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**Steam Generator Production Engineering: Depth Version of CC.**  
(Classification problems. 48). (Design series. 21).

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[A freely-faceted depth classification version of Colon Classification for compound subjects going with the Host Subject "D8, D4h Steam Generator Production Engineering" is given. The use of different devices — such as, Geographical Device, Environment Device, Numerical Device, and Alphabetical Device — has helped in achieving economy in schedule building. An index to the schedule, eleven examples of subjects classified, and an alphabetical index to the subjects are given. The pattern of incidence of Quasi Isolates is commented upon.]

**ABBREVIATIONS USED :**

(AD) = Alphabetical Device	(HS) = Host Subject
(BS) = Basic Subject	(M) = Matter Isolate
CC = Colon Classification	(ND) = Numerical Device
(CN) = Class Number	(P) = Personality
(E) = Energy Isolate	(QI) = Quasi Isolate
(GD) = Geographical Device	(SD) = Subject Device

**1 Scope of the Paper**

This paper demonstrates the design of a depth classification version of CC for compound subjects going with the (HS) "D8, D4h Steam Generator Production Engineering". The methodology for designing a freely faceted scheme for classification based on postulates, canons, and principles, has been used (3, 6).

**2 Schedule of Isolates**

**21 SPECIATORS IN (1P1)**

The Quasi Isolates helpful in deriving speciators to form Compound Isolates in (1P1), are given in Table 1. The sequence among the (QI), determined by using Group Strategy and Wall

Picture Principle, is deemed to be helpful to a majority of the specialists in the subject (1, 6).

211 Table 1 List of Quasi Isolates in (1P1)

SN	Sector (S- )	Quasi Isolate
1-37		BY WHOLE-COMMODITY ASSOCIATED ATTRIBUTES
1	(A)	By Trade name (Brand)
2	(I)	By Make
3-5		By Purpose
3	ZA	By Application
4	Z9L	By Environment
5	Z1	By Portability
6-37		By Overall design parameter
6-15		By Efficiency
6	Zs	By Topping
7	Zh	By Reheat
8	Zb	By Superheat
9-15		By Economiser
9	XS	By Direction of gas flow
10	XP	By Direction of water flow
11	XJ	By Geometrical arrangement
12	XF	By Design
13	XC	By Form of heating surface
14	X5	By Tube bank
15	X2	By Thermal performance
16-18		By Air heater
16	Xm	By Variety
17	Xf	By Arrangement
18	Xc	By Direction of gas flow
19	V	By Capacity
20	UNZ	By Design pressure
21	UGZ	By Thermal efficiency
22-23		By Temperature
22	UF	By Temperature at outlet
23	UC	By Temperature at inlet
24-25		By Heat transfer
24	RZ	By Mode
25	Ra	By Medium
26	AZ	By Fuel
27	9PZ	By Rate of combustion
28	9MZ	By Number of gas passes
29	9L	By Circulation
30-32		By Dimension
30	9CZ	By Overall size
31	9C	By Width
32	9B	By Height
33-37		By Construction
33	99V	By Site of assembly
34	99I	By Material of construction
35	99a	By Method of support

36-37		By Furnace construction
36	91	By Refractory wall
37	901	By Tube position
<b>BY ORGAN-ASSOCIATED ATTRIBUTES</b>		
38-51		By Furnace
38	9mZ	By Variety
39	9f	By Number
40	9e	By Position
41	9d	By Volume
42	9c	By Heating surface area
43	1	By Height
44-45		By Burner
44	0A	By Variety
45	01	By Position
46-49		By Drum
46	0zA	By Variety
47	0z1	By Number
48	0y	By Position
49	0x	By Length
50	0kZ	By Tube
51	0bZ	By Header
<b>BY OPERATION ASSOCIATED ATTRIBUTES</b>		
52-56		By Firing method
52-53	zAZ	By Solid fuel
52		By Liquid fuel
53	z0Z	By Draught
54		By Temperature control
55-56		By Method
55	zsZ	By Method
56	yZ	By Device

## 22 SCHEDULE OF (1P2)

In the schedule of (1P2), each isolate denotes a major organ or component of the steam generator.

## 23 SCHEDULE OF (1P3)

In the schedule of (1P3), each isolate denotes a sub-organ or sub-component of a major organ or component enumerated in (1P2).

## 24 SCHEDULE OF (1M1)

A schedule of special Property Isolates is given in (1M1). A compound Matter-Property Isolate can be formed by compounding two or more isolates taken from this schedule. A "hyphen" (-) is used between the components. Isolates from the schedule of Common Property Isolates (4, 5) can be used wherever found necessary.

## 25 SCHEDULE OF (1E)

A schedule of special Energy Isolates is given. Isolates

from the schedule of Common Energy Isolates can be used wherever found necessary.

#### 26 SCHEDULE OF (2M1)

The schedule of (2M1) isolates consists of Method Isolates associated with the (1E) isolate "85 Prevention".

#### 3 Host Subject

In CC, Ed 7, "Steam generator" (Boiler) is enumerated as an isolate in (1P1) for subjects going with the (BS) "D8 Commodity Production Engineering", as shown below:

- D8 Commodity Production Engineering
- D8,D4h Steam generator
- D8,D4h4 Fire-tube
- D8,D4h5 Water tube

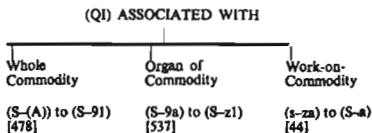
#### 4 Notation

The notation assigned to the different (Q1) in (1P1) in our earlier schedule for the subject (2) has been revised affecting a saving in the number of digits in a (CN). The sectors assigned are shown in column 2 of Table 1 in Sec 211.

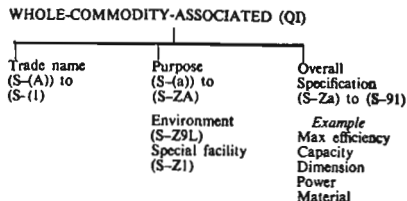
#### 5 Pattern of (Q1) in (1P1): Observation

Depth versions of CC for about thirty (HS) in Commodity Production Engineering have been designed so far. The normal pattern of incidence of (Q1) in (1P1) for such subjects is indicated in Sec 51 to 53. The preferred pattern of allocation of sectors and the number of Isolate Numbers available in any one order of array in the range of sectors allocated, with the condition that no Isolate Number has more than three digits, are also indicated in Sec 51.

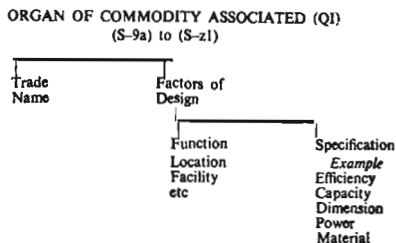
#### 51 THREE GROUPS OF (Q1)



## 52 WHOLE-COMMODITY-ASSOCIATED (Q1)



## 53 ORGAN OF COMMODITY-ASSOCIATED (Q1)



The pattern of incidence of organ-associated (Q1) is similar to that for whole-commodity-associated (Q1). The pattern may repeat for each of the organs of the commodity. The organ-associated (Q1) may be arranged among themselves according to an appropriate Principle for Sequence of Isolates, such as, the principle of Spatial Contiguity and its corollaries.

## 54 WORK-ON-COMMODITY-ASSOCIATED (Q1)

A work-on-commodity associated (Q1) is usually associated with an action on the commodity. For example, method of assembling (manually assembled commodity, automatically assembled commodity), method of operation, method of control, and method of maintenance.

## 55 HELPFULNESS OF RECOGNISING PATTERN

The helpfulness of recognising an overall pattern in the variety and sequence of (Q1) in (IP1) for subjects going with a

(HS) in Commodity Production Engineering, in the methodology and work of designing a scheme for classification, may be summarised as follows:

1 In designing schemes for classification of subjects going with different (HS) in Commodity Production Engineering, economy in schedule building can be achieved to an appreciable extent. For example, in formulating the different (QI) in (IP1), in arranging the (QI) in a helpful sequence, and in assigning notation. The work in the idea plane in designing a depth classification scheme largely consists of formulating (QI) in (IP1) and arranging them in a helpful sequence.

2 The canons and principles of classification — such as the Canons of Relevance, Consistent Sequence, and Mnemonics, and the Principles for Sequence of Isolates, can be conveniently conformed to.

3 The extension of a scheme for classification designed for the classification of whole books to a depth version for the classification of micro documents can be done without greatly disturbing the structure of the schedules and even preserving the notation used by the scheme for the whole book level. The universe of subjects is ever dynamic; it is becoming increasingly more dynamic. It is practically impossible to anticipate all the varieties of subjects that may emerge in future. However, the subjects likely to be embodied in books in the near future can be anticipated to some extent. For, it is generally found that subjects which are to-day embodied in micro documents only are the ones likely to attract whole books in future. Thus, although the rate of development of the universe of subjects is continuously forcing the rate of obsolescence of even schemes primarily meant for the classification of whole books only, a classifier with a knowledge of the methodology for the design and development of freely faceted classification based on explicitly stated postulates, canons, and principles, can extend the scheme on right lines to meet many of the developments in the universe of subjects.

4 The sectors suggested for the groups of (QI) should normally be adequate to accommodate the isolates and speciators derived on the basis of the (QI) in each group of (QI). Provision has been made to allow the choice among the sectors for each of the (QI) so as to facilitate the use of different devices including "Divide like" Device.

5 Again, at the notational level, conformity to the Canons of Mnemonics — Scheduled, Systematic, and Seminal — can be secured because of the provision for choice among the sectors in each group of (QI).

6 The pattern of grouping of the (QI) and the sequence of the (QI) within the groups, more or less parallel the sequence of

ideas of the specialist concerned with the design for production of a commodity: that is, the concept of the commodity to meet certain purpose defined by the consumer, the design specification of the commodity as a whole — that is, overall efficiency, dimension, power to be used, and material of make — in conformity with the purpose which the commodity is to serve, the design features of the components of the commodity to secure efficiency in their respective functions and to conform to the overall design specification of the commodity as a whole, and then the ideas relating, to the working of the commodity, namely, starting, operating maintaining, and controlling.

7 The pattern of incidence of (Q1) mentioned above is also similar to that in the schedule of (1P1) for (HS) in Commodity Production Technology.

## 6 Index to Schedule

*Note.*—1 The terms enumerated in the schedules in Sec 7 are listed in this index. However, terms denoting ideas, the numbers for which are indicated, to be derived using such devices as (AD), (ND), (SD) are not included.

2 The number from the Schedule given against each index entry is preceded by an abbreviation for the name of the appropriate fundamental category — such as, (1P1), (1M1), and (1E),

Absorption device (1P3), 9G	Attemperation (1P1), zh
Acid	Attemperator (1P3), 934
cleaning (1E), 118	Attenuation (1P3), 9G
flooding (2M1), 32	Austenite steel (1P1), 996
sludge (1P1), G5	Automatic
tar (1P1), G5	assembly (1E), 7G
Aerated burner (1P1), 0P1	control (1E), 5G
Agricultural product (1P1) J	firing (1P1), ZX
Air	temperat control (1P1), zx
cooled refractory wall (1P1), 98	Auxiliary
heated (1P2), K	boiler (1P1), ZU
heater (1P1), Xa	equipment (1E), 258
Alarm (1P3), 984	Bagasse (1P1), JB6
Alcohol (1P1), Rf1	Balanced draught (1P1), z8
Alumin-Mn alloy (1P1), 99L	Bar burner (1P1), 0R1
Ammonia (1P1), Rh1	Bare
Anthracite	plate refrac wall (1P1), 951
Gaseous (1P1), PM	tube refrac wall (1P1), 952
Solid (1P1), C1	Bechive coke (1P1), E3
Antifreeze (1P1), Rf	Beryllium fluoride (1P1), Ra7
Application (Q1) (1P1), ZAZ	Binary vapour (1P1), Zw
Arrangement (Q1) (1P1), Xf	Bismuth (1P1), Rv1
Ash	Bituminous coal
cleaning (Q1) (1P1), f	Gaseous (1P1), PN
removal (1E), 8F	Solid (1P1), C3
Assembly control (1E), 7	Black liquor recovery (1P1), ZS
Atmospheric burner (1P1), 0P1	

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 Blowdown (IP3), 987  
 Boil out (IE), 117  
   with alkali (2M1), 33  
 Boiler (IP2), B  
   defect (IM1), 4  
   prod eng (IP1), D4h  
 Box header (IP1), 0d  
 Brace (IP3), 32  
 Brand (Q1) (IP1), (A)  
 Bricksetting (IP1), 99h  
 Brine (IP1), Rg  
 Broken coke (IP1), EB  
 Brown coal (IP1), C6  
 Building heating (IP1), ZEZ  
 Bulging (IM1), 42  
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   (IP3), 94l  
   (Q1) (IP1), 0zX  
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 Butane air (IP1), P4  
 By-product coke (IP1), E4  
  
 Calcium chloride (IP1), Rg1  
 Capacity (Q1) (IP1), V  
 Carbon  
   monoxide (IP1), P1  
   steel (IP1), 993  
 Carburetted water gas (IP1), PG  
 Cast iron (IP1), 99B  
 Catalyst poison (IM1), 4f4  
 Cause of defect (Q1) (IM1), 4a  
 Cement kiln (IP1), ZR44  
 Central station (IP1), ZE1  
 Centre-fire burner (IP1), 0G  
 Cereal substance (IP1), J3  
 Chain grate stoker (IP1), zE  
 Checking (IE), 81  
 Chemical (IP1), Rd  
 Circular  
   burner (IP1), 0B  
   gas burner (IP1), 0M  
 Circulation (Q1) (IP1), 9L  
 Cleaning (2M1), 3  
 Clinker  
   chill refract wall (IP1), 981  
   control (IE), 58  
 Close spaced tube (IP1), 90Z  
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   Solid (IP1), E  
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 Collapse (IM1), 41  
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     control (IE), 56  
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   Concentrated combustion  
     burner (IP1), 0FK  
 Concrete (IP1), 99S  
 Conduction (IP1), S2  
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   tube reheater (IP1), Zq  
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 Cooler (IP3), 96  
  
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   Operation (IE), 385  
   Preparation (IE), 12l  
 Copper alloy (IP1), 99P  
 Corn  
   cob (IP1), J35  
   stalk (IP1), J32  
 Corner burner (IP1), 04  
 Counter gas flow in  
   air heater (IP1), Xd  
   boiler (IP1), XT  
 Country of make (Q1) (IP1), (I)  
 Cross  
   drum (IP1), 0y3  
   water flow (IP1), XR  
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 Crushing (IM1), 41  
 Cyclone furnace (IP1), 9s  
  
 Damper bypass (IP1), zb  
 Defective material (IM1), 4b  
 Deposit (IM1), 4f2  
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   of boiler (Q1) (IP1), XF  
   pressure (IP1), UNZ  
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   burner (IP1), 06  
   contact (IP1), zh2  
   heat transfer (IP1), S  
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   gas flow in  
     air heater (Q1) (IP1), Xb  
     boiler (Q1) (IP1), Xs  
   waterflow (IP1), XP  
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 Dowerthorn (IP1), RpA/RpE  
 Draft (IP2), N  
 Draining (IE), 123  
 Draught (Q1), (IP1), z0Z  
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   boiler (Q1) (IP1), 0wZ  
   of boiler (IP1), F  
   type surface (IP1), zh3  
 Drumless (IP1), 0zF  
 Dry storage (IE), 8C  
 Dryer (IP2), S  
 Dual circulation (IP1), 9L2  
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 Dutch oven furnace (IP1), 9r  
 Dwelling (IP1), ZE3  
  
 Economiser (IP2), J  
   variety (IP1), Xr  
   electrode core (IP1), ED  
   Environment (IP1) (Q1), Z9L  
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   refractory wall (IP1), 953  
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   control (IM1), 4r  
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   construction (Q1) (IP1), 90y  
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 Gamma burner (IP1), 0FF  
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   burner (IP1), 0FR  
   flow *irt*  
     Air heater (IP1), Xc  
     Boiler (IP1), XS  
   *irt* Therm efficiency (IP1), Zv  
   Oil (IP1), M5  
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 Gasoline (IP1), M2  
 Geometrical arrangement (IP1), XJ  
 Glass making (IP1), ZR45  
 Glycerine (IP1) Rf2  
 Glycol (IP1), Rf3  
 Grate (IP2), C  
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 Great Britain (IP1), (56)  
 Grit arrester (Q1) (IP1), p  
 Gun burner (IP1), 0G  
  
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 Header (IP2), H  
   Boiler (Q1) (IP1), 0bZ  
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   boiler (Q1) (IP1), 9B

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- Hot water supply (IP1), ZB
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- In-line tube bank (IP1), X6
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- Inner liner (IP3), 411
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- Low  
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 of support (Q1)(IP1), 99zZ

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   change (IM1), 4k  
   plant (IP1), zRb  
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 Middle temperature (IP1), Rm  
 Miniature (IP1), 9D  
 Mobiltherm  
   600 (IP1), Rp6  
   Light (IP1), Rp8  
 Mode of heat transf (QI)(IP1), RZ  
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 Molten salt *irt*  
   High temp range (IP1), Rt  
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   air heater (IP1), Xc  
   boiler (IP1), XS  
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 Per-ignitable burner (IP1), OR2  
 Petroleum  
   coke (IP1), G1  
   oil (IP1), M1  
   pitch (IP1), G8  
   product  
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   fluoride (IP1), Rs5  
   nitrate (IP1), Rs2  
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## 7 Schedule

Schedule of (IP1)
<i>By Operation-associated</i>
<i>attributes</i>
f <i>By Ash cleaning</i>
f1 <i>Manual</i>

f6	Mechanical
p	<i>By Grit arrester</i>
p3	<i>Scroll type</i>
xZ	<i>By Temperature control</i>
yZ	<i>By Device</i>

zb	Damper bypass	On	Horizontal return
zd	Recirculation	0b	Vertical
zf	Differential firing	0t	Inclined
zh	Attemperation	0u	Finned
zh2	Spray type (Direct contact)	0wZ	<i>By Drum</i>
zh3	Drum-type surface	0x	<i>By Length</i>
zh4	Submerged		<i>Note. -- Division</i>
zm	Firing rate control		<i>by (ND).</i>
zmZ	<i>By Method</i>	0y	<i>By Position</i>
zt	Manual	0y1	Longitudinal
zv	Semi-automatic	0y3	Cross
zs	Automatic	0z	<i>By Number</i>
			<i>Note. -- Division</i>
			<i>by (ND).</i>
z0Z	<i>By Draught</i>	0zA	<i>By Variety</i>
z1	Natural	0zF	Drumless
z3	Induced		
z5	Forced (Pressure furnace)	0zX	<i>By Burner</i>
z8	Balanced	0zY	<i>By Position</i>
		01	Under-fire
		02	Side-fire
zAZ	<i>By Firing</i>	03	Over-fire
zBZ	For solid fuel	04	Corner
zD	Stoker	06	Direct (Over 2000°F)
		0AZ	<i>By Variety</i>
	T (A2) into (A1) begins	0B	Circular
zE	Chain grate	0B2	Return flow
zF	Travelling grate	0C	Multi-tip
zG	Coking grate	0F	Oil burner
zH	Sprinkler	0F2	Spray
zH2	Shovel	0F3	Pressure jet
zH5	Rotary	0F5	Rotary
zK	Spreader	0F6	Rotamiser
zM	Retort	0FB	Low pressure
zM1	Single	0FD	Rotovac
zM2	Multiple	0FF	Y (Medium pressure)
zM3	Screw type	0FG	Oil-o-matic
zM6	Ram type	0FJ	Quiet May
zNZ	For liquid fuel	0FK	Concentrated combustion
zP	Horizontal firing	0FN	Self-proportioning
zQ	Vertical firing	0FR	Gas burner
zR	Opposed (turbo)	0G	Centre-fire (gun)
zS	Tangential	0H	Multispud
	T (A2) into (A1) ends	0K	Coke oven gas
		0M	Circular gas burner
		0N	Non-aerated
zSZ	<i>By Method</i>	0N1	Flat flame
zT	Hand	0N2	Pinhole
zV	Semi-automatic	0N4	Nozzle mixing
Xz	Automatic		
		0P	Pre-aerated
0aZ	<i>By Organ-associated</i>	0P1	Aerated (Atmosphere)
	<i>attributes</i>	0R1	Bar
0bZ	<i>By Header</i>	0R2	Pre-ignitable
0d	Box	0R3	Ring
0e	Sectional (Sinuous)	0R4	Ribbon
0kZ	<i>By Tube</i>	0R6	Tunnel
0m	Horizontal straight		

0Z	<i>By Furnace</i>	991Z	<i>By Material of construction</i>
(S-1)	<i>By Height</i>	992	Steel
	<i>Note.—Division</i>		T3 (A2) into (A1) begins
	<i>by (ND).</i>	993	Carbon (plain)
9c	<i>By Heating surface area</i>	994	Low alloy
	<i>Note.—Division</i>	995	Straight chromium
	<i>by (ND)</i>	996	Austenite
9d	<i>By volume</i>	998	Integral clad
	<i>Note.—Division</i>		T3 (A2) into (A1) ends
	<i>by (ND).</i>		
9e	<i>By Position</i>		
9e1	Internal		
9e5	External	99B	Cast iron
9f	<i>By Number</i>		T4 (A2) into (A1) begins
	<i>Note.—Division</i>		White
	<i>by (ND).</i>	99C	White
9mZ	<i>By Variety</i>	99D	Gray
9n	Twin surface	99F	Malleable
9p	Scotch	99G	Ductile
9r	Dutch oven		T4 (A2) into (A1) ends
9s	Cyclone		
9t	Turbo	99K	Non-ferrous metal
9v	Combination		T5 (A2) into (A1) begins
9w	Water screen		Al-Mn
9z1	Hopper bottom	99L	Ni-Cu
9z3	Slagtap (wet)	99P	Other Cu alloys
90x	<i>By Construction</i>	99Q	Dioxidised copper
90y	<i>By Furnace construction</i>		T5 (A2) into (A1) ends
90z	<i>By Tube positioning</i>		
902	Close spaced	99S	Concrete
903	Welded ligament panel	99T	Prefab
904	Flat stud welded to side		<i>By Site of assembly</i>
905	Full stud wall,	99V	Shop assembled
	Refractory covered		T6 (A2) into (A1) begins
906	Tube and tile		Packaged
908	Tube spaced from refractory	99W	Semi-shop assembled
			T6 (A2) into (A1) ends
91Z	<i>By Refractory wall</i>		
92	Solid	99Y	Site erected
95	Water cooled		(Field erected)
931	Bare plate		
932	Bare tube	9AZ	<i>By Dimension</i>
933	Extended surface	9B	<i>By Height</i>
955	Protected tube		<i>Note.—Division</i>
98	Air cooled		<i>by (ND).</i>
981	With clinker chill		<i>By Width</i>
985	With water back		<i>Note.—Division</i>
99az	<i>By Method of support</i>	9C	<i>by (ND).</i>
99b	Suspended		<i>By Size (Overall)</i>
99d	Structural support	9CZ	Manifure
		9D	Small
	T2 (A2) into (A1) begins	9E	Medium
99f	Independent of brick setting	9F	Large
99h	On brick setting	9G	
	T2 (A2) into (A1) ends		

9L	<i>By Circulation</i>	E3	Beehive
9L1	Natural	E4	By-product
9L2	Dual	E5	Fluid coke
9L3	Positive	E6	Coke breeze
	<i>T (A3) into (A1) begins</i>	E7	Gas works coke
9L6	Once through (Benson)	E8	Domestic coke
9L7	Modified (Monotube)	EB	Broken coke
9L8	Forced (Lamont)	EC	Foundry coke
	<i>T (A3) into (A1) ends</i>	ED	Electrode coke
		G	Oil refinery waste
9MZ	<i>By Number of gas pass</i>	G1	Petroleum coke
9N	Single	G2	Acid sludge
9P	Multiple	G3	Soda bottom
	<i>Note.—Division</i>	G4	Neutralised sludge
	<i>by (ND).</i>	G5	Acid tar
9PZ	<i>By Rate of combustion</i>	G6	Wash tailing
	<i>(in Btu)</i>	G7	Tank cleaning
9R	Low (Upto 100)	G8	Petroleum pitch
9S	Medium (100 to 999)	J	Agricultural product
9T	High (1,000 to 9,999)	J3	Cereal substance
9U	Very high (10,000 to 99,999)	J31	Straw
9V	Ultra high (above 100,000)	J32	Corn stalk
	<i>Note.—For specific</i>	J33	Rice hull
	<i>rate, division of 9R</i>	J34	Oat hull
	<i>to 9V by (ND).</i>	J35	Corn cob
	<i>(Illustrative)</i>	J8	Coffee grounds
9R55	55 Btu	J91	Other wastes
9T28	2,800 Btu	JB	Wood
9U35	35,000 Btu	JB1	Soft
9V25	250,000 Btu	JB3	Hard
		JB6	Bagasse
		M	Liquid (Oil)
AZ	<i>By Fuel</i>	M1	Petroleum oil
B	Solid	M2	Gasoline
	<i>T6 (A2) into (A1) begins</i>	M3	Kerosene
C	Pulverised coal	M5	Gas oil
C1	Anthracite	M6	Shale oil
C2	Semi-anthracite	M7	Fuel oil
C3	Bituminous coal	M8	LPD
C31	Low volatile	P	Gaseous fuel
C32	Medium volatile	P1	Carbon monoxide
C33	High volatile	P4	Butane-air
C33A	A	P6	(Propane-air)
C33B	B	P6	Methane-air
C33C	C	PB	Natural gas
C4	Sub-bituminous coal	PC	Refinery oil gas
C5	Lignite	PD	Blast furnace gas
C6	Brown coal	PF	Coke oven gas
C7	Hard coal	PG	Carburetted water gas
C8	Peat	PJ	Producer gas
E	Coke	PM	Anthracite
E1	High temperature	PN	Bituminous coal,
E2	Low temperature	PQ	Coke



STEAM GENERATOR: DUTY CLASSIFICATION

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PR	Retort coal gas	Ra4	Lithium fluoride
PT	Water gas, Coke	Ra5	Sodium fluoride
PV	Water gas, Bituminous	Ra6	Potassium fluoride
PX	Multiple fuel	Ra7	Beryllium fluoride
PY	Convertible	Rt	Molten salt
R	<i>By Heat transfer medium</i>	Rt1	Sodium
Rb	Water (favoured)	Rt2	Potassium
Rc	Vapour	Rt4	Sodium-Potassium alloy
Rd	Chemical		T3 (A4) into (A2) ends
Re	T2 (A3) into (A2) begins Low temperature range (Less than 50°F)	Ru	Very high temperature range (Above 1200°F)
Rf	T1 (A4) into (A2) begins	Rv	T4 (A4) into (A2) begins
Rf1	Antifreeze	Rv1	Molten salt
Rf2	Alcohol	Rv2	Bismuth
Rf3	Glycerine	Rv3	Lithium
Rf4	Glycol	Rv4	Lead
Rf5	Brine	Rv5	Tin
Rg1	Calcium chloride	Rv6	Zinc
Rg2	Sodium chloride		Lead-Bismuth alloy
Rh	Refrigerant		T4 (A4) into (A2) ends
Rh1	Ammonia	RZ	T2 (A3) into (A2) ends
Rh2	Halocarbon compound	S	<i>By Mode of heat transfer</i>
Rh3	Methyl chloride	S2	Direct
Rh5	Sulphur dioxide	S3	Conduction
Rj	Hydrocarbon oil	T	Convection
Rj5	Petroleum product	T5	Indirect
Rk	Organosilicate		Radiant
	T (A4) into (A2) ends	U	<i>By Temperature (Overall)</i>
Rm	Middle temperature range (200°F to 850°F)		<i>Note.—Division by (ND).</i>
Rn	T2 (A4) into (A2) begins	UC	<i>By Temperature at inlet</i>
Rn8	Liquid metal		<i>Note.—Division by (ND).</i>
Rn8	Mercury	UF	<i>By Temperature at outlet</i>
Rp	Hydrocarbon oil		<i>Note.—Division by (ND).</i>
Rp5	Petroleum product	UGZ	<i>By Thermal efficiency (%)</i>
Rp6	Mobiltherm 600	UH	Low (Upto 24)
Rp8	Mobiltherm light	UJ	Medium (25 to 59)
RpA	Dowtherm A	UK	High (above 60)
RpB	Dowtherm B		
RpE	Dowtherm E	UNZ	<i>By Design pressure</i>
Rq	Organo-silicate	UP	Low
	T2 (A4) into (A2) ends	UQ	Power (medium)
Rr	High temperature range (600 to 1400°F)	UR	High
		V	<i>By Capacity (lb/hr)</i>
		VB	Upto 100
		VC	100 to 999
Ra	T3 (A4) into (A2) begins	VD	1,000 to 9,999
Ra1	Fused salt	VE	10,000 to 99,999
Ra1	Sodium nitrate	VF	100,000+
Ra2	Sodium nitrite		<i>Note.—For</i>
Ra3	Potassium nitrate		

	specific capacity; di- vision of VB to VF by (ND). (Illustrative)	Zm Zn Zp Zq	Radiant Convection Hairpin loop Continuous tube T8 (A2) into (A1) ends
VC95	950 lb/hr		
VE86	86,000 lb/hr		
VK	Capacity (in KW)	Zs	Topping
X	By Method of increasing efficiency		T9 (A2) into (A1) begins
Xa	Air heater	Z1	Steam
	By Direction of gas flow	Z12	Steam exhaust
Xc	Parallel	Zv	Gas
Xd	Counter	Zv1	Supercharged
	By Arrangement	Zv2	Self-sustained
Xf	Horizontal	Zv3	Power cycle
Xh	Vertical	Zv4	Heating feed water
	By Variety	Zv5	Exhaust heat recovery
Xm	Recuperative (Tubular)	Zw	Binary vapour
Xn	Regenerative (Rotary)	Zw8	Mercury vapour
Xr	Economiser	Z0Z	By Purpose
	By Thermal performance		By Portability
X2	Non-steaming	Z2	Stationary
X3	Steaming	Z3	Portable
	By Tube bank		
X5	Staggered	Z9L	By Environment
X6	In-line		Note.—Division by "Common Environment Isolates" schedule (Lib. sc. 5; 1968; Paper C, Sec. 03) (Illustrative)
	By Form of heating surface	Z9N1	Corrosive
XC	Plain tube	Z9UR.5	Humid
XD	Extended surface	ZAZ	By Application
	By Design	ZB	Hot water supply
XF	Continuous	ZC	Vapour generation
XG	Return bend		T10 (A2) into (A1) begins
	By Geometrical arrangement	ZD	Steam
XJ	Horizontal	ZE	Space heating
KK	Vertical	ZE1	District (Central station)
	By Direction of water flow	ZE2	Building
XP	Longitudinal	ZE3	Dwelling
XR	Cross		Note.—Division as for '3 in (1P2) of NA Architecture', (Illustrative)
	By Direction of gas flow	ZE33	Urban
XS	Parallel	ZE4	Hotel
XT	Counter flow	ZE43	Restaurant
		ZE(· · ·)	Other building
			Note.—Division by (SD). (Illustrative)
ZaZ	By Thermal efficiency increase	ZE(2)	Library
Zb	Superheater		
	T7 (A2) into (A1) begins		
Zd	Self-draining		
Ze	Non-draining		
Zf	Pendent-mounted		
	T7 (A2) into (A1) ends		
Zh	Reheater (Resuperheater)		
	T8 (A2) into (A1) begins		
Zj	Integral		
Zk	Separately fired		

## STEAM GENERATOR: DEPTH CLASSIFICATION

E7

ZE(NT)	Theatre	K	Air heater
ZK	Power utility (KW)	M	Superheater
	<i>Note.—Division</i>	N	Draft
	<i>by (ND).</i>	P	Control
ZM	Waste heat recovery	Q	Pulverising mill
		R	Stoker
	<i>T 11 (A2) into (A1) begins</i>	S	Dryer
ZN	Wood industry	T	Distributor
ZP	Machine	U	Feed system
ZP2	Diesel engine	W	Water treatment unit
ZP7	Nuclear reactor		
ZR	Process plant		Schedule of (IP3)
ZRb	Metallurgical		
ZRb4	Ore roasting	1	Support and structure
ZRb5	Smelting		associated
ZRbB	Iron and steel	11	Foundation
ZR3	Food processing	141	Wall
ZR4	Refractories	18	Door, Exit
ZR44	Cement kiln	2	Storage and casing
ZR45	Glass making	3	Joining and fastening
ZR5	Oil refinery	32	Brace
ZS	Paper making	35	Stay
	(Black liquor recovery)	36	Connection
ZT	Packing house	4	Separation mechanism
ZU	Auxiliary boiler	41	Liner
ZX	Research	411	Inner
Z(···)	Other application	415	Outer
	<i>Note.—Division</i>	92	Lead
	<i>by (SD).</i>	921	Inlet
	<i>T 11 (A 2) into (A 1) ends</i>	925	Outlet
		93	Control
		934	Attenuator
(I)	<i>By Country of make</i>	94	Heating mechanism
	<i>Note.—Division</i>	941	Burner
	<i>by (GD).</i>	945	Fuel
	<i>(Illustrative)</i>	96	Cooler
(56)	Great Britain	965	Water screen
(73)	USA		
		98	Signal and indicator
(A)	<i>By Trade name</i>	984	Alarm
	<i>Note.—Division by (AD)</i>	987	Blowdown
	<i>(Illustrative)</i>	9B	Measuring device
(C)	Cochran	9B1	Viscosity
(P)	Powermaster	9B2	Flow
		9B3	Work. Force
		9B4	Temperature
		9B5	Pressure
A	Support and structure	9C	Observation device
B	Boiler	9C1	Window
C	Furnace, Grate	9C2	Manhole
D	Shell	9C4	Lance hole
E	Tube	9F	Safety device
F	Drum	9G	Attenuation/Absorption
H	Header		device
J	Economiser	9G4	Shock absorber

Schedule of (1M1)	23	Superheater cleaning
3	Function	24 Piping system blow out
4	Boiler defect	25 Test operation
	<i>By Cause</i>	255 Controls
4a	Primary	256 Interlocks
4b	Defective material	258 Auxiliary equipment
4d	Poor workmanship	3 Normal operation
4f	Internal corrosion	31 Start up
4f2	Deposit	33 Feedwater supply
4f4	Catalyst poison	34 Firing
4g	External corrosion	36 Combustion air supply
4b	Erosion	38 Shut down
4j	Thermal stress	385 Cooling
4k	Metallurgical change	5 Control
4k2	Hydrogen embrittlement	53 Feed water
4m	Poor maintenance	55 Fuel
4m4	Failure to clean	56 Combustion air
4m5	Water supply failure	58 Clinker
4r	Failure to control	5B Manual
4r5	Firing	5G Automatic
4s	Inadequate water treatment	7 Assembly
	<i>By Variety of defect</i>	7B Manual
41	Collapse, Crushing inward	7G Automatic
42	Bulging	8 Maintenance, Routine
43	Distortion	81 Testing, Checking
44	Cracking	83 Detection
45	Burning, Overheating	85 Prevention
46	Explosion	86 Treatment, Repair
47	Vibration	8C Dry storage
4F	Smoke	8E Standby storage
		8F Ash removal
Schedule of (1E)		Schedule of (2M1)
11	Preparation	Method Isolates for the
111	Removal of foreign material	(1E) Isolate "85 Prevention"
115	Hydrostatic test	3 Cleaning
116	Leak inspection	31 Scale removal
117	Boil out	32 Acid flooding
118	Acid cleaning	33 Flushing with water
121	Cooling	34 Boil out with alkali
123	Draining	35 Second flushing out
125	Flushing	3B Manual
126	Reinspection	3G Mechanical
2	Low load operation	5 Lighting off
22	Safety valve test	8 Supervision

## 8 Examples

### 81 Note

Some of the subjects of the documents cited as examples in the classified part in Sec 83 were found to be multifocal. As the examples given in Sec 83 are meant mainly to demonstrate the method of constructing (CN) with the depth schedule, each and every subject dealt with in a document is

not included in the list of examples. Only one or two subjects have been selected from a document.

## 82 ALPHABETICAL INDEX TO SUBJECTS

Given below is an alphabetical index to the subjects of the documents listed in Sec 83 Classified Entries. The Serial Number of the entry in Sec 83 is given as the Index Number against each entry in this section. The alphabetical subject index has been prepared according to Chain Indexing.

- Aerated burner, Cast iron construction, Packaged assembly, Natural gas fuel, Capacity 87-233 KW, Space heating, Water tube steam generator 4  
 Analysis, Vibration, Feed system, Power utility, Boiler 6  
 Ash cleaning, Scroll type grit arrester, Automatic temperature control, Ram type stoker, Wet back, Pulverised coal, Medium design pressure, Capacity 8500 lb/hr, Ruston and Hornsby, Water tube steam generator 10  
 Automatic temperature control, Ram type stoker, Wet back, Pulverised coal, Medium design pressure, Capacity 8500 lb/hr, Ruston and Hornsby, Water tube steam generator 10  
 Boiler 1-11  
 defect, Oil-fired, Superheater, Power utility, Water tube steam generator 8  
 Capacity  
 87-233 KW, Space heating, Water tube steam generator 4  
 800-8500 KW, Hot water supply, Vekos Power master, Water tube steam generator 11  
 5000 lb/hr, Longitudinal water flow, Hot water supply, Fin Pak, Water tube steam generator 9  
 8500 lb/hr, Ruston and Hornsby, Water tube steam generator 10  
 500000 lb/hr, Power utility, Water tube steam generator 7  
 Cast iron construction, Packaged assembly, Natural gas fuel, Capacity 87-233 KW, Space heating, Water tube steam generator 4  
 Chemical aspect, Evaluation, Corrosion deposit, Oil fired, Power utility, Water tube steam generator 5  
 Coal  
 Medium design pressure, Capacity 8500 lb/hr, Ruston and Hornsby, Water tube steam generator 10  
 Radiant heat transfer, Capacity 500000 lb/hr, Power utility, Water tube steam generator 7  
 Commodity production engineering 1-11  
 Computer, Simulation, Function, Steam generator 1  
 Control equipment, Drum type, Steam generator 2  
 Conversion, Natural draught, Tangential firing, Two burners, Multi-tip corner burner, Pulverised coal, Radiant heat transfer, Capacity 550000 lb/hr, Power utility, Water tube steam generator 7  
 Copper  
 salt, Prevention, External corrosion, Peat fuel, Water tube steam generator 3  
 sulphate, Prevention, External corrosion, Peat fuel, Water tube steam generator 3  
 Corner burner, Pulverised coal, Radiant heat transfer, Capacity 500000 lb/hr, Power utility, Water tube steam generator 7  
 Corrosion  
 deposit, Oil fired, Power utility, Water tube steam generator 5  
 Oil-fired, Power utility, Water tube steam generator 5  
 Defect, Oil fired, Superheater, Power utility, Water tube steam generator 8

- Design pressure, Capacity  
 580-8500 KW, Hot water supply, Vekos Powermaster, Water tube steam generator 11  
 8500 lb/hr, Ruston and Hornsby, Water tube steam generator 10  
 Drum type steam generators 2
- Efficiency  
 80 per cent, High design pressure, Capacity 580-8500 KW, Hot water supply, Vekos Powermaster, Water tube steam generator 11  
 Control equipment, Drum type steam generator 2  
 Electronic model, Analysis Vibration, Feed system, Power utility, Water tube steam generator 6  
 Evaluation, Corrosion deposit, Oil fired, Power utility, Water tube steam generator 5
- Feed system, Power utility, Water tube steam generator 6  
 Fin Pak, Water tube steam generator 9  
 Finnod tube, Two gas pass, Medium design pressure, Capacity 5000 lb/hr  
 Longitudinal water flow, Hot water supply, Fin Pak, Water tube steam generator 9  
 Fuel change, Efficiency 80 per cent, High design pressure, Capacity 580 to 8500 KW, Hot water supply, Vekos Powermaster, Water tube steam generator 11  
 Function, Steam generator 1
- Grit arrester, Automatic temperature control, Ram type stoker, Wet back, Pulverised coal, Medium design pressure, Capacity 8500 lb/hr, Ruston and Hornsby, Water tube steam generator 10
- Heating, Water-tube steam generator, 4  
 Heat transfer, Capacity 500,000 lb/hr, Power utility, Water tube steam generator 7
- High design pressure, Capacity 580 to 8500 KW, Hot water supply, Vekos Powermaster, Water tube steam generator 11
- Hot water supply  
 Fin Pak, Water tube steam generator 9  
 Vekos Powermaster, Water tube steam generator 11
- Hybrid computer, Simulation, Function, Steam generator 1
- Load, Steam generator influencing Efficiency, Control equipment, Drum type steam generator 2  
 Longitudinal water flow, Hot water supply, Fin Pak, Water tube steam generator 9
- Manual ash cleaning, Scroll type grit arrester, Automatic temperature control, Ram type stoker, Wet back, Pulverised coal, Medium design pressure, Capacity 8500 lb/hr, Ruston and Hornsby, Water tube steam generator 10
- Medium design pressure  
 Capacity 5,000 lb/hr, Longitudinal water flow, Hot water supply, Fin Pak, Water tube steam generator 9  
 Capacity 8,500 lb/hr, Ruston and Hornsby, Water tube steam generator 10
- Model, Analysis, Vibration, Feed system, Power utility, Water tube steam generator 6
- Multi-tip corner burner, Pulverised coal, Radiant heat transfer, Capacity 500000 lb/hr, Power utility, Water tube steam generator 7

Natural draught, Tangential firing, Two burners, Multi-tip corner burner, Pulverised coal, Radiant heat transfer, Capacity 500000 lb/hr, Power utility, Water tube steam generator 7

gas fuel, Capacity 87-233 KW, Space heating, Water tube steam generator 4

Conversion, Natural draught, Tangential firing, Two burners, Multi-tip corner burner, Pulverised coal, Radiant heat transfer, Capacity 550000 lb/hr, Power utility, Water tube steam generator 7

Oil fired Superheater, Power utility, Water tube steam generator 8

Power utility, Water tube steam generator 5

Overheating, Oil fired, Superheater, Power utility, Water tube steam generator 8

Packaged assembly, Natural gas fuel, Capacity 87-233 KW, Space heating, Water tube steam generator 4

Power utility, Water tube steam generator 5-8

Pulverised coal, Medium design pressure, Capacity 8,500 lb/hr, Ruston and Hornsby, Water tube steam generator 10

Radiant heat transfer, Capacity 500000 lb/hr, Power utility, Water tube steam generator 7

Ram type stoker, Wet back, Pulverised coal, Medium design pressure, Capacity 8500 lb/hr, Ruston and Hornsby, Water tube steam generator 10

Ruston and Hornsby, Water tube steam generator 10

Scroll type grit arrester, Automatic temperature control, Ram type stoker, Wet back, Pulverised coal, Medium design pressure, Capacity 8500 lb/hr, Ruston and Hornsby, Water tube steam generator 10

Sectional header, Aerated burner, Cast iron construction, Packaged assembly, Natural gas fuel, Capacity 87-233 KW, Space heating, Water tube steam generator 4

Simulation, Function, Steam generator 1

Space heating, Water tube steam generator 4

Stoker, Wet back, Pulverised coal, Medium design pressure, Capacity 8,500 lb/hr, Ruston and Hornsby, Water tube steam generator 10

Tangential firing, Two burners, Multi-tip corner burner, Pulverised coal, Radiant heat transfer, Capacity 500000 lb/hr, Power utility, Water tube steam generator 7

Temperature control, Ram type stoker, Wet back, Pulverised coal, Medium design pressure, Capacity 8500 lb/hr Ruston and Hornsby, Water tube steam generator 10

Two burners, Multi-tip corner burner, Pulverised coal, Radiant heat transfer, Capacity 500000 lb/hr, Power utility, Water tube steam generator 7

gas pass, Medium design pressure, Capacity 5000 lb/hr, Longitudinal water flow, Hot water supply, Fin Pak, Water tube steam generator 9

Vekos Powermaster, Water tube steam generator 11

Vibration, Feed system, Power utility, Water tube steam generator 6

Wet back, Pulverised coal, Medium design pressure, Capacity 8500 lb/hr,  
 Ruston and Hornsby, Water tube steam generator 10  
 Superheated, Power utility, Water tube steam generator 8  
 Wood waste, Fuel change, Efficiency 80 per cent, High design pressure,  
 Capacity 580 to 8500 KW, Hot water supply, Vekos Powermaster, Water  
 tube steam generator 11

## 83 Classified Entries

- D8 COMMODITY PRODUCTION ENGINEERING  
 D8, D4h Steam Generator  
 D8, D4h; 3:g37(D8,B4)
- 1 N70 BLACK (D M). Study of dynamic behaviour of a boiler plant using hybrid computing techniques. (J Inst Fuel. 43;1970:467-75).  
 D8,D4h-0wZ,93;a17&gD8 D4hc11  
 STEAM GENERATOR, FUNCTION, SIMULATION, HYBRID COMPUTER
- 2 N68 UNBEHAUEN (H). On load dependence of the stability and control quality in interconnected temperature control for the live steam of a drum boiler [in German] (Brennstoff-Werme-Kraft. 20; 1968; 463-69).  
 D8,D4h5-C8;4g:85;(CUSO4)  
 STEAM GENERATOR, WATER TUBE, PEAT FIRED, EXTERNAL CORROSION, PREVENTION, COPPER SULPHATE
- 3 N70 O'CONNOR (E F). Use of copper salts for inhibition of external fouling of peat fired. boilers. (J Inst Fuel. 43; 1970; 449-50).  
 D8,9J5-ZE-VK2334-87-PB-99W-99B0-P1-0e  
 STEAM GENERATOR, WATER TUBE, SPACE HEATING, 87-233 KW CAPACITY, NATURAL GAS FUEL, PACKAGED ASSEMBLY, CAST IRON CONSTRUCTION, ABRATED BURNER, SECTIONAL HEADER
- 4 N70 IDEAL STANDARD 525. (Steam heat engine. 89;1970:37).  
 D8, D4h; 5-JK-M;4f2:g(E)  
 STEAM GENERATOR, WATER TUBE, POWER UTILITY, OIL FIRED CORROSION DEPOSIT, EVALUATION, CHEMICAL ASPECT
- 5 N70 HALSTEAD (W D). Some chemical aspects of fireside corrosion in oil-fired boilers. (J Inst Fuel. 43;1970:234-9).  
 D8, D4h5-ZK,U;b95:fD;bV7D5  
 STEAM GENERATOR, WATER TUBE, POWER UTILITY, FEED SYSTEM, VIBRATION, ANALYSIS, ELECTRONIC MODEL
- 6 N68 DUSSOURD (J L). Investigation of pulsations in the boiler feed systems of a central power station. (J basic eng, Trans, ASME series D. 90;1968;607-19).  
 D8,D4h5-ZK-VF55-T5-C-0C-04-0z2-zS-z1-95,PB  
 STEAM GENERATOR, WATER TUBE, POWER UTILITY, CAPACITY 550000 LB/HR, RADIANT HEAT TRANSFER, PULVERISED COAL, MULTI-TIP CORNER BURNER, TWO BURNERS, TANGENTIAL FIRING, NATURAL DRAUGHT, CONVERSION, NATURAL GAS FUEL



- 7 N70 SNELL (P A) and CROSSWELL (P J). Conversion of a power station water tube boiler to natural gas firing. (J Inst Fuel. 43; 1970; 248-51).
- D8,D4h5-ZK-Zb-M;45  
STEAM GENERATOR, WATER TUBE, POWER UTILITY, SUPER-HEATER, OIL FIRED, OVERHEATING
- 8 N70 HOLLAND (N H). Discussion on high-temperature corrosion investigations on an oil-fired boiler at Marchwood power station. (J Inst fuel. 43;1970;97-103).
- D8,D4h5-(F+P)-ZB-XP-VD5-UQ-9P2-0u  
STEAM GENERATOR, WATER TUBE, FIN PAK, HOT WATER SUPPLY LONGITUDINAL WATER FLOW, CAPACITY 5000 LB/HR MEDIUM DESIGN PRESSURE, TWO GAS PASS, FINNED TUBE
- 9 N70 CLONSAST. (Steam heat engin. 39;1970;36).
- D8,D4h5-(R+H)-VD85-UQ-C-985-zzm6-p3-m1  
STEAM GENERATOR, WATER TUBE, RUSTON AND HORNSBY, CAPACITY 8500 LB/HR, MEDIUM DESIGN PRESSURE, COAL FUEL WET BACK, RAM TYPE STOKER, SCROLL TYPE GAIT ARRESTER, AUTOMATIC TEMPERATURE CONTROL, MANUAL ASH CLEANING
- 10 N68 WHAT IS THE COST OF A COAL FIRED PLANT? (Eng boiler house rev. 83; 1968;1757).
- D8,D4h5-(V+P)-ZB-VK580-8500-UR-UK80-PY(M->JB)  
STEAM GENERATOR, WATER TUBE, VEKOS POWER MASTER, HOT WATER SUPPLY, CAPACITY 580 TO 8500 KW, HIGH DESIGN PRESSURE, EFFICIENCY 80 PER CENT, FUEL CHANGE, OIL TO WOOD WASTE
- 11 N70 OIL-WOODWASTE FIRED boiler developed by G W B. (Steam heat eng. 40;1970;26-9).

#### 91 Bibliographical References

- 1 Sec 21 NEELAMEGHAN (A) and GOPINATH (M A). Grouping of quasi-isolates. (Annual seminar, (DRTC). 4;1966;Paper K).
- 2 Sec 4 ——— and ——— Production engineering of boiler: Depth classification (Annual seminar, (DRTC). 3;1965;Paper L).
- 3 Sec 1 ———, ——— and DENTON (P H). Motor vehicle production: Depth classification: Demonstration. (Lib sc. 4;1967;Paper H).
- 4 Sec 24 ——— and SANGAMESWARAN (S V). Food technology: Depth classification version of C.C. (Lib sc. 7;1970; Paper L, Sec 7, P 264-6).
- 5 Sec 24 RANGANATHAN (S R). Common property isolates. (An lib sc. 7;1960;1-12).
- 6 Sec 1 ———. Design of depth classification: Methodology (Lib sc. 21 1;1964; Paper A).