reducing the probability of an accident and to mitigate the consequences to man and his environment. In his welcoming address on behalf of the Federal Republic of Germany Mr. H.H. Haunschild pinpointed the dilemma of reactor safety in asking what degree of safety has been achieved and why it can be regarded as adequately safe. The elaboration of technical rules and safety standards should prove to be a fruitful field for international co-operation.
Profesor K.H. Beckurts, representing the Kernforschungsanlage Jülich, said, "The public debate conducted in many countries on nuclear safety and its effects on the licensing procedures reflect the high topical importance of reactor safety research. It is of particular interest to integrate the high standard of technologicalachievements into an adequate philosophy of safety principles and to stabilize it by elaborating standards for quality and reliability which, as far as possible, should be commonly recognized on an international basis".
In the technical sessions papers were read that provided information on the pints stressed by speakers at the opening ceremony.

* 23.258

GEUE J.

Capital costs for nuclear power plants, bibliography.
Australian Atomic Energy Commission, Res. Establishement, Lucas Heights. 1972. 37 p. (AAEC LIB/BIB Nº 327)
Construction and other capital costs for nuclear power plants.
Capital costs considered as one of many factors in the economics of nuclear power plants.

* 23.259

GEUE J.

Nuclear materials managements and safeguards, bibliography
Australian atomic energy commission, research establishment, Lucas Heights, 1972. 94 p. (AAEC LIB/BIB Nº 362)

* 23.260

GEUE J.

Electric heaters for reactor loops, bibliography.
Australian atomic energy commissión, research establishment, Lucas Heights. 1972 33 p. (AAEC LIB/BIB Nº 365)

* 23.261

BOURNE A.J.

A criterion for the reliability assessment of protective systems.
Publicado en: Control, Oct. 1967.

* 23.262

GREEN A.E.

Safety assessment of automatic and manual protective systems for reactors.
Publicado en: Instrument practice, Feb. 1970, p. 109–113
A brief survey of some aspects of the safety assessment of protective systems for nuclear reactors is given.
This includes an outline of the techniques for the quantification of the assessment process in considering both automatic and manual actions.
It is concluded that the quantification process is useful in leading to the constitution of criteria for the selection of courses of action and recommendations by the assessor.

* 23.263

GREEN A.E.

Assessment of sensing channels for high integrity protective systems.
Publicado en: Instrument practice, 22 (10) Oct. 1968, p. 862–866.

* 23.264

EAMES A.R.

Reliability assessment of protective systems.
Publicado en: Nuclear engineering, March 1966, 5 p.

* 23.265

GAGLIARDI G.

De la manutention a la télémanipulation.
Publicado en: La technique moderne, Jan. 1972

* 23.266

FIEGE A. and PETERSEN H.

Probleme bei der auslegung von loop–druckrohren für den schnellen hochflusstestreaktor FR 3.
Publicado en: Ist. Int. conf. on structural mechanis in reactor technology, Berlín, Sept. 1972, 3, part F, p. 169–187.

* 23.267

STEWART W.G.

Cooling electronic controls; in harsh production environments
Publicado en: Automation, Jan. 1972.

* 23.268

BATELLE NORTHWEST LABORATORY, RICHLAND, WASHINGTON

Review of acoustic emission technology.

P.C-1 – C.26

Acoustic emission is a phenomenon arising from the release of energy as a solid material undergoes plastic deformation and fracture. Part of this energy is converted to elastic waves which spread through the material and can be detected at the material surface using high sensitivity sensors. Therein lies the basis for utilizing acoustic emission as a technique to detect formation or growth of flaws in a solid. Two outstanding features of acoustic emission as an integrity monitoring device are the ability to detect crack formation or growth at the time it occurs, and to accomplish this remotely. Also, simultaneous interrogation of multiple sensors (three or more) provides the necessary information to locate the source of the signals using triangulation.

* 23.269

LIBBY H.L.

Miscellaneous eddy current techniques.
Pacific Northwest Lab., Richland, Washington. 1969. 22 p. (BNWL-996)
This report describes several eddy current test techniques. These are presently in different stages of development and may be of interest to those developing or using eddy current nondestructive test methods.
The following techniques are described: Controlling the curvature of test coil impedance lift-off coil stabilizing the temperature of eddy current test coils, notes on the eddy current ultrasonic transducer, notes on the impedance relationship of a solenoid encircling a bar, measuring the flow of eddy currents in liquid Wood's metal, an operational test for phase detectors.

* 23.270

LIBBY H.L. and WANDLING C.R.

Eddy current multiparameter test for tube flaws in support regions
Battelle Northwest Lab., Richland, Washington. 1970 p. 25 (BNWL-1468)
Laboratory tests at Battelle-Northwest show that a twofrequency multiparameter eddy current nondestructive test offers a way to dramatically reduce interfering tube test signals caused by simulated tube supports made of stainless steel or mild steel. An analysis of complex plane data of the tube support signals and a signal caused by a suspected region of intergranular corrosion in a stainless steel tube confirms the discrimitation which we observed experimentally. The test described appears to be a workable system which represents a compromise between 1) full application of the multiparameter test principles (with the resulting complexity of circuits and adjustments and 2) a test system of reasonable complexity which may meet the needs of a practical field problem. Further tests are needed using real tube supports to determine optimum operating conditions.

* 23.271

LIBBY H.L.

Eddy current nondestructive test tubing cross-section display device.
Battelle Northwest Lab., Richland, Washington. 1969 15 p. (BNWL-1158)
Additional test results of an eddy current tubing cross-section display device described in an earlier report are given. The tubing cross-section display device gives a cathode ray tube presentation showing the approximate location of tubing flaws detected by the eddy current method. A multiparameter eddy current tester is used to provide the needed variety and separation of signals, and the method of display is similar to that used in a radar system plan position indicator. Signals resulting from artificial flaws within the tube wall have now been displayed. A composite photograph of the display shows the relative location of outer wall, within the wall, and inner wall artificial flaws in 0.080 in wall, 3–7/16 in. O.D. type 304 stainless tube. Display circuit for handling six signal channels has been built.

* 23.272

ABLITT J.F.

An introduction to the "syrel" reliability data bank.
U.K. Atomic Energy Authority, Systems Reliability Service; Lancashire. 1973 20 p. (SRS/GR/14)
This document has been prepared as a guide to potential users of both the Event Data Store and Reliability Data Store of the SYREL Data Bank.

* 23.273

U.K. ATOMIC ENERGY AUTHORITY, SYSTEMS RELIABILITY SERVICE. LANCASHIRE.

UKAEA'S systems reliability service; What's SRS to you?

Publicado en: Trade and Industry, July 1972, p.4
Over the past 20 years or so the Health and Safety Branch of the UK Atomic Energy Authority has built up an unrivalled mass of information on the performance of a wide variety of equipment, including electronic, mechanical and pneumatic instruments, electrical and automation devices, and such plant components as pumps, motors, bearings and seals. Derived from safety and reliability assessments of nuclear reactors and chemical and other types of plant, and from detailed records of operating history, these data offer an obvious base on which the likely performance of a plant can be quantitatively forecast, optimum maintenance schedules can be planned, the economic effects of plant modifications can be determined, and so on. To exploit the data in this way, the UKAEA has perfected specialised statistical methods of evaluating the information; and to facilitate their application, it has established a large, ever-growing data bank, linked to an extensive computer installation for rapid processing. In short, the UKAEA has at its disposal a systems-reliability organization, which, with a highly qualified and experienced staff, and with the necessary facilities (eg, data store, computers, facilities for fundamental research and analytical and mathematical modelling) all under one management, has carved for itself a leading position in its field. Realising that this organisation could contribute greatly to the efficiency, maintainability and safety of plant in industry in general, the UKAEA has set out to place its facilities and know-how at the service of any firm requiring them. All its experience and information are now available, if not for the asking, at least on a repayment basis, from its Systems Reliability Service.
The types of service which SRS offers are outlined in this article.

*** 23.274**

EAMES A.R.

Principles of reliability for nuclear reactor control and instrumentation systems.
U.K.Atomic Energy Authority, Lancashire. 1972 8 p. (SRD(R) 1)
This report lays down a number of reliability principles with a view to safe and economic nuclear reactor operation. Some basic precepts are initially specified and these are followed by various sections dealing with system design, equipment, controls, sensors, wiring, maintenance and human factors. Under each of these sections, a number of reliability principles are stated with a view to meeting the basic precepts.

*** 23.275**

GREEN A.E.

Quantitative assessments of system reliability.
Institution of Chemical Eng., London.
Publicado en: Inst. Chem. Eng. Symp. Series, Nº 33, 1972, p. 103–108 (4th Symp. on chemical process hazards with special reference to plant design)
In the design and operation of plant in various fields of application there is an increasing need to assess, with the minimum of subjectiveness, the reliability of systems. This need arises in various ways such as safeguarding capital investment in a plant or reducing risk to human life.
Some aspects of the prediction of the reliability of protective systems are discussed using quantified reliability techniques.

*** 23.276**

FUMAGALLI E. and VERDELI G.

Static tests on a model of presstressed concrete pressure vessel for a THTR nuclear reactor.
ISMES, Bergamo. 1970
Presentado en: Meeting concerning experimental investigation and safety aspects of PCRV's, Delft, Dec. 1970.
Model studies form an important element in the design of a prestressed concrete pressure vessel, as they represent a most valuable tool for analysis in the elastic range, to be used along with the calculation procedure. They are a particularly significant research instrument in the elasto-viscous range up to the collapse of the model for determining the actual safety degree of the structure where the calculation systems are wholly unreliable.
The tests described herein were carried out at the ISMES laboratories in 1967–1970 as port of a research program financed by the Ente Nazionale per l' Energia Eletrica (ENEL) of Italy.

*** 23.277**

LAULETTA E. and CASTOLDI A.

Il comportamento dinamico dei ponti sospesi studiato a mezzo di modelli
ISMES, Bergamo. 1972. 19 p.
Il comportamento del ponte e sufficientemente lineare da permettere l' analisi modale. I modi propri del ponte permettono di individuare dei sistemi con caratteristiche proprie ben distinte per cui l' uso del criterio giapponese e giustificato. Il problema della scelta dello spettro da assegnarsi per periodi lunghi e tuttora da risolvere. I modi superiori oltre 1 eps possono essere trascurati. Non appare lecito invece limitarsi al primo modo soltanto. In generale il tiro nelle funi portanti aumenta di poco rispetto al valore statico, mentre il momento d' incâstro delle pile assume valôri paragonabili a quelli ottenuti per l' effetto del peso proprio e dell' azione del vento

*** 23.278**

OBERTI G. and CASTOLDI A.

New trends in model research on large structures.
ISMES, Bergamo.
Presentado en: 9th Congress of the Int. Ass. for Bridge and Structural Eng., Amsterdam, May 1972, p. 715–726
Some general considerations on the usefulness of model studies in both the design and verification stages of large tridimensional structures are first outlined.
The new testing techniques in both the static and dynamic fields, based on the use of modern data acquisition systems in association with a computer, are then analyzed. As regards the dynamic field, emphasis is placed on the considerable simplification of the excitation equipment with consequent cost reduction.
In this connection, the results of some elastic model tests conducted at ISMES, Bergamo, Italy, by using the above criteria are illustrated.

*** 23.279**

FUMAGALLI E.

Applicazioni nucleari all'ingegneria civile.
ISMES, Bergamo.
Presentado en: XVIII Cong. nucleare di Roma, Mar. 1972, 22 p.

*** 23.280**

FUMAGALLI E.

L'impliego dei glicerolati di piombo per schermi biologici ad elevata efficacia.
ISMES, Bergamo.
Publicado en: Relazioni su richerche e studi promosi dall'Anidel. 1972, 7 p.
In continuazione al programma di ricerche gia sviluppato all' "ISMES" su calcestruzzi da schermaggio biologico per reattori di potenza, vennero posti allo studio conglomerati schermandi ad elevata efficacia, particolarmente indicati per applicazioni a reattori di ricerca e a mezzi di trasporto facendo ricorso a leganti di tipo organico.
E sembrato che i cementi a base di litargirio e glicerina chimicamente definiti come glicerolati di piombo, potessero utilmente impiegarsi a tale scopo.
Si ebbe gia occasione, in una precedente publicazione (I), di considerarse l'opportunita d'impiegare conglomerati eterogenei al fine di ottenere una piu equilibrata azione schermante. Maggiormente qui, trattandosi di materiali ad elevata efficacia, si e ritenuto di dover correggere, con l'aggiunta di ferro, l'azione schermante del piombo che costituisce pur sempre l'elemento base del conglomerato.
Non e dato in questa sede fornire elementi informativi sui rapporti di dosaggio da adottarsi per i due; essi vanno determinati in relazione al tipo di radiazione incidente e conseguono, di necessita, a verifiche di calcolo in sede di progetto.
Dopo aver configurato conglomerati utilizzabili in sede practica, si sono eseguite esperienze atte a determinare le caracteristiche fisico-meccaniche d'interesse applicativo.

*** 23.281**

KLEINGARN W.

Naturzugkühlturn in ibbenbüren.
Publicado en: Beton-und stahlbetonbau, 62 (1) 1967, 8 p.

*** 23.282**

KLEINGARN W.

Reinforced concrete constructions of high-capacity cooling towers. (en alemán)
Publicado en: Födern und heben. 19, (1), jan. 1969.

*** 23.283**

BAUUNTERNEHMUNG E. HEIKAMP GMBH, WIESBADEN

Betoanbau des inlandes; Naturzung-trocken-külturm. 1966.

*** 23.284**

NIEMANN H.J., PETERS H.L. and ZERNA W.

Naturzughühltürme im wind.
Publicado en: Beton und stahlbetonabu, 67 (6) Juni 1972, p. 121–129
In den Abschmitten 2 und 3 wurde über Winddruckmessungen an einem wirklichen Bauwerk und an Modellen im Windkanal berichtet. Beide Untersuchungen bezogen sich auf die stationären Druckanteile. Es ergab sich, daBfür sehr groBe Reynoldszahlen Re das Druck feld nicht mehr von Re sondern nur noch von der Oberflächenraughigkeit k/D abhängt. Als kenzeichnender Parameter für das Druck feld kann das Druckminimum min c φ benutzt werden. Bild 10 zeigt für 4 Werte des Belastungsparameters min c φ die zugehörigen Druckverteilungen (Kurve K 4 bis K 7). Die bekannte Kurve K 2 wurde zusätzlich zu Vergleichszwechen benutzt. Die SchalenschnittgröBen werden nach der vollständigen linearen Biegetheorie mit Hife eines numerischen Rechenverfahrens berechnet.
Es zeigt sich, daB auch für die Extremwerte der SchnittgröBen der Belastungsparameter min c φ als cin Kennwert angeschen werden kann. Die Oberflächenrauhigkeit der Kühlerschale hat damit einen ganz wesentlichen EinfluB auf die SchalenschaittgröBen. Durch die Wahl einer entsprechenden RippengröBe können die SchnittgröBen so beeinfluBt werden, daB eine wirtschaftliche Bemmessung möglich ist. Aus diesem Grunde Schlagen die Verfasser als optimale Druckverteilung die Kurve K 6 vor. Die Kurve K 2, die aus Früheren Windkanalversuchen zusammengesetzt worden war, führt bei der Bemessung zu praktisch gleichen Ergebnissen. Eine weitere VergröBerung des Druckminimums auf etwa min c φ = – 0,8 ergibt nur einen geringen Vorteil für die Bemessung, der Rippenherstellung. Eine Verkleinerung des Druckminimums auf etwa min c φ = – 1,5 verringert die erforderliche Rippenhöhe und läBt die BemessungsschnittgröBen in noch vertretbaren Grenzen ansteigen. Die zugehörige Druckverteilung ist durch die Kurve K 5 gegeben. Eine weitere Verminderung des Druckminimums bis min c φ = – 2,6 führt in aller Regel zu unwirtschaftlichen Konstruktionen.

*** 23.285**

WILLE G.

Besonderheiten beim bau von kühltürment mit natürlichem sug.
Publicado en: Beton, 2–69, p. 62–67
Die Probleme bei der Bauausführung für hyperbolische Kühltürme mit den hier aufgeführten Abmessungen für Rotationsschalen mit negativ gekrümmter Meridiankurve sind durch die sehr dünne Wandung charakterisiert (Bild 11). Die hierfür nockendigen Systeme der Kletterschalung sind so weit entwickelt, daB bei richtiger Handnabung durch Spezialisten keine Schwierigkeiten bei der Herstellung der Strale auftreten. Zu Beachten ist, daB Atweichungen von der Geometrie der strale durch ungenaue oder fehlerhafte enmessungen der Kletterschalung während des Bouvorganges zur Herabsetzung der Beulsicherheit und zu Abweichungen hinsichtlich des Eigenschwingungsverhaltens führen, die der Rechnung kaum zugänglich sind. Der EinfluB von Herstellungsverformungen auf Beulverhalten und Eigenschwingungen der Schale ist noch weitgehend ungeklärt. Deshalb sollte auf Einhaltung der exakten geometrischen Form bei der Herstellung der Mantelschale gröBter Wert gelegt werden. Die doppelseiting angeordnete Bewehrung sollte oberhalb der Schalung immer gut gehalten werden, um ihre Lage innerhalb der Betonwandung zu gewährleisten. Auf Kühltürme wirken in erheblichem Umfang Feuchtigkeit, Frost und Rauchgase ein, die bei ungenügender Betonüberdeckung die Stahleinlagen durch Korrosion gefährden. Der gründung eines Kühlturmes mit natürlichem Zug, vor allem im Bergsenkungsgebiet, ist gröBte Aufmerksamkeit zu Schenken. Es treten hier für Schale, Tasse und Rieselwerk bei ungleichmäBigen Setzungen oft nur schwer zu beherrschende Probleme auf. Ganz besonderes Augenmerk ist auf die Betonqualität zu legen, um allen äuBeren und inneren Einflüssen, die durch die enormen Abmessungen dieser Bauwerke bedingt sind, widerstehen zu können.
Zusammenfassend läBt sich sagen, daB groBe Naturzughühler nicht alltägliche und kühne Bauwerke des modernen Ingenieurbaues darstellen und ihre Herstellung einen sehr hohen Stand an technischer Ausrüstung. Erfahrung und gründlicher Arbeitsüberwachung voraussetzt.

*** 23.286**

ZERNA W. and KRATZIG W.

Probleme der konstruktion und berechnung von natuzugkühltürmen in schalenbauweise.
Bauunternahumng, E. Heitkamp, Langekampstrasse. p. 355–382

*** 23.287**

ZERNA W. et al.

Naturzugp kühltürme: ihre festigkeitsberechnung und konstruktion. Tagung vom 19. April 1968. Essen, Vulkan–Verlag Dr. W. Classen/c. 1968/ p. 109 (Haus der technik-vortragsveröffentlinchungen, Heft 180).

*** 23.288**

PETERS H.L.

Der vollständige spannungs-und verformungszuzstand groBer naturzugkühltürme in schalenbauweise.
Publicado en: Beton und stahlbetonbau, 8/1972, p. 175–182.
Es wurde die Ermittlung des Spannungs und Verformungszustandes allgemeimer Rotationsschalen mit Hilfe der., Dynamischen Relaxation" gezeigt. Anschaulich gedeutet wird dabei der gesuchte statische Gleichgewichtszustand als End- und Ruhezustand eines gedämpft schwingenden Systems errechnet. Als Zahlenbcispiel wurde ein Kühlturmbauxerk gewählt, bei dem die Membrantheorie zur Ermittlung des Spannungszustandes für den auftretenden Fall der Auflagerverschiebung nicht ausreicht. Ein Beispiel also, bei dem durch den schärferen Nachweis echte neue Erkenntnisse über das Tragwerk gewonnen werden. Die Berechnungen wurden mit hilfe des Algol-Rechenprogramms, wie es in abgedruckt wurde, durchgeführt.

* 23.289

FREWING J.J.

Lubrication of nuclear power stations; the role of Shell APL grades over the next decade.
Shell Int. Petroleum Co., London. 1969
The main purpose of this report is to supplement the information given in MOR 201 on UK nuclear power station development and to review future lubrication requirements.
It should not be taken as an indication of our placing any new or undue emphasis on the importance of the lubricants business associated with land-based power generation.
It is recognised that lubricants business for power stations generally, varies widely in importance from country to contry and in many instances is relatively unattractive-although in some countries there may be an element of prestige value especially for nuclear stations, This is reflected in the very limited effort allocated to this sector of trade in SIPC's Marketing Development Programme and no doubt operating companies, too, will wish to keep the value of such business in perspective in formulating their own marketing plans.

* 23.290

JONES J.A., MCORE H. D. and SCARLETT N.A.

Grease lubrication of ball bearings in helium.
Presentado en: Symp. on lubrication in hostileenvironmentsLondon, Jan. 1969.

* 23.291

COSMODYNE, TORRANCE, CALIF.

SF_6 handler streamlines CB maintenance.
Publicado en: Electrical world, Nov. 1971

* 23.292

STEWART J.E. and DESAI A.F.

Cryogenics: a solution to radioactive pollution.
Cosmodyne, Torrance, Calif. 1971
Publicado en: Electrical worlds, Nov. 1971
One of the most demanding technological problems a nuclear-plant owner must face is the removal of radioactive isotopes from gaseous discharges.Cryogenics, a technology brought of age by the aerospace program, is being increasingly viewed as an aid in this task, through cryogenic distillation or refrigerated adsorption or absorption processes.
With the emphasis today on ecology and keeping the environment clean, tremendous pressures are being exerted on electric utilities as operators of nuclear power plants to keep the release of all radioactivity to a minimum. Atomic Energy Commission standards, adopted from the international community, set a maximum permissible concentration (MPC). In addition, AEC requires that the release of radioactivity be kept "as low as practicable." Many utilities, in fact, plan o limit the amount released to no more than the normal background radiation level.

* 23.293

FRETWELL H.J.

A nitrogen supply system for post-run cooldown of nuclear reactors.
Cosmodyne, Torrance, Calif.
Publicado en: Advances in cryogenics eng. 10, Aug. 1964

* 23.294

FUMAGALLI E.

Calcestruzzi da schermaggio biologico per reattoti di potenza.
ISMES, Bergamo. 1960, p. 9
In relazione ai problemi tecnológici connessi con la realizzazione di pareti schermanti alle radiazioni nucleari di reattori di potenza, presi in esame i principi informatori dettati dalla fisica nucleare, si esaminano le norme di confezione e di scelta dei conglomerati cementizi piu idonei. L'articolo e pure corredato da una serie di risultati sperimentali di interesse per la miglior conoscenza delle caratteristiche fisico–meccaniche dei materiali medesimi.

* 23.295

OBERTI G. and LAULETTA E.

Dynamics test on models of structures.
ISMES, Bergamo, 1962
Presentado en: 2nd World conf. of eartquake eng. Tokio, July 1960 p. 945–960.
The present paper illustrates the guiding criteria followed at the italian Experimental Institute for Models and Structures (I.S.M.E.S.) in Bergamo in the study of structural stability againts seismic effects through the aid of models.
The first part of the paper is devoted to theoretical considerations, while the second deals with the testing equipment in use the Institute and the tests carried out.

* 23.296

LAULETTA E.

Dynamic features of recent italian arch dam.
ISMES, Bergamo 1964
Presentado en: 8th Cong. on Large Dams, Edimburgh, May. 1964, sin paginar.
The present paper deals with some dynamic features (natural periods and damping coefficientes) determined on the Ambiesta Dam (Italy) by means of blasts.
These features are compared and completed with those obtained analytically and by testing on models.

* 23.297

LAULETTA E.

Theoretical considerations and experimental research in the behavior of tall buildings during earthquakes.
ISMES, Bergamo 1965. 15p.
The investigation described in the present paper was prompted by an analytical study of the earthquake resistant capacity of a nearly 200 m high reinforced concrete building under construction in Canada.
The dynamic calculations performed showed that the building may be assimilated to a flexible beam with four concentrated masses.
The doubts arisen, from both a quantitative and a qualitative standpoint, regarding the reliability of such a representation have made it advisable to have tests performed on a model requiring no schematizing. The tests were carried out according to the technique and the guiding criteria outlined in the paper.
Essentially, this is a "modal analysis" of a complex structure made by means of models.
The paper also contains general considerations on various aspects or earthquake resistant engineering, with special regard to tall buildings.

FUMAGALLI E. * 23.298

Caratteristiche di resistenza dei conglomerati cementizi per stati di compressione pluriassiali.
ISMES, Bergamo. 1965. p. 550–566
This article is the first report on the experimental investigations carried out by ISMES within the research program promoted and financed by AITEC, with the contribution of CNR.
The two–and three– dimensional tests conducted on small–aggregate concrete specimens prepared with various cement contents and tested at different curing periods are reported.
The failure tests were carried out contemporaneously on 70 mm cubes and 200 mm high cylinders with a diameter of 100 mm.
The former were loaded by two opposite pairs of jacks, distribution pads and a containing frume, white the latter were tetel in a triaxial chamber. The tests have made it possible to compare the results obtained in the two cases and, first of all, to conclude that the biaxial tests on cubes by means of jacks are not reliable because they are strongly affected by the tangencial action of the loading pads.
In this connection it is well to point out the great specific strenght reduction obtained on specimens when the third dimension along the unstressed axis is descreased.
Of considerable interest are the results provided by the biaxial tests on cylindrical specimens performed for the first time in a hydrostatic chamber with the specimen free to deform axially. The very low failure values permit to roughly support the theory according to which failure occurs through the brittleness of the material every time the ideal principal tensile stress reaches its ultimate value.
In the light of this theory it may, therefore, be assumed that, in the case of a homogeneous and uniform stream of compressive stresses, the material breaks under the ideal principal stress of lateral tension. Doubts are also expressed by the Author about the meaning, of the conventional failure tests under uniaxial compression on account of the disturbance caused in the stream of stresses by the tangential action of the loading pads.
Finally, considerations are presented of failures of the plasto-viscous type due to triaxial compressive states.

SCOTTO F. * 23.299

Techniques for rupture testing of presstressed concrete vessels models.
ISMES, Bergamo, 1970.
Presentado en: Conf. organized by British Nuclear Energy Soc., London, July 1969, p. 23–29
The paper is related to the experience of the author in the field of prestressed concrete pressure vessel models, built and tested for ENEL by the "Istituto Sperimentales Modelli e Structure" ISMES at Bergamo Italy within the framework of the EURATOM and THTR Contracts and ENEL research work. The tests refer to the 1:20 prestressed concrete models of vessels for "High-temperature gas cooled reactors" of the HTGR (English) and THTR (German) type, and to a couple of simply supported end slabs of the THTR model, prestressed respectively with three systems of straight tendons at 60° and with hooping tendons only. The first part of the paper describes in detail the separate "copper-sealing system" studied for the THTR model to ensure complete tightness up to collapse of the concrete structure and tendons. This system is, in fact, essential to avoid the tests in the ultimate condition of the model being invalidated by undue leakages of the pressurizing fluid, and to permit a reliable study of the propagation of concrete cracking as pressure is increased. Detailed information is also given of special "crack detectors" deviced by ISMES and devoloped by the author to detect and follow internal cracks in critical sections of the structure. The second part discusses the reliability and interest of such a type of tests and of the relevant results together with economic implications.

DURAPIPE & LAMBERTS SALES' STAFFORDSHIRE, INGL. * 23.301

ABS plastics for chlorine doping and radwaste.
Publicado en: Nuclear eng., Aug. 1971
An inusual installation of ABS plastics pipework has been carried out at Dungeness B nuclear power station by one of the contractors Sir Robert McAlpine & Sons Ltd., who have installed over 5.000 ft of this material to take chlorine solution through a cooling water intake tunnel stretching 2.700 ft out sea. For this application, ABS replaces conventional hard-rubber lined and covered mild steel at a 40 o/o to 50 o/o cost saving, say Lambert Brothers (Walsall) Ltd., who supplied and fabricated the pipework. Tests show the system to be functioning well.

LASELL R.C. * 23.302

Some mechanical and electrical considerations of resistance thermometry.
Rosemount Eng. Co., Minnesota. 20 p.

RIVERS R.D. ed * 23.303

Impregnated activates carbon for removal of radioiodine compounds from reactor containment atmospheres; Supplement 1.

1973. 43 p. (Topical Report AAF–TR–7102)
Test procedures used to define the parameters of activated carbons for reactor containment service are described. The results of these performed on a specific grade of iodized coconut shell activated carbon, AAF 2701, are presented. A set of quality control acceptance levels for this material is listed.

RIVERS R.D. ed * 23.304

Design and testing of fan cooler-filter systems for nuclear applications.
1972. 208 p. (Topical report AAF–TR–7101)
Components for Nuclear Fan Cooler/Filter Systems developed by American Air Filter Company and/or used by it in such systems are described. Analytical techniques used by AAF in seismic design, and cooling coil and relief valve selection for normal and DBA Service are presented. Tests of the performance of cooling coils, moisture separator, HEPA filters, carbon filters, and relief valves under simultad DBA conditions are detailed. Quality Control and field test procedures and equipment related to system components are outlined.

STERKE A. de * 23.305

Some aspects of radiography and ultrasonic testing of welds in steel with thicknesses from 100–300 mm.
Röntgen Technische Diehst, Rotterdam.
British J. of Non-Dest. Testing, 2 (4) Dec. 1967 13 p.
Presentado en: 4th Annual conf. of the Non-destructive Testing Soc. of Great Britain, Univ. of Keele, Sept. 1967.

* 23.306

STERKE A. de

Weld inspection by ultrasonic waves.
Röntgen Technische Dienst, Rotterdam.
Materialsevaluation, Jan. 1964
Attention is drawn to the increasing importance of ultrasonic examination as an extension of X–ray inspection in particular, where the examination of greater weld lengths, the examination of welds in plates over 2 in, thickness, and the inspection of welds in T-joints or other similar shapes of welds difficult to examine by radiography, are concerned. It is emphasized that preference should be given to ultrasonic examination for the detection of two-dimensional defects like cracks, lack of fusion, etc.
Careful calibration of ultrasonic equipment and probes is advised to enable identification of defects. In this respect, the possibilities of the IIW calibration block as a useful auxiliary are mentioned. It is explained that standard reference blocks have only limited value for the determination of the size of weld defects. Probe guiding devices to facilitate the scanning of welds in T-joints and normal butt welds are described.
An appeal is made to design engineers to adopt types of joints which improve the possibilities for an efficient ultrasonic examination and to make proposals with respect to the drawing up of acceptance criteria for discontinuities, so that-eventually-a practical and realistic basis for ultrasonic acceptance standards can be obtained.

* 23.307

VRIES A.J. de

Welding of hard PE-pipes; experiences in welding and inspection of hard polyethylene transport pipelines.
Röntgen Technische Dienst, Rotterdam. 1970, 11 p.
In the article some values of the parameters occurring in heated-tool welding of HPE pipes are described.
The facts given are based on the practical experience of Röntgen Technische Dienst.
The causes and consequences of the most common defects which can be made during welding in the field, are mentioned.
The article further describes in what manner the weld defects can be found by the application of destructive or non-destructive methods.

* 23.308

RAAD J.A. de

Ultrasonic and other nondestructive testing methods for tube jo'–*s used in heat exhangers.
R. .gen Technische Dienst, Rotterdam.
Presentado en: Int. symp. on non-destructive testing of nuclear power reactor components. Rotterdam, Febr. 1970, p. 18 (Technical monograph P–2670)

* 23.309

STERKE A. de

A practical introduction to penetrants.
Röntgen Technische Dienst, Rotterdam.
4 p. (Technical monograph P–3371)

* 23.310

STERKE A. de BLIECH T. de

Nondestructive examination of tube plate connections.
Röntgen Technische Dienst, Rotterdam.
13 p. (Technical monograph A-2570)
Presentado en: 6th Int. conf. on non-destructive testing, June 1970 Hannover.

* 23.311

DRAGNEV T.

Non-destructive assay techniques for nuclear safeguards measurements.
Publicado en: Atomic energy rev. 11 (2) 1973, p. 341–368
Three main aspects, important from the IAEA safeguards point of view, are briefly discussed: the role of non-destructive assay techniques (NDAT) in the IAEA safeguards system; a short description and comparison of NDAT, together with their present status from the point of view of their use in this system: and, finally recent IAEA experience in the development and demonstration of these techniques under Agency field conditions. Many relevant references are given but the paper does not claim to be a complete review of non-destructive assay techniques.

* 23.312

STAUBFORSCHUNGSINSTITUT DES HAUPTVERBANDES DER GEWERBLICHEN BERUFSGENOSSENSCHAFTEN, BONN

Vorläufige richtlinien zur prüfung von filtern zur abscheindung von schwebstoffen.
Publicado en: Staub, 23 (1) 1963, p. 21–27.

* 23.313

BANGERT F.

Bewertung von schwesbstoffiltern nach der ölnebelmethode.
Publicado en: Staub, 21 (7) 1961, p. 298–300
The oil-mist method is one of the most important methods for the assessment of aerosol filters. The manufacture, use and measurement of reproducible, constant and longlasting oil-mist/air mixtures of a few Υ /m3 are reported. Finally, reference is made to the state reached in a series of experiments that have been running for a long period, and which already show that the aerosol concentration, under otherwise constant conditions, also plays a much greater part in the assessment of filters than was previously assumed.

* 23.314

STRATMANN J.

Prüfung von shwebstoffiltern auf fabrikations-und transport schäder und praktische erfahrung mit lüftungsalagen für laboratorien mit radioaktiver abluft.
Publicado en: Staub-reinhaltung der luft, 26 (10) 1966, p. 441-443.
First, the testing of high-efficiency filters by means of "oil-thread test" is treated. The kind of damages appearing most frequently at fabrication and transport is determined. Moreover, it is reported about the problems incident to the installation and removal of high-efficiency filters and the applicability ofhigh–efficiency filter boxes.

* 23.315

HASENCLEVER D.

Welche ansprüche kann man an hochwertige filteranlagen stellen?
Publicado en: Staub-reinhaltung der luft, 26 (10) 1966, p. 427-31.

* 23.316

HASENCLEVER D.

Uber die prünfung von filtern zur abscheidung radioaktive aerosole.
Publicado en: Staub, 19 (2) 1959, p. 37--43.
The article describes three different methods and test arrangements for the testing of the precipitating degree of filters. They permit the observation of the behavior of filters towards aerosols, the size of which reaches from the submicroscopic range to the 10 μ range. A defined quartz dust, a paraffin oil smoke as also radioactive indicated suspended matter < 0.3 μ diameter were used as test aerosols. The results obtained from the same filter materials by different methods are compared with each other and are discussed. It is made clear that the testing of filters solely by one of the three methods can only be regarded as sufficiently precise for certain sundry cases. In particular, with the aid of measuring results it is shown that an oil smoke test alone can lead to false conclusions respecting the useability of a filter in practice. Alone a testing by all the methods described here permits a comprehensive and close to practice judgment about the useability of a filter for the precipitation of radioactive aerosols.

* 23.317

MCKEAN J.D., TYRELL J. and BURROW E.D.

Heysham nuclear power station.
British nuclear design and construction, Leicester. 1971
Publicado en: Nuclear eng. int., Nov. 1971
The Heysham nuclear power station site has 150.000 people living within a 5 mile radius and consequently the design of the station has been subjected to particularly close scrutiny. Prestressed concrete closures have been developed for the boiler pods and secondary and tertiary shut down systems have been incorporated. Some aspects of the prestressed concrete pressure vessels and of the fuelling and control equipment which have not previously been described are also highlighted.

* 23.318

KOSUNEN S.

The fuel-handling machine for loviisa I.
Publicado en: Nuclear eng. int. June 1973
The first nuclear power station in Finland, currently under construction at Loviisa, will utilize a pressurized water reactor of 440 MW (e) size supplied by the Soviet Union. A substantial proportion of the components and sub-systems are, however, being supplied by Finnish industry. The equipment for refuelling and maintenance operations is an example of such work and the design described here incorporates several novel features.

* 23.319

JAFS D.

The Finnatom loop test rig.
Publicado en: Nuclear Eng. Int. Dec. 1971
A hot loop suitable for full scale testing of primary reactor circulators is shortly to be commissioned in Finland.

* 23.320

CHAMBON P.

Boiler plant at Wylfa nuclear power station.
Inst. of mechanical eng. London. 1966.
Presentado en: Joint meeting of the inst. of mechanical eng. with the soc. des ingénieurs civils de France at the headquarters of the soc. Paris, Dec. 1966 14 p.
The Wylfa nuclear power station now under construction for the C.E.G.B., is sited at the northern tip of the Isle of Anglesey, North Wales. Each of its two reactors is of the natural uranium, graphite-moderated, carbon dioxide gas-cooled type, and each will produce 590 MW (e) net output. Each reactor system is designed as an integrated unit with the adoption of a prestressed concrete pressure vessel which encloses the complete reactor, internal shielding, coolant gas circuits and the boiler.
This paper describes the arrangement of the boiler within the reactor pressure vessel, and deals with various aspects of the boiler design. The compact arrangement of heating surface requires particular care during manufacture and assembly, and the paper explains the manufacturing techniques which are being employed, as well as the procedures which are being adopted for the installation of the boilers within the pressure vessels.

* 23.321

GEORGE B.V. and TAYLOR P.A.

Pod boilers.
Babcock and Wilcox (Operations) London. p. 17-19

* 23.322

WORLEY N.G.

Helical boilers for nuclear systems
Presentado en: Int. nuclear ind. fair, Oct. 1972, Basel 10 p.
Helical boilers are being employed or are proposed for gas-cooled reactors-both the Advanced Gas-Cooled Reactor (AGR) and High-temperature Gas-cooled reactor (HTGR) types, sodium cooled fast reactors and water reactors for marine propulsion.
The paper describes the mayor technical characteristics of boilers of this type from the aspects of manufacture, operation and desing. The experimental and fabrication developments which form the technical background to nuclear helical boiler systems are also covered.

* 23.323

RPA (REYROLLE PARSONS AUTOMATION), GATESHEAD. INGL.

From teaching aids to industrial control systems.
Electrical rev. Dec. 3, 1971
The rapid and diverse development of Reyrolle Parsons Automation has resulted in a leading position in system engineering.

* 23.324

FOORD K.D.

High temperature bolting steels.
British steel corp., , specials steels div., Sheffield. 1972

* 23.325

FOORD K.D.

Cleaner steels or the nuclear power industry.
British steel corpo. Special steels div., Sheffield. 1972.

* 23.326

FOORD K.D. and HUSH W.M.

Properties of standard and nitrogen bearing austenitic stainless steels at cryogenic temperatures down to $4^{o}K$.
British steel corp. Special steels div., Sheffield. 1972. 8 p.
A number of steels are available for cryogenic engineering purposes ranging from 3 1/2 o/o nickel steels through austenitic stainless steels to 36 o/o nickel iron.
Choice is dictated by the nechanical and physical properties of the steel at operating temperature, the design and design criterion selected, and the material and fabrication costs. These parameters will have varying importance according to the final manufactured product and its usage. For example, for scientific apparatus the magnetic properties of the steel may be very important, but these are not normally considered by a fabricator of large liquid gas storage tanks, concerned with the integrity of his construction. This paper presents information on the standard and 'Hi-proof' nitrogen bearing austenitic stainless steels which have been widely used for cryogenic purposes down to $4^{o}K$. Comparisons are made with other steels where appropriate.

* 23.327

LLEWELLYN D.T. and HOOPER R.

A survey of the stress corrosion cracking of steels.
British steel corp., Specials steels div., Rotherham 1972. 12 p.
(PROD/MEP/6287/–/71/A)

* 23.328

ORR J.

A summary of the properties of 9o/o Cr 1o/o Mo steel,
British steel corp., Special div., Rotherham. 1972. 16 p. (PROD/MEP/6600/–72/D)
The available information on 9 o/o Cr 1o/o Mo has been reviewed and summarised in this report. It has been shown how variations in heat treatment affect the tensile properties and the shorter term rupture properties. Data on oxidation characteristics, fabrication and weldability, have also been included.

* 23.329

STONE P.G.

Esshete 800L progress report; part 1: fabrication aspects.
British steel corp ., Special steels div., Rotherham. 12 p.
A summary is presented of progress on the fabrication aspects of the Esshete 800L research project. The current results on compositional, coid work and welding topics are reviewed in the context of the Nuclear Power Plant Fabrication Industry's technical requirements, leading to areas for turher research work being identified.

* 23.330

BANGERT F.

Raumfilter-ABC-filter für sammelschutzräume
Zivilschutz, 31 (11) 1967

* 23.331

ORR J.

The metallurgy and properties of stabiblised 2 .1/4o/o Cr 1o/o Mo steel for liquid metal cooled nuclear power plant. British Steel Corp., Special Steels Div., Rotherham. 1972 12 p. (PROD/MEP/6600/1/72).
The available metallurgical information on stabilised 2 1/4o/o Cr 1o/o Mo steel is reviewed and summarised in this report. The tensile stress rupture and impact properties of normalised and tempered material are included for 2 1/4o/o 1 o/o Mo-Nb steel. The stress relief cracking and hot tearing resistance of the steel have been assessed using simulative tests.
It is concluded from these tests that the steel is readily weldable and this is supported by commercial experience. Alternative stabilising alloying additions are also discussed.

* 23.332

BECKITT F.R. and GLADMANT.

Physical metallurgy of creep resistant austenitic steels.
British Steel Corpo., Special Steels Div., Rotherham.
1972? p. 12
The role of composition in the development of creep resisting austenitic steels has been outlined. The importance of the precipitation of fine particles during creep testing has been discussed and the solubility concepts leading to optimisation of creep strength have been presented. The role of boron in increasing creep strength and rupture life has been considered and the shortcomings of the current understanding of its effect have been emphasized.

* 23.333

GERLACH K. and WILHELM J.

Atemfilter zur abscheidung von spaltjod.
Informe anual 1970, Febr. 1971, KFK 1365. p. 134-136

* 23.334

GERLACH K. and WILHELM J.

Atemfilter zur abscheidung von spaltiod.
Informe anual 1971, Marzo 1972 KFK 1565. p. 203-207

* 23.335

LONDRES. BRITISH STANDARDS INSTITUTION

Draft british standard guide to the design, testing and use of packaging for the safe transport of radioactive materials (revision of BS 3895). 1973. 109 p. (73/43620 DC)

* 23.336

BRITISH NUCLEAR DESIGN AND CONSTRUCTION LTD., LEICESTER.

Hartlepool nuclear power station; twin reactor A.G.R.
1250 MWe. 1970. 31 p.

* 23.337

STAMPE G.

Wie lange hält ein dräger-at emfilter?
Drager, Lubeck, sin paginar.

* 23.338

CITA A.

Abacus for the choice of the speed adoptable for a hydraulic turbine on the basic of the maximum normal discharge to be delivered by the turbine and of the corresponding mean operating head under which the turbine shall work. Bulletin U.I.I. sept. 1972 6th IAHR Symp. 1972.

The choice of the most suitable speed for a hydraulic turbine designed to utilize a given discharge under a given head is facilitated by the use of an abacus, already adopted by the Politecnico di Milano since 1940 Here this abacus is properly revised and improved in consideration of the development ocurred in the last thirty years in the construction and operation characteristics of turbines.

* 23.339

BORCIANI G. and DEL BRENNA F.

Stress analysis of some components of hydraulic machines through model and prototype testing.
Bulletin U I I sept. 1972
Here are examined some typical examples of photoelasticity and strain gages to determine stress distribution.
Models which has been adopted in hydraulic machines, in preliminary tests on reduced scale models.

* 23.340

BAGLIANI G.

Energy problems: hydraulic equipment for pumping plants
Bulletin U I I sept. 1972, presented 26 Meeting A T I
After a brief exam of the reassons for the adoption of hydraulic pumped storage to produce peak power, the paper presents a survey of the pumping plants built so far and in schedule in the world and in particular in Italy. The paper illustrates the most significant features of the hydraulic machinery already installed or to be installed. The last part of the paper deals briefly with the main problems concerning the hydraulic machinery to be installed in pumped storage plants.

* 23.341

LONDRES. BRITISH STANDARDS INSTITUTION.

A review of the methods of calculating stresses due to local loads and local attachments of pressure vessels.
London, 1969. 9 p. (De su: British standards institution 6439)

* 23.342

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION, VIENNA.

Information sources on industrial quality control.
New York, United Nations, 1973.
xii, 58 p. (Guides to information sources, Nº 6)

* 23.343

LONDRES. BRITISH STANDARD INSTITUTION.

Specification for steels for fired and unfired pressure vessels: plates. London, 1964-1970
2 v. (De su: British standard 1501)
Contenido: p.1: Carbon and carbon manganese steels: imperial units. -p.2: Alloy steels: imperial units.

* 23.344

LONDRES. BRITISH STANDARDS INSTITUTION.

Specification for steels for fired and unfired pressure vessels. Forgings. London, 1969. 47 p. (De su British standard 1503)

* 23.345

LONDRES. BRITISH STANDARDS INSTITUTION

Specification for carbon and low alloy steel pressure vessels for primary circuits of nuclear reactors.
London. 1965. 103 p. (De su: British standard, Nº 3915)

* 23.346

LONDRES. BRITISH STANDARDS INSTITUTION.

Methods for non-destructive testing of steel castings....
London, 1966. 28 p. (De su: British standards, Nº 4080)

* 23.347

LONDRES. BRITISH STANDARDS INSTITUTION.

Specification for carbon and low alloy steel containment structures for stationary nuclear power reactors.
London, 1967. 91 p. (De su: British standard 4208)

* 23.348

LONDRES. BRITISH STANDARDS INSTITUTION.

Methods for non-destructive testing of plate material.
Part 1A. Ultrasonic detection of laminar imperfections in ferrous wrought plate.
London, 1968. 18 p. (De su: British standard 4336: part 1A)

* 23.349

LONDRES. BRITISH STANDARDS INSTITUTION.

Method for assessing black light used in non-destructive testing.
London, 1969. 12 p. (De su: British standard 4489)

* 23.350

LONDRES. BRITISH STANDARDS INSTITUTION

Specification for field welding of carbon steel pipelines.
London, 1969. 56 p. (De su: British standard 4515. 1969)

* 23.351

LONDRES, BRITISH STANDARDS INSTITUTION.

Specification for fusion welding of steel castings.
London, 1970-1972. 2 p. (De su: British Standard 4570)

* 23.352

LONDRES, BRITISH STANDARDS INSTITUTION.

Specification for class I arc welding of austenitic stainless steel pipework for carrying fluids.
London, 1971. 71 p. (De su: British standard 4677)

* 23.353

LONDRES. BRITISH STANDARDS INSTITUTION.

Glossary of general terms used in quality assurance.
London, 1971. 11 p. (De su: British standard 4778)

* 23.354

LONDRES. BRITISH STANDARDS INSTITUTION.

A review of design methods given in present standards and codes and design proposals for nozzles and openings in pressure vessels.
London, 1969, 22 p. (De su: British standard PD 6437)

23.355

TORNGREN S.

Plate heat exhangers in nuclear power stations.
Symposium on nuclear science and engineering Bombay.
India, BARC, 13 mar. 1973. 6 p.