Catalogue No. 205

2 1959

BRAY

REG. TRADE MARK

Flat Flame and Cylindrical

JETS

For COAL GAS

GEO. BRAY & COMPANY LIMITED
LEICESTER PLACE, LEEDS 2, ENGLAND
London Office:
305-306 GRAND BUILDINGS, TRAFALGAR SQUARE, W.2.

USEFUL CONVERSION FACTORS

Aides a la Conversion du Système Britannique au Système Métrique

1 inch = 2·54 centimetres = 0·0254 metre
1 cu. ft. = 28·3 litres = 0·0283 cu. metre
1 B.Th.U. = 0·252 Kilogram calorie
1 B.Th.U. per cu. ft. = 8·90 Kilogram calories per cu. metre

Y

Flat Flame and Cylindrical

JETS

For COAL GAS

Characteristics of Jets and Guide to their Selection

Catalogue No. 205
1955

GEO. BRAY & COMPANY LIMITED
Leicester Place, Blackman Lane, Leeds 2, England
Telegrams BRAY LEEDS 2 Telephone LEEDS 20981 (9 lines)
Established 1863

LONDON OFFICE
305-306 GRAND BUILDINGS : : TRAFALGAR SQUARE, W.2.
Telephone WHItehall 3033 Telegrams GEBRAY LONDON

BURNER DEPARTMENT

For the details of other Bray Burners & Jets see the following publications

ELECTRICAL DEPARTMENT

INSULATOR DEPARTMENT

BRAY BURNERS

THE NAME BRAY has been associated with accurate and uniform gas jets since 1863, in the days when neat gas burners, consuming enriched gas, provided the main source of domestic and public illumination. With the substitution of heating value for illuminating power as the criterion of gas quality, the range of jets was considerably extended, with the addition of slotted and cylindrical orifices to the slit union and batswing types, so that, at the present time, in practically every field of domestic and industrial utilization, the Bray Jet, with its accurately calibrated porcelain tip, is accepted as a precise, reliable, reproducible and durable ignition source. Table 1 shows the wide range of uses to which Bray jets are subjected, space considerations precluding the inclusion of a list of appliance manufacturers, who rely upon their efficient and effective working.

We are proud that the name BRAY has always been regarded as synonymous with SERVICE in the Gas Industry, and the assistance of our technicians is at all times at the disposal of appliance manufacturers and gas engineers for the elucidation of their heating problems. It has been decided in the preparation of a new catalogue, to extend this service further, by the addition of technical information, tables and charts, which will not only strengthen the general conviction of the supremacy of Bray jets, but will also enable the designer of appliances to select with ease and confidence, from the large variety of types and sizes, the most suitable jet for his particular purpose.

It will be observed that the range of sizes of some of the more popular types has been considerably extended, while in other cases a specified range of sizes is not given, as the sizing and calibration of these are made in accordance with the customer's requirements.

TABLE OF CONTENTS

NOTE: The "REGULATOR H" Jets refer to heating jets with slotted ports and two-hole tips.

The "REGULATOR L" Jets refer to luminous jets with batswing and slit union tips.

INTRODUCTION

BRAY COAL GAS JETS consist in the main of non-primary aerated or neat gas jets, wherein aeration of the flame is carried out entirely at the point of combustion. They incorporate Slotted Ports, described in Section I, Batswing and Slit Union Ports, in Section II and Cylindrical Ports in Section III. All are characterised by the incorporation of tips of ceramic material (porcelain). It is proposed in these introductory remarks to deal in turn with (1) Neat Gas Jets, (2) Slotted Ports, and (3) Porcelain Tips.

(1) NEAT GAS JETS

For a given gas consumption non-primary aerated flames cover a wider area than Bunsen flames which, being more localised, have a higher flame temperature. This does not result in a higher efficiency: from one cubic foot of gas of a calorific value of 500 B.Th.U. per hour only 500 B.Th.U. are available for heating whether primary aeration is resorted to or not, and whereas in certain specialised operations it may be of advantage to provide the heat in small flames of high temperature, in many cases there is a definite advantage in providing larger flames of lower temperature. This often results in a higher efficiency of heat transfer.

In addition, the neat gas burners have several advantages over the Bunsen burner, as summarised below:—

(1) Absence of noise.

(2) Fixed dimensioned orifices with standardised gas consumptions.

(3) Absence of adjusting devices.

(4) Abolition of back-firing troubles.

(5) Greatly reduced sensitiveness to changes in the quality of the gas.

(6) Easier and less costly maintenance.

(7) Simplified testing of appliances.

(8) Simplicity of design with smaller gas connections, resulting in considerable economies in appliance construction.

(2) SLOTTED PORTS

Bray "Geyser", "Industrial" and "Miniature" Jets incorporate porcelain tips with orifices specially shaped to produce fan-shaped flames of large surface area. The method of operation of these ports is as follows:—

Opposite sides of the stream of gas at the two short dimensions of the rectangular port opening are diverted towards each other as the opening is approached by the gas stream. Meanwhile, the middle portion of the stream tends to pass straight through the centre area of the port opening. The streams impinge on each other and the entire gas stream diverges as it issues from the port. This results in a flattened cross-section which is at right angles to the long dimension of the port.

The outer envelopes of these flames consist of completely combusted gas, so that, in a multiple burner, these may be permitted to overlap without detriment to the combustion, and thus ensure lighting across. In a bar burner the main axis of the flames may be in alignment with the burner, or, where it is desirable to reduce the distance between jets, these may be adjusted so that the flames are at an angle to the burner axis, the versatility of the jets in this connection being an important characteristic of slotted ports.

Further characteristics of the slotted ports should be noted. These are dealt with under the headings of (a) Flame Stability, (b) Noise of Operation, (c) Turndown, (d) Combustion.

(a) **Flame Stability.** Lack of flame stability may be defined as that condition where the flames either abruptly change shape to an irregular form, or lift and blow away from the port. This occurs at high gas pressures, so that it is advisable with slotted port jets, to operate at gas pressures of from 1·0 to 2·5 inches water gauge. For example, with a jet consuming 3,500 B.Th.U. per hour, and for high calorific value gas, the limit of flame stability has been found to occur at a gas pressure of 4·6″ w.g. Ports of smaller area can be operated at higher gas pressures before the limit of flame stability is reached.

(b) **Noise of Operation.** The flames from slotted ports are noiseless until the limit of flame stability is reached.

(c) **Turndown.** The gas supply to the slotted port burners may be reduced to as much as 1/130th of the normal consumption before extinction.

(d) **Combustion.** Within the limits of stable operation combustion is entirely satisfactory, even in the yellow tip regions, provided there is no contact with cold surfaces.

(3) PORCELAIN TIPS

The above flame characteristics pre-suppose that the slotted ports are of correct design, with smooth walls and freedom from burrs. Careful selection of materials of construction, close tolerances in manufacture and meticulous inspection are therefore necessary to ensure optimum working of the jets. In the case of the Bray jet, the porcelain tip is incorporated, prepared from materials obtained from all over the world, the slots produced by methods which ensure uniformity, and each jet is subjected to rigorous tests before leaving the Works. It is for these reasons that the Bray jet is accepted throughout the Gas Industry as a precise, reliable, reproducible and durable ignition source.

The only alternative to porcelain would be corrosion-resisting metal such as stainless steel, with which great difficulties are experienced in producing ports of the required small size, and configuration, with the resultant precision machining to remove burrs and ensure perfectly smooth port walls.

INTRODUCTION *(continued)*

A major advantage of porcelain tips is also the low burner head temperature, due to lower rates of heat transfer from the flames to the burner manifold, compared with metallic tips. The excessive port temperatures with the latter may result in an undesirable cutback of heat input rate during the burner warm-up period.

Whereas preheating of the gas to temperatures between 400°F and 500°F may be desirable, temperatures above this may cause cracking of the gas. Tests have shown that with a multiple burner, fitted with Bray jets, and installed inside a combustion chamber, the temperatures attained were between 350°F and 475°F.

As a point of interest it should be noted that 2 or 3 different sizes of jet can be used to give the same B.T.U. output simply by adjusting the operating pressure.

PRINCIPAL USES OF JETS

Table I

DOMESTIC	WATER HEATING	Instantaneous	Geyser Cylindrical
		Storage	Geyser Cylindrical
		Wash Boilers	Industrial Geyser Miniature
	SPACE HEATING	Convectors	Industrial Geyser Miniature Regulator H. Multiflame Special Regulator L.
		Gas Fires	Industrial Miniature Multiflame
		Clothes Driers	Industrial Geyser Miniature Cross-lighting
	COOKING	Cookers	Miniature
		Boiling Rings	Miniature
		Food Warming Cabinets	Cross-lighting Side-hole
		Hot Cupboards	Cross-lighting Side-hole
LIGHTING		Emergency	Special Market Regulator L. Economisers
		Open Air	Market
INDUSTRIAL		Canteen Equipment	Geyser Industrial Cylindrical
		Gas-fired Boilers	Industrial Cylindrical
		Ovens	Industrial Geyser Side-hole
		Furnaces	Industrial
		Overhead Radiant Heaters	Industrial
		Infra Red Panels	Industrial

Table 2

Classification in order of Catalogue Numbers

Catalogue Number	Name of Jet, etc.	Type of Orifice	Thread Size	Nominal Gas Rates cu. ft. per hr.
105–106	Mushroom Burner Heads			4·0–38·0
115	Miniature	Slotted	$\frac{1}{4}$″ 26 T.P.I.	0·5–5·0
118	Miniature	Slotted	$\frac{1}{4}$″ 36 T.P.I.	0·5–5·0
188	Side Hole	Cylindrical	But. 27 T.P.I.	—
191	Multi-flame	Cylindrical	But. 27 T.P.I.	3·0–12·0
201	Special	Two-hole	But. 27 T.P.I.	2·5–11·0
202	Special	Slit Union	But. 27 T.P.I.	2·0–13·0
207	Regulator	Slotted	But. 27 T.P.I.	1·0–10·0
208	Regulator	Batswing	But. 27 T.P.I.	3·0–12·0
209	Regulator	Slit Union	But. 27 T.P.I.	3·0–12·0
210	Economiser	Slotted		
211	Economiser	Batswing		
213	Cylindrical Jet	Cylindrical	But. 27 T.P.I.	0·25–3·5
217	Geyser	Slotted	But. 27 T.P.I.	1·0–13·0
219	Market	Slit Union	But. 27 T.P.I.	13·5–15·0
221	Special	Batswing	But. 27 T.P.I.	3·0–12·5
224	Economiser	Slit Union		
226	Market	Batswing	But. 27 T.P.I.	15·0–16·5
231	S.G. Burner	Batswing	But. 27 T.P.I.	—
233	Pilot	Cylindrical	$\frac{3}{16}$″ 24 T.P.I.	0·25–4·0
234	Pilot	Cylindrical	1 B.A. Female	0·25–4·0
235	Industrial	Slotted	But. 27 T.P.I.	1·0–13·0
236	Pilot	Cylindrical	$\frac{3}{16}$″ 24 T.P.I.	0·25–4·0
237	Cylindrical Jet	Cylindrical	2 B.A. Male	—
238	Pilot	Cylindrical	1 B.A. Female	0·25–4·0
239	Pilot	Cylindrical	·144 36 T.P.I.	—
241	Cylindrical Jet	Cylindrical	$\frac{3}{16}$″ 36 T.P.I.	0·25–3·5
242	Cylindrical Jet	Cylindrical	$\frac{3}{16}$″ 36 T.P.I.	—
254	Cluster Flame	Cylindrical	But. 27 T.P.I.	2·0–6·0
262	Regulator	Two-hole	But. 27 T.P.I.	1·0–10·0
263	Geyser	Two-hole	But. 27 T.P.I.	1·0–10·0
266	Industrial	Slotted	$\frac{1}{8}$″ B.S.P. Taper	1·0–10·0
433	Pilot	Cylindrical	$\frac{3}{16}$″ 24 T.P.I.	0·25–4·0
434	Pilot	Cylindrical	$\frac{3}{16}$″ 24 T.P.I. F.	0·25–4·0
437	Pilot	Cylindrical	$\frac{3}{16}$″ 24 T.P.I.	—
439	Pilot	Cylindrical	$\frac{1}{8}$″ 40 T.P.I.	—
450	Pilot	Cylindrical	·144 36 T.P.I.	—
465	Cross Lighting	Cylindrical	But. 27 T.P.I.	1·0–6·0
466	Cross Lighting	Cylindrical	But. 27 T.P.I.	1·0–6·0
467	Cylindrical Jet	Cylindrical	$\frac{1}{8}$″ B.S.P. Taper	0·25–3·5
470	Geyser	Slotted	But. 27 T.P.I.	1·0–10·0
471	Geyser	Slotted	But. 27 T.P.I.	1·0–10·0
481	Cross Lighting	Cylindrical	But. 27 T.P.I.	1·0–6·0
482	Cross Lighting	Cylindrical	$\frac{1}{8}$″ B.S.P. Taper	1·0–6·0
485	Multi-flame	Cylindrical	But. 27 T.P.I.	3·0–12·0
486	Industrial	Slotted	Whit. 28 T.P.I.	1·0–10·0
487	Industrial	Slotted	$\frac{1}{8}$″ B.S.P. Taper	1·0–10·0
491–498	Side Hole	Cylindrical	But. 27 T.P.I.	2·0–15·0
531–538	Side Hole	Cylindrical	$\frac{1}{8}$″ B.S.P. Taper	2·0–15·0
516	Cluster	Cylindrical	But. 27 T.P.I.	—

Table 3

Classification According to Type of Orifice

	Slotted	Two Hole	Cylindrical: One hole	Cylindrical: Two holes	Cylindrical: Multi-holes	Slit Union	Batswing
GEYSER	217 470 471	263					
INDUSTRIAL	235 266 486 487						
REGULATOR H.	207	262					
MINIATURE	115 118						
SPECIAL		201					
CYLINDRICAL			213 467 241 237 242				
SIDE HOLE			491 531	492 532	493/8 533/8 188		
CROSS LIGHTING				465 466	481 482		
CLUSTER FLAME					254 516		
MULTI-FLAME					191 485		
PILOT			233 234 236 238 433 434 439 239 450	437			
SPECIAL						202	221
S. G. BURNER							231
MARKET						219	226
REGULATOR L.						209	208
ECONOMISER	210					224	211

Table 4

Jet Characteristics

GEYSER: Flat Flame, Slotted Orifice

Buttress Thread

Unijet: one hole tip broad flame		217
medium flame	471	
narrow flame	470	
Union Jet: two hole tip		263

INDUSTRIAL: Flat Flame, Slotted Orifice

	Brass Socket	All Porcelain
Buttress thread	235	486
$\frac{1}{8}$″ B.S.P. Taper	266	487

MINIATURE: Flat Flame, Slotted Orifice

$\frac{1}{4}$″ diam. 26 T.P.I. Thread	115
$\frac{1}{4}$″ diam. 36 T.P.I. Thread	118

REGULATOR: Heating, Flat Flame

Slotted Orifice: Buttress thread

Unijet: one hole tip	207
Union Jet: two hole tip	262

ECONOMISERS for above

Unijet: one hole tip	210
Batswing	211
Slit Union	224

CROSS LIGHTING: Cylindrical Jet

Buttress thread

2 holes: Horizontal flames	465
Inclined flames	466
Multi-holes: 2 main holes horizontal	
Buttress Thread	481
$\frac{1}{8}$″ B.S.P. Taper thread	482

SIDE HOLE: Cylindrical 1-8 holes

Horizontal Flames:

Brass socket: Buttress thread	491–498
All Porcelain: $\frac{1}{8}$″ B.S.P. Taper	531–538
Inclined Flames: Buttress thread	188

MULTI-FLAME: Radial Flames

Buttress Thread

9 holes all equal	191
7 holes: 2 at bottom of large diameter	485

CYLINDRICAL: One Hole Vertical Flames

Non-atmospheric: Buttress thread	213
$\frac{1}{8}$″ B.S.P. Taper	467
$\frac{3}{16}$″ 36 T.P.I.	241
Atmospheric: 2 B.A.	237
$\frac{3}{16}$″ 36 T.P.I.	242

CLUSTER FLAME:

Buttress thread

Atmospheric	254
Non-atmospheric	516

SPECIAL: Flat Flame

Buttress Thread

Union Jet: 2 hole tip	201
Slit Union	202
Batswing	221

S.G. BURNER: Flat Flame

Buttress Thread

	231

MARKET: Flat Flame

Buttress Thread

Slit Union	219
Batswing	226

REGULATOR (Lighting): Flat Flame

Buttress Thread

Batswing	208
Slit Union	209

PILOT: Cylindrical Jet

	Flat Topped Protruding Porcelain Tip	Rounded Porcelain Tip
$\frac{3}{16}$″ 24 T.P.I. Male	233	236
1 B.A. Female	234	238
$\frac{3}{16}$″ 24 T.P.I. Male with one vert. and 1 horizontal flame	437	
Fitted with regulating screws		
$\frac{1}{8}$″ x 40 T.P.I. Male	439	
$\frac{3}{16}$″ 24 T.P.I. Male	433	
$\frac{3}{16}$″ 24 T.P.I. Female	434	
Atmospheric		
·144 36 T.P.I.	239	
Do. with metal windshield	450	

(FLAT FLAME) SLOTTED PORT JETS

GEYSER

This well-known type of burner is sturdily constructed, with a brass socket, fitted with brass gauze, and a porcelain tip which may be slotted, in the "Unijet" types, Nos. 217, 470 and 471, with a central orifice, or, in the "Union" type, No. 263, with twin ports, inclined towards each other at an angle of 45° from the vertical, so that the flames impinge one upon the other. The side flames, projecting from the base of the main flame, are characteristic of the Union two hole tip.

The three "Unijet" types on the other hand, are designed for the normal broad flame, No. 217, a medium flame No. 471, and a narrow flame, No. 470.

No. 217
UNIJET (1 hole tip)
Buttress Thread (Taper)
27 T.P.I.

No. 471
UNIJET (1 hole tip)
Buttress Thread
(Taper) 27 T.P.I.

No. 470
UNIJET (1 hole tip)
Buttress Thread
(Taper) 27 T.P.I.

No. 263
UNION JET (2 hole tip)
Buttress Thread (Taper)
27 T.P.I.

The "GEYSER" jet is widely used in water-heating appliances of all kinds, instantaneous and storage, for canteen equipment, ovens, washboilers, convectors, clothes driers, etc. etc.

SECTION I (FLAT FLAME) SLOTTED PORT JETS

INDUSTRIAL JETS

The "Industrial Jet" as the name implies, was originally intended for incorporation in industrial equipment, and, in view of the more severe conditions under which it is required to operate, is of more robust construction than the "Geyser" jet. For normal applications it is constructed of a heavier brass section socket with brass gauze and a thicker porcelain tip, but for applications where the high prevailing temperatures preclude the use of a brass socket, the entire jet is constructed of porcelain. All patterns of "Industrial Jet" are fitted with unijet, one-hole tips.

No. 235
UNIJET (1 hole tip)
Buttress Thread (Taper)
27 T.P.I.

No. 266
UNIJET (1 hole tip)
⅛″ B.S.P. Thread (Taper)

No. 486
UNIJET (1 hole tip)
Whit. Thread (Taper)
28 T.P.I.

No. 487
UNIJET (1 hole tip)
⅛″ B.S.P. Thread (Taper)

In addition to its many industrial uses, in canteen equipment, gas-fired boilers, ovens and furnaces, the "Industrial Jet" is extensively used in most types of domestic equipment, including wash boilers, overhead radiators, convectors, gas fires, clothes driers etc.

Table 5

GEYSER JETS
INDUSTRIAL JETS
REGULATOR JETS H

COLD GAS RATES
Cubic feet per hour

(The × in the left hand columns indicates the sizes in which each particular burner is made)

'GEYSER'	'INDUSTR AL JET'	'REGULATOR H'	Specific Gravity	0·45	0·45	0·45	0·45	0·50	0·50	0·50	0·50	0·55	0·55	0·55	0·55
			Pressure ins. w.g.	1·0	1·5	2·0	2·5	1·0	1·5	2·0	2·5	1·0	1·5	2·0	2·5
			JET No.												
×	×		0000	0·51	0·62	0·72	0·79	0·49	0·59	0·67	0·76	0·46	0·56	0·65	0·73
×	×	×	000	0·97	1·19	1·38	1·54	0·93	1·14	1·31	1·47	0·88	1·08	1·25	1·40
×	×	×	00	1·88	2·30	2·66	2·97	1·79	2·19	2·53	2·83	1·71	2·09	2·41	2·70
×	×	×	0	2·78	3·40	3·93	4·39	2·64	3·24	3·74	4·18	2·52	3·09	3·56	3·98
	×		½	3·22	3·94	4·54	5·09	3·07	3·75	4·34	4·85	2·92	3·58	4·13	4·62
×	×	×	1	3·67	4·49	5·19	5·80	3·49	4·28	4·94	5·52	3·33	4·08	4·71	5·26
	×		1½	4·11	5·04	5·82	6·50	3·92	4·80	5·54	6·19	3·73	4·57	5·28	5·90
×	×	×	2	4·56	5·58	6·45	7·21	4·34	5·31	6·14	6·86	4·14	5·07	5·85	6·54
	×		2½	5·00	6·12	7;07	7·90	4·76	5·82	6·73	7·42	4·53	5·55	6·41	7·17
×	×	×	3	5·43	6·66	7·69	8·59	5·17	6·34	7·32	8·18	4·93	6·04	6·98	7·80
	×		3½	5·86	7·18	8·29	9·27	5·58	6·84	7·90	8·83	5·32	6·52	7·53	8·42
×	×	×	4	6·30	7·71	8·91	9·96	6·00	7·34	8·48	9·48	5·72	7·00	8·08	9·04
	×		4½	6·72	8·23	9·51	10·6	6·40	7·84	9·05	10·1	6·10	7·47	8·63	9·65
×	×	×	5	7·15	8·76	10·1	11·3	6·81	8·34	9·62	10·8	6·49	7·95	9·18	10·3
×	×	×	6	7·99	9·78	11·3	12·6	7·61	9·31	10·8	12·0	7·25	8·88	10·3	11·5
×	×	×	7	8·82	10·8	12·5	13·9	8·39	10·3	11·9	13·3	8·00	9·80	11·3	12·6
×	×		8	9·66	11·8	13·7	15·3	9·20	11·3	13·0	14·5	8·77	10·7	12·4	13·9
×	×		9	10·5	12·9	14·9	16·6	10·0	12·2	14·1	15·8	9·53	11·7	13·5	15·1
	×		10	11·3	13·9	16·0	17·9	10·8	13·2	15·3	17·1	10·3	12·6	14·6	16·3

Example of the Use of Table 5

The size of "Industrial Jets" is required for a bar burner to be fitted with 8 jets. The hot gas rate is 30 cubic feet per hour. The consumption reduction has been determined for similar conditions and found to be 15%. The cold gas rate will therefore be 35·3 cu. ft. per hour, and the cold gas rate per jet 35·3/8=4·4 cu. ft. per hour. The burner is to operate at a pressure of 1·5 ins. w.g., with gas of a specific gravity of 0·50.

From the Table, the No. 1 jet will give 4·28 cu. ft. per hour under these conditions, and will be selected.

(FLAT FLAME) SLOTTED PORT JETS

REGULATOR H

The "Regulator" H jet, consisting of brass socket fitted with brass gauze and porcelain tip, is similar to the "Geyser" jet, but of lighter construction. It is of two types, the Unijet, one hole tip, No. 207, and the Union jet, two hole tip,No. 262.

No. 207
UNIJET (1 hole tip)
Buttress Thread (Taper) 27 T.P.I.

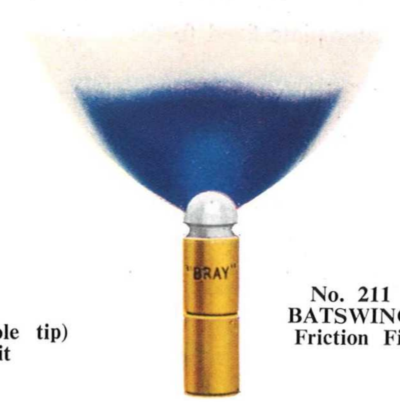
No. 262
UNION JET (2 hole tip)
Buttress Thread (Taper) 27 T.P.I.

In one of the applications of this jet, it is fitted at the centre of a bar burner, with "Miniature" jets spaced on each side, for use in convectors. The "Regulator" H jet is located behind the observation window and lighting port, so that it provides the ignition point, and by its greater luminosity, shows if the burner is alight. Luminosity is increased still further by one or other of the "Economisers" described below.

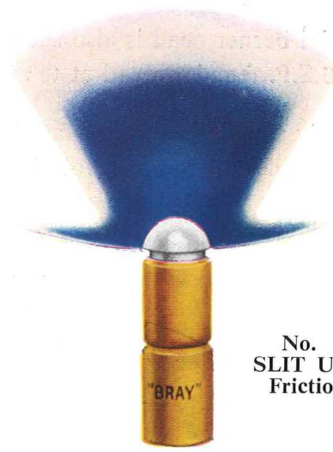
ECONOMISER

The "Economiser" is designed to work in conjunction with the "Regulator" jet, and consists of a brass socket, with brass gauze, to slide over the top of the "Regulator" jet and provide a friction fit, and porcelain tips of three patterns, the Unijet No. 210, the Batswing, No. 211, and the Slit Union, No. 224.

No. 210
UNIJET (1 hole tip)
Friction Fit



No. 211
BATSWING
Friction Fit



No. 224
SLIT UNION
Friction Fit

In combination with the "Regulator" jet, the economisers, which increase flame luminosity for the same gas consumption, are often used for emergency lighting.

The cold gas rates for the "Geyser", "Industrial Jet" and "Regulator" H jets for various specific gravities and gas pressures, are shown on the preceding page. Cold gas rates will in all cases be higher than the required hot rates, the consumption reduction on warming-up differing according to the location of the burner. The percentage consumption reduction for a particular application can only be found by experiment.

TABLE 5

GEYSER JETS
INDUSTRIAL JETS
REGULATOR JETS H.

Densite´	0,45	0,45	0,45	0,45	0,50	0,50	0,50
Pression mm.	25	38	50	64	25	38	50
No du Bec							
0000	14	18	20	22	14	17	19
000	27	34	39	44	26	32	37
00	53	65	75	84	51	62	72
0	79	96	111	124	75	92	106
½	91	111	128	144	87	106	123
1	104	127	147	164	99	121	140
1½	116	142	165	184	111	136	157
2	129	158	183	204	122	150	173
2½	141	173	200	224	135	165	190
3	154	188	218	243	146	179	207
3½	166	203	235	262	158	193	224
4	178	218	252	282	170	208	240
4½	190	233	269	300	181	222	256
5	202	248	286	320	193	236	272
6	226	277	320	357	215	263	306
7	250	306	354	393	237	291	337
8	273	334	387	432	260	319	367
9	297	365	422	470	283	345	399
10	320	393	453	506	306	374	433

CONSOMMATIONS DE GAZ
(STAT FROID)

litres/hr.

0,50	0,55	0,55	0,55	0,55
64	25	38	50	64
22	13	16	18	21
42	25	31	35	40
80	48	59	68	76
118	71	87	101	113
137	83	101	117	131
156	94	115	133	149
175	106	129	149	167
194	117	143	165	185
210	128	157	181	203
231	139	171	198	221
250	151	184	213	238
268	162	198	229	256
286	173	211	244	273
306	184	225	260	291
340	205	251	291	325
376	226	277	320	357
410	248	302	350	393
447	270	331	382	427
484	291	357	413	461

(FLAT FLAME) SLOTTED PORT JETS
MINIATURE

These small jets ($\frac{3}{8}''$ overall height) consist of a hexagonal brass socket, with slotted port porcelain tip.

Their many applications include wash boilers, gas fires, clothes driers, cookers and boiling rings, etc.

Incorporated in burner bars they are extensively used for convector heaters, with or without a central "Regulator" burner.

No. 115
Outside Thread $\frac{1}{4}''$ dia. 26 T.P.I.

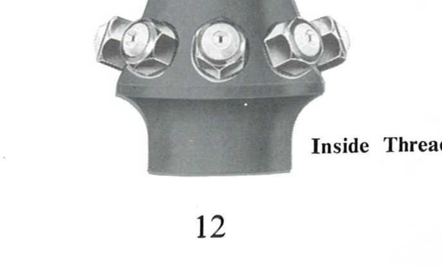
No. 118
Outside Thread $\frac{1}{4}''$ dia. 36 T.P.I.
UNIJET (1 hole tip)

BURNER HEADS
FOR GAS COOKERS AND PORTABLE BOILING RINGS

A special burner head is also supplied incorporating eight "Miniature" Jets set at an angle in a turned brass body with $\frac{3}{8}''$ B.S.P. female thread at the base and circular plate fixed to the body with a screw.

The body and securing screw are in dull chrome finish, while the top plate is of 16 gauge stainless steel, self colour. Each burner head is tested before leaving the Works,

Burner Head No.	Description
105	No Top Plate or Securing Screw
106	$2\frac{1}{4}''$ Top plate and securing screw



Inside Thread $\frac{3}{8}''$ B.S.P.

Table 6

MINIATURE JETS

COLD GAS RATES
Cubic feet per hour

Specific Gravity	...	0·45	0·45	0·45	0·45	0·50	0·50	0·50	0·50	0·55	0·55	0·55	0·55
Pressure ins. w.g.	...	1·0	1·5	2·0	2·5	1·0	1·5	2·0	2·5	1·0	1·5	2·0	2·5
Code Letter													
Z	...	0·25	0·31	0·36	0·40	0·24	0·29	0·34	0·38	0·23	0·28	0·32	0·36
Y	...	0·49	0·60	0·70	0·78	0·47	0·57	0·66	0·73	0·45	0·55	0·63	0·71
X	...	0·73	0·88	1·03	1·15	0·69	0·85	0·98	1·09	0·66	0·81	0·93	1·04
W	...	0·96	1·17	1·35	1·51	0·91	1·12	1·29	1·44	0·87	1·06	1·23	1·37
V	...	1·18	1·45	1·67	1·87	1·13	1·38	1·59	1·78	1·07	1·32	1·52	1·70
U	...	1·41	1·72	1·99	2·23	1·34	1·64	1·89	2·12	1·28	1·56	1·80	2·02
T	...	1·63	2·00	2·30	2·58	1·55	1·90	2·19	2·45	1·48	1·81	2·09	2·34
S	...	1·85	2·27	2·62	2·93	1·76	2·16	2·49	2·79	1·68	2·06	2·38	2·66
R	...	2·08	2·54	2·94	3·28	1·98	2·42	2·80	3·13	1·88	2·31	2·67	2·98
Q	...	2·30	2·82	3·25	3·63	2·19	2·68	3·09	3·40	2·09	2·56	2·95	3·30
P	...	2·52	3·09	3·56	3·98	2·40	2·94	3·39	3·79	2·29	2·80	3·23	3·62
N	...	2·74	3·36	3·88	4·34	2·61	3·20	3·69	4·13	2·49	3·05	3·52	3·94
J	...	3·63	4·46	5·13	5·74	3·46	4·23	4·89	5·43	3·29	4·04	4·66	5·21
E	...	4·51	5·52	6·37	7·13	4·29	5·25	6·07	6·78	4·09	5·01	5·78	6·47

BURNER HEADS with 8 Miniature Jets

COLD GAS RATES
Cubic feet per hour

Specific Gravity	...	0·45	0·45	0·45	0·45	0·50	0·50	0·50	0·50	0·55	0·55	0·55	0·55
Pressure ins. w.g.	...	1·0	1·5	2·0	2·5	1·0	1·5	2·0	2·5	1·0	1·5	2·0	2·5
Code Letter													
Z	...	2·01	2·46	2·84	3·18	1·91	2·34	2·70	3·02	1·82	2·23	2·58	2·89
Y	...	3·94	4·82	5·57	6·22	3·75	4·59	5·30	5·85	3·58	4·38	5·06	5·66
X	...	5·82	7·05	8·23	9·20	5·54	6·78	7·83	8·76	5·28	6·46	7·47	8·35
W	...	7·66	9·38	10·84	12·12	7·30	8·94	10·32	11·54	6·96	8·52	9·84	11·00
V	...	9·47	11·60	13·39	14·97	9·02	11·04	12·74	14·26	8·59	10·54	12·15	13·59
U	...	11·26	13·79	15·92	17·80	10·72	13·13	15·16	16·95	10·22	12·52	14·46	16·16
T	...	13·04	15·97	18·44	20·62	12·41	15·20	17·55	19·62	11·83	14·49	16·74	18·71
S	...	14·82	18·15	20·96	23·43	14·11	17·28	19·95	22·31	13·46	16·47	19·02	21·27
R	...	16·62	20·34	23·50	26·26	15·82	19·37	22·36	25·00	15·96	18·46	21·32	23·84
Q	...	18·39	22·52	26·01	29·07	17·50	21·44	24·75	27·17	16·69	20·44	23·60	26·39
P	...	20·15	24·68	28·50	31·86	19·18	23·50	27·13	30·34	18·29	22·40	25·87	28·92
N	...	21·94	26·87	31·03	24·70	22·89	25·58	29·54	33·03	19·92	24·39	28·17	31·49
J	...	29·04	35·57	41·06	45·91	27·64	33·86	39·10	43·44	26·36	32·28	37·27	41·67
E	...	36·06	44·16	50·99	57·02	34·33	42·04	48·54	54·27	32·73	40·08	46·28	51·74

Will you please note that only sizes up to and including Code Letter "S" of our No. 118 Miniature Jet are recommended for use in the 105 and 106 Burner Head.

Flame Dimensions of Slotted Port Jets

Table 7 gives the flame dimensions for a number of slotted ports, as fitted to Geyser, Industrial and Miniature Burner Jets, with gas of 530 B.Th.U. calorific value, and at a pressure of $1\frac{1}{2}''$ w.g.

Characteristic flames shapes are shown in the photographs illustrating the various types of jets. It should be mentioned that the photographic representations are full size, but the flame representation is for one particular size of jet, in general, the No. 2 size jet.

Table 7 Flame Dimensions of Slotted Ports

Jet No.	Flame Dimensions		Thickness ins.
	Height ins.	Spread ins.	
Y	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{1}{8}$
000, W	$\frac{3}{4}$	$\frac{3}{4}$	$\frac{1}{8}$
U	$\frac{7}{8}$	$\frac{7}{8}$	$\frac{1}{8}$
T	1	$\frac{7}{8}$	$\frac{1}{8}$
00, S	$1\frac{1}{8}$	$1\frac{1}{8}$	$\frac{1}{8}$
R	$1\frac{1}{4}$	$1\frac{1}{4}$	$\frac{1}{8}$
0, N	$1\frac{1}{2}$	$1\frac{1}{2}$	$\frac{1}{8}$
1, J	$1\frac{3}{4}$	$1\frac{3}{4}$	$\frac{1}{8}$
2, E	$2\frac{1}{8}$	$2\frac{1}{8}$	$\frac{3}{16}$
3	$2\frac{1}{4}$	$2\frac{3}{8}$	$\frac{3}{16}$
4	$2\frac{1}{2}$	$2\frac{1}{2}$	$\frac{3}{16}$

Nomogram for Slotted Port Jet Calculations

The nomogram shown overleaf has been designed for the determination of jet sizes and of gas inputs with different jets for gases of different specific gravities and operating at different pressures. As the specific gravity range extends from 0·40 to 0·60 and is calibrated in intervals of 0·01, while the pressure range extends from 0·5 to 5·0 inches water gauge, the nomogram supplements the cold gas rate tables, enabling determinations to be made at intermediate gravity and pressure values.

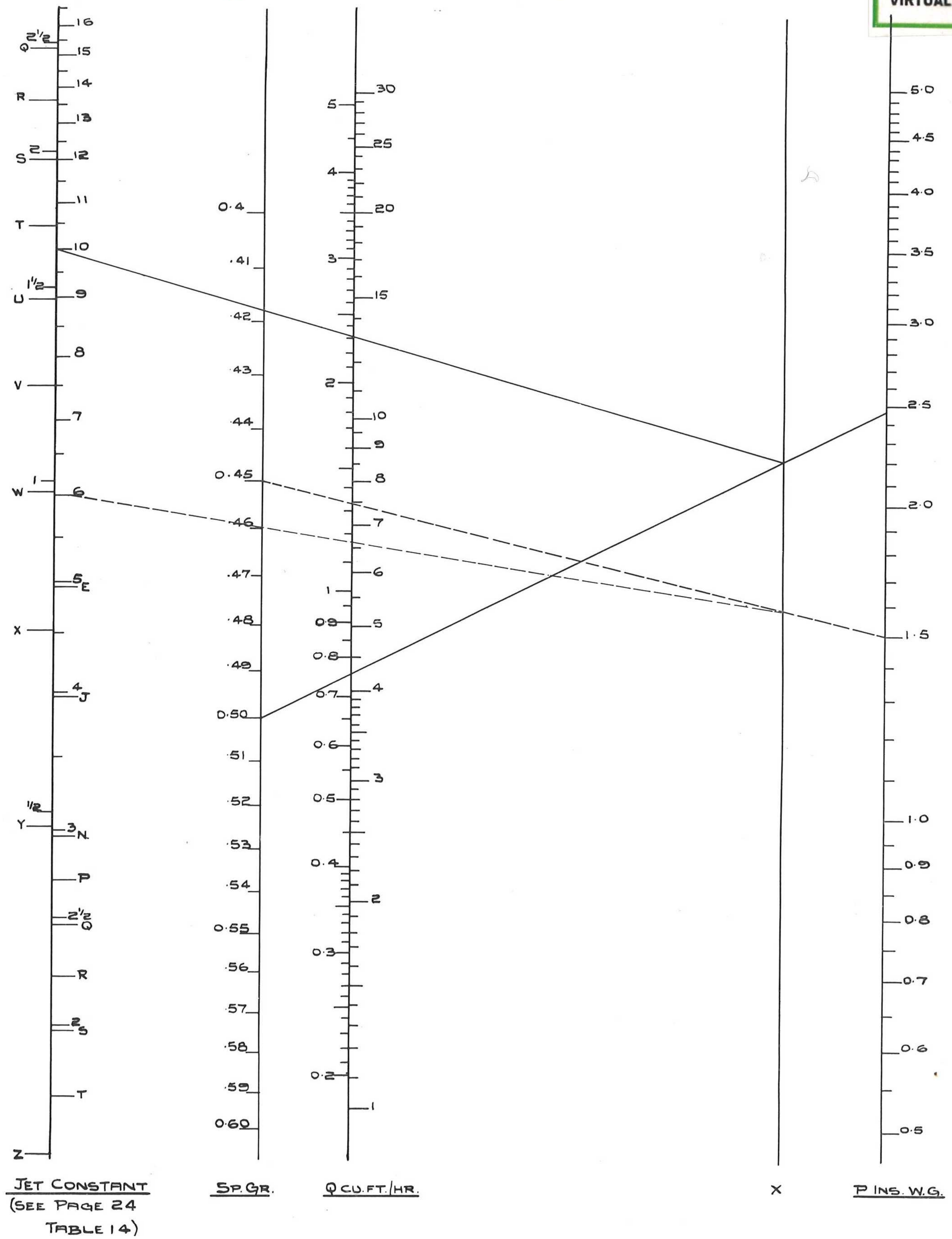
The nomogram consists of five scales, the first being calibrated in jet sizes, in Jet Constants (page 27, Table 14) for the larger slotted port jets, and in Code letters for the Miniature jets. The second scale is calibrated in specific gravities, and the third in gas consumptions, cubic feet per hour. The fourth scale is ungraduated, while the fifth is calibrated in gas pressures from 0·5 to 5·0 ins. w.g.

It will be observed that the first and third scales are graduated on both sides. The left hand scale of the first should be used with the left hand scale of the third, and the right hand scale with the corresponding right hand scale.

The method of operation is shown in the two examples. To determine the gas consumption for a particular jet size, a straight line is first drawn from the specific gravity on the second scale to the gas pressure on the right hand scale. From the point of intersection of the ungraduated scale a second line is drawn to the jet size, intersecting the Q scale at the required consumption. Alternatively to determine the jet size for a particular gas consumption the second line is drawn from the point of intersection, through the gas consumption on the Q scale and extended to intersect the Jet Constant scale at the appropriate jet size.

The examples show that with gas at a pressure of 2·5″ water gauge and specific gravity 0·50, a jet with Jet Constant 10 will pass 13·2 cubic feet of gas per hour (Unbroken Lines). Again, with gas of a specific gravity of 0·45 and operating at a pressure of 1·5 inches water gauge, a Size W Miniature jet will pass 1·18 cubic feet per hour (Broken Lines).

Nomogram for Slotted Port Jet Calculations



(FLAT FLAME) BATSWING & SLIT UNION JETS

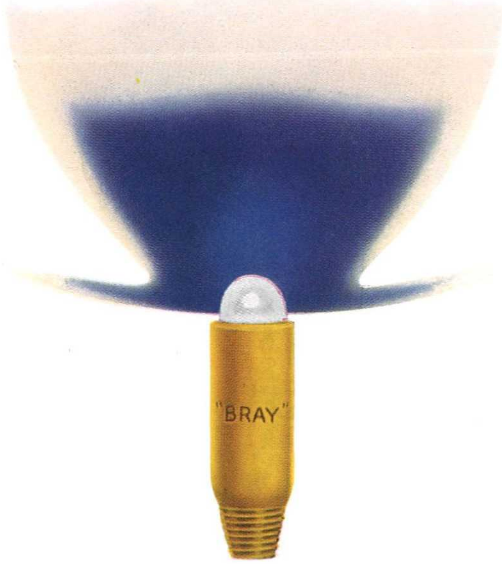
SPECIAL and S. G. BURNER JETS

The "Special" and "S.G." burner jets are designed to give luminous flames, and while originally supplied for lighting purposes, are particularly suitable for convector heaters, where illumination is required through a front panel, to effect a pleasing appearance.

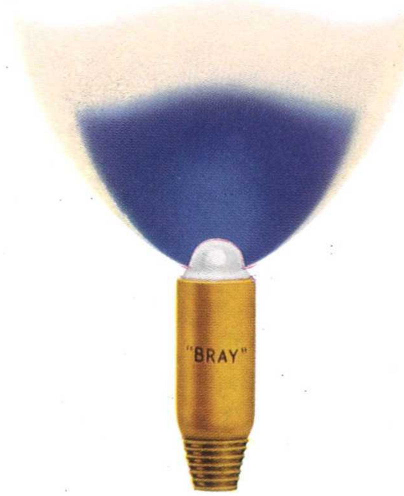
They are constructed of a brass socket fitted with gauze and incorporate a porcelain gas regulator. The porcelain tips may consist of Union jets (2 hole tip) as in No. 201, Slit Unions as in No. 202, or Batswing jets as in No. 221 and the "S.G." Burner No. 231.

The "Special" jets have each a specified range of sizes, but the "S.G." Burner jet, a very popular type for luminous convectors, is calibrated according to customers' requirements.

No. 201
UNION JET (2 hole tip)
Buttress Thread (Taper) 27 T.P.I.

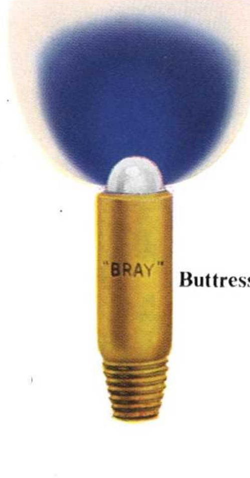


No. 202
SLIT UNION
Buttress Thread (Taper) 27 T.P.I.



No. 221
BATSWING
Buttress Thread (Taper) 27 T.P.I

The principal uses of these jets are for emergency lighting in public buildings, cinemas and gas works, and for heating appliances where light in addition to heat is required.



No. 231
Buttress Thread (Taper) 27 T.P.I.

SECTION II

(FLAT FLAME) BATSWING & SLIT UNION JETS

MARKET

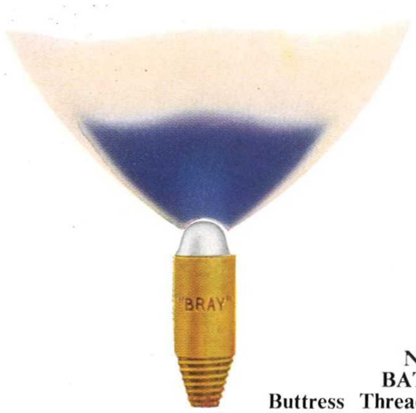
The "MARKET" Jets are essentially for emergency and open-air lighting, burning with a very wide-spread luminous flame. They are constructed of a brass socket, fitted with brass gauze and incorporate either a Batswing No. 226 or a Slit Union porcelain tip No. 219.

No. 226
BATSWING
Buttress Thread (Taper) 27 T.P.I.

No. 219
SLIT UNION
Buttress Thread
(Taper) 27 T.P.I.

The "Regulator" L Jets are similarly constructed to the "MARKET" jets, but are of smaller sizes, with Batswing No. 208 and Slit Union, No. 209, porcelain jets. In addition to lighting purposes, these jets also find a use in convectors, where luminous flames are required. The brass socket is narrower, than that of the "Special" jets, for which, in many instances, these jets may be substituted.

REGULATOR L



No. 208
BATSWING
Buttress Thread (Taper) 27 T.P.I.

No. 209
SLIT UNION
Buttress Thread (Taper) 27 T.P.I.

SPECIAL JETS
MARKET JETS
REGULATOR L

Jet No. 201, Col. 1; No. 221, Col. 2; No. 202, Col. 3; No. 208 & 209, Col. 4.

Specific Gravity ...				0·45	0·45	0·45	0·45	0·50	0·50	0·50	0·50	0·55	0·55	0·55	0·55
Pressure ins. w.g. ...				1·0	1·5	2·0	2·5	1·0	1·5	2·0	2·5	1·0	1·5	2·0	2·5
Col. 1	Col. 2	Col. 3	Col. 4												
		0		1·88	2·30	2·66	2·97	1·79	2·19	2·53	2·83	1·71	2·09	2·41	2·70
00				2·33	2·85	3·30	3·68	2·22	2·72	3·14	3·51	2·12	2·59	2·99	3·34
0	1	1	00	2·78	3·40	3·93	4·39	2·64	3·24	3·74	4·18	2·52	3·09	3·56	3·98
1				3·22	3·94	4·54	5·09	3·07	3·75	4·34	4·85	2·92	3·58	4·13	4·62
2	2	2	0	3·67	4·49	5·19	5·80	3·49	4·28	4·94	5·52	3·33	4·08	4·71	5·26
3	3	3	1	4·56	5·58	6·45	7·21	4·34	5·31	6·14	6·86	4·14	5·07	5·85	6·54
4	4	4	2	5·43	6·66	7·69	8·59	5·17	6·34	7·32	8·18	4·93	6·04	6·98	7·80
5	5	5	3	6·30	7·71	8·91	9·96	6·00	7·34	8·84	9·48	5·72	7·00	8·08	9·04
6	6		4	7·15	8·76	10·1	11·3	6·81	8·34	9·62	10·8	6·49	7·95	9·18	10·3
		6		7·57	9·27	10·7	12·0	7·11	8·83	10·2	11·4	6·87	8·42	9·72	10·9
7			5	7·99	9·78	11·3	12·6	7·61	9·31	10·8	12·0	7·25	8·88	10·3	11·5
	7			8·30	10·3	11·9	13·3	7·90	9·80	11·3	12·6	7·63	9·34	10·8	12·1
8		7	6	8·82	10·8	12·5	13·9	8·39	10·3	11·9	13·3	8·00	9·80	11·3	12·6
9	8		7	9·66	11·8	13·7	15·3	9·20	11·3	13·0	14·5	8·77	10·7	12·4	13·9
		8		10·1	12·3	14·3	15·9	9·60	11·7	13·6	15·2	9·15	11·2	12·9	14·5
			8	10·5	12·9	14·9	16·6	10·0	12·2	14·1	15·8	9·53	11·7	13·5	15·1
	9			10·9	13·4	15·4	17·3	10·4	12·7	14·7	16·4	9·92	12·1	14·0	15·7
		9		11·3	13·9	16·0	17·9	10·8	13·2	15·3	17·1	10·3	12·6	14·6	16·3
MARKET															
219	226														
10				11·8	14·4	16·6	18·6	11·2	13·7	15·8	17·7	10·7	13·1	15·1	16·9
11	10			13·0	15·9	18·4	20·6	12·4	15·2	17·5	19·6	11·8	14·5	16·7	18·7
	11			14·3	17·5	20·2	22·5	13·6	16·6	19·2	21·5	12·9	15·8	18·3	20·5

SECTION III

CYLINDRICAL JETS

SIDE HOLE

The "Side Hole" jets may consist of brass sockets with porcelain tips, as Nos. 491–498 and No. 188, or be wholly constructed of porcelain, Nos. 531–538.

Jets Nos. 491–498 and 531–538 are made with from one to eight side holes, giving symmetrically disposed horizontal flames, and No. 188 with eight inclined holes. The former jets have a specified consumption but in the case of the No. 188 jets, the holes are calibrated to the customers' own requirements respecting consumption. They are principally used for food warming cabinets and ovens, but their versatility should suggest many other applications to the designers of gas appliances.

Nos. 491 to 498
Buttress Thread (Taper) 27 T.P.I.

Porcelain

Nos. 531 to 538
$\frac{1}{8}''$ B.S.P. Thread (Taper)

No. 188
Buttress Thread (Taper) 27 T.P.I.

CLUSTER FLAME

No. 254 This jet is peculiar in that it has been designed to admit a small amount of primary air, a series of holes being pierced in the brass socket, which is fitted with a porcelain gas regulator and porcelain tip, the latter being pierced with a number of holes at small angles from the vertical, to give the cluster of flames from which the jet derives its name.

For certain heating purposes this small degree of primary aeration is found to be advantageous.

No. 254
Buttress Thread (Taper) 27 T.P.I.

No. 516
Patent No. 656378
Buttress Thread (Taper) 27 T.P I.

No. 516 Patent No. 656378 This new Bray jet is non-atmospheric, consisting of a brass socket with porcelain tip arranged with six holes, providing six pencils of flame as shown in the illustration.

This jet is made to customers' requirements with respect to consumption. An extensive range of applications in both domestic and industrial fields includes geysers, storage and instantaneous water heaters, canteen apparatus and gas-fired boilers, etc.

COLD GAS RATES

Cubic feet per hour

Table 9

SIDE HOLE JETS
CLUSTER FLAME JETS

Specific Gravity		0·45	0·45	0·45	0·45	0·50	0·50	0·50	0·50	0·55	0·55	0·55	0·55
Pressure ins. w.g.		1·0	1·5	2·0	2·5	1·0	1·5	2·0	2·5	1·0	1·5	2·0	2·5
JET No. SH	Cl No. 254												
1	35	1·88	2·30	2·66	2·97	1·79	2·19	2·53	2·83	1·71	2·09	2·41	2·70
	41	2·78	3·40	3·93	4·39	2·64	3·23	3·74	4·18	2·52	3·09	3·56	3·98
2	45	3·67	4·49	5·19	5·80	3·49	4·28	4·94	5·52	3·33	4·08	4·71	5·26
	50	4·56	5·58	6·45	7·21	4·34	5·31	6·14	6·86	4·14	5·07	5·85	6·54
3	56	5·43	6·66	7·69	8·59	5·17	6·34	7·32	8·18	4·93	6·04	6·98	7·80
4		7·99	9·78	11·3	12·6	7·61	9·31	10·8	12·0	7·25	8·88	10·3	11·5
5		9·66	11·8	13·7	15·3	9·20	11·3	13·0	14·5	8·77	10·7	12·4	13·9
6		10·5	12·9	14·9	16·6	10·0	12·2	14·1	15·8	9·53	11·7	13·5	15·1
7		11·8	14·4	16·6	18·6	11·2	13·7	15·8	17·7	10·7	13·1	15·1	16·9
8		13·0	15·9	18·4	20·6	12·4	15·2	17·5	19·6	11·8	14·5	16·7	18·7

SECTION III

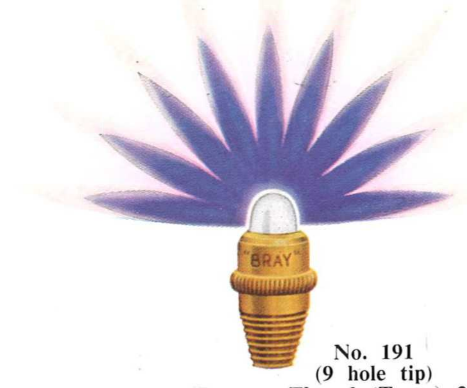
CYLINDRICAL JETS

MULTI-FLAME

The Multi-flame jets are constructed of brass sockets with buttress taper threads, and porcelain tips which have a series of cylindrical holes in alignment, but arranged at angles to give a series of radial flames.

In the No. 191 jet there are nine holes giving a similar number of flames of equal size, but in the No. 485 jet, the two "bottom" side holes are of large diameter, while five small holes are arranged across the top of the tip.

These burners are chiefly used for gas fires and convector heaters.



No. 191
(9 hole tip)
Buttress Thread (Taper) 27 T.P.I.

No. 485
(7 hole tip)
Buttress Thread (Taper) 27 T.P.I.

CROSS LIGHTING

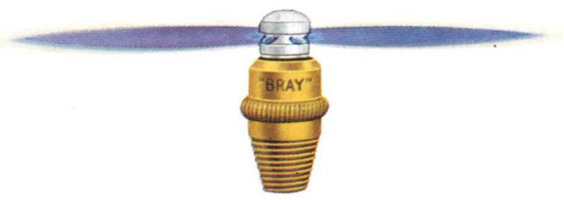
These jets, as the name implies, are so designed that when placed in line at some distance apart, they will light up one from the other. They are constructed with brass sockets (No. 466 also incorporates a brass gauze).

No. 465 gives a pair of horizontal pencil flames and No. 466 a pair of inclined flames, each at 45° from the horizontal. The Nos. 481 and 482 jets are arranged with a series of side holes, two opposite holes being of large diameter, while the others are small.

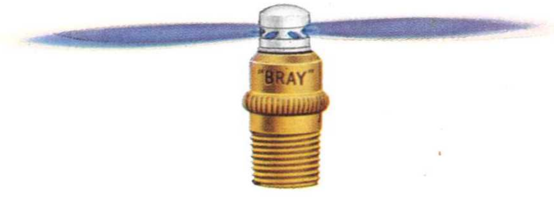
Clothes drying cabinets and hot cupboards are among the appliances which have been supplied with these jets.

No. 465
Buttress Thread (Taper) 27 T.P.I.

No. 466
Buttress Thread (Taper) 27 T.P.I.



No. 481
Buttress Thread (Taper) 27 T.P.I.



No. 482
⅛″ B.S.P. Thread (Taper)

Table 10

Approximate Hot Gas Rates and Flame Lengths of MULTI-FLAME Jets

(Flame lengths expressed as the distance in inches between the yellow tips of the two lowest flames)

	Hot Gas Rates				Flame Lengths							
					Cat No. 191				Cat. No. 485			
Pressure	1.0″	1.5″	2.0″	2.5″	1.0″	1.5″	2.0″	2.5″	1.0″	1.5″	2.0″	2.5″
Jet Size												
3	2.2	3.0	3.6	4.2	1.2	1.5	1.7	2.0	4.4	5.5	6.5	7.2
4	2.9	4.0	4.8	5.6	1.5	1.8	2.2	2.6	5.2	6.5	7.7	8.6
5	3.7	5.0	6.0	7.0	1.9	2.2	2.7	3.1	6.1	7.5	8.9	10.0
6	4.5	6.0	7.2	8.4	2.2	2.6	3.1	3.6	6.9	8.5	10.1	11.4
7	5.3	7.0	8.4	9.8	2.5	3.0	3.6	4.1	7.8	9.5	11.3	12.9
8	6.1	8.0	9.6	11.1	2.8	3.4	4.0	4.6	8.7	10.5	12.4	14.2
9	6.9	9.0	10.8	12.4	3.1	3.8	4.5	5.2	9.5	11.5	13.6	15.7
10	7.7	10.0	12.0	13.7	3.4	4.2	5.0	5.7	10.4	12.5	14.8	17.1
11	8.5	11.0	13.2	14.0	3.7	4.6	5.4	6.2	11.2	13.5	16.0	—
12	9.3	12.0	14.4	15.2	4.0	5.0	5.9	6.8	12.1	14.5	17.2	—

Table 11

Approximate Hot Gas Rates and Flame Lengths of CROSS LIGHTING Jets Cat. Nos. 465, 481 and 482

(Flame lengths expressed as the distance in inches between the yellow tips of the flames)

	Hot Gas Rates				Flame Lengths							
					Cat. No. 465				Cat. Nos. 481, 482			
Pressure	1.0″	1.5″	2.0″	2.5″	1.0″	1.5″	2.0″	2.5″	1.0″	1.5″	2.0″	2.5″
Jet Size												
1	0.8	1.0	1.2	1.3	1.7	2.1	2.5	2.9	1.6	2.0	2.3	2.6
2	1.6	2.0	2.3	2.7	3.2	3.9	4.6	5.2	3.0	3.7	4.3	5.0
3	2.4	3.0	3.5	4.0	4.8	5.8	6.8	7.6	4.5	5.5	6.4	7.5
4	3.2	4.0	4.7	5.2	6.3	7.6	8.8	9.8	5.9	7.2	8.4	9.9
5	4.1	5.0	5.8	6.6	7.8	9.4	10.9	12.2	7.3	9.0	10.4	—
6	4.9	6.0	7.0	7.9	9.4	Turbulent flames			8.7	Turbulent flames		

Table 12

Approximate Hot Gas Rates and Flame Lengths of CROSS LIGHTING Jets Cat. No. 466

(Flame Lengths expressed as (1) distance in inches from flame port to yellow tip of one flame
(2) distance in inches between the yellow tips of the two flames)

No 466 JETS	Hot Gas Rates				Flame Lengths							
					Flame Lengths from flame port to flame tip				Flame Lengths distance between flame tips			
Pressure	1.0″	1.5″	2.0″	2.5″	1.0″	1.5″	2.0″	2.5″	1.0″	1.5″	2.0″	2.5″
Jet Size												
1	0.8	1.0	1.2	1.3	0.9	1.0	1.2	1.3	1.4	1.8	2.1	2.4
2	1.6	2.0	2.3	2.7	1.7	2.1	2.4	2.7	2.5	3.2	3.6	4.2
3	2.4	3.0	3.5	4.0	2.5	3.1	3.5	4.1	3.6	4.5	5.2	5.9
4	3.2	4.0	4.7	5.2	3.3	4.0	4.7	5.4	4.6	5.7	6.7	7.6
5	4.1	5.0	5.8	6.6	4.1	4.9	5.9	6.7	5.7	7.0	8.2	9.2
6	4.9	6.0	7.0	7.9	4.9	5.9	7.1	8.1	6.9	8.3	9.7	11.0

CYLINDRICAL JETS

The non-atmospheric cylindrical jets have a central hole in the porcelain tip. A jet Cat. No. 241 is also available, with a hexagonal brass socket. These jets give a single "ratstail" flame, and are in use for pilot jets and other heating purposes.

No. 213
Buttress Thread (Taper) 27 T.P.I.

No. 241
Outside Thread
$\frac{3}{16}''$ dia. 36 T.P.I.

No. 467
$\frac{1}{8}''$ B.S.P. Thread (Taper)

CYLINDRICAL JETS Atmospheric

Two types of cylindrical jets, incorporating small holes in the brass sockets to allow for a small amount of primary air are also supplied. The principal uses of these jets are for domestic water heaters, canteen equipment and gas-fired boilers, etc.

No. 237
Outside Thread 2 B.A.

No. 242
Outside Thread
$\frac{3}{16}''$ dia. 36 T.P.I.

Table 13

CYLINDRICAL JETS
PILOT JETS

COLD GAS RATES
Cubic feet per hour

Specific Gravity ...		0·45	0·45	0·45	0·45	0·50	0·50	0·50	0·50	0·55	0·55	0·55	0·55
Pressure ins. w.g. ...		1·0	1·5	2·0	2·5	1·0	1·5	2·0	2·5	1·0	1·5	2·0	2·5
Jet Nos.		Cubic feet per hour											
Cyl.	Pil.												
00	00	0·25	0·31	0·36	0·40	0·24	0·29	0·34	0·38	0·23	0·28	0·32	0·36
0	0	0·51	0·62	0·72	0·79	0·49	0·59	0·67	0·76	0·46	0·56	0·65	0·73
1	1	0·97	1·19	1·38	1·54	0·93	1·14	1·31	1·47	0·88	1·08	1·25	1·40
2	1½	1·43	1·75	2·02	2·26	1·36	1·66	1·92	2·15	1·30	1·59	1·83	2·05
3	2	1·88	2·30	2·66	2·97	1·79	2·19	2·53	2·83	1·71	2·09	2·41	2·70
4		2·33	2·86	3·30	3·69	2·22	2·72	3·14	3·51	2·12	2·59	2·99	3·35
5	3	2·78	3·40	3·93	4·39	2·64	3·24	3·74	4·18	2·52	3·09	3·56	3·98
6		3·22	3·94	4·54	5·09	3·07	3·75	4·34	4·85	2·92	3·58	4·13	4·62
	4	3·67	4·49	5·19	5·80	3·49	4·28	4·94	5·52	3·33	4·08	4·71	5·26

CYLINDRICAL JETS

PILOT

Ten types of pilot jet are available, suitable for pilot lights in all types of gas appliances. These include the four simple types, Nos. 234 and 238, Nos. 233 and 236, the jet No. 437 with two flames, vertical and horizontal, made to customers' requirements with respect to consumption and length of flames, and three jets with adjustment screws, fitted with either retaining spring or lock-nut as desired, including No. 439, No. 434, and No. 433. Two atmospheric pilot jets are also supplied, one, No. 239 without, and one, No. 450, with metal windshield. These two jets are also made to customers' requirements with respect to consumption.

No. 234
Inside Thread
1 B.A.

No. 238
Inside Thread
1 B.A.

No. 439
Outside Thread
$\frac{1}{8}''$ dia. x 40 T.P.I.

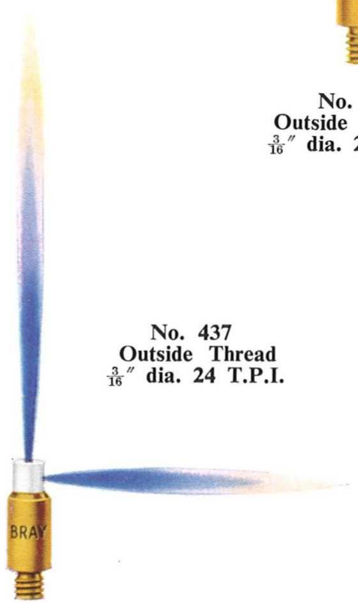
No. 434
Inside Thread
$\frac{3}{16}''$ dia. 24 T.P.I.

No. 233
Outside Thread
$\frac{3}{16}''$ dia. 24 T.P.I.

No. 236
Outside Thread
$\frac{3}{16}''$ dia. 24 T.P.I.

No. 433
Outside Thread
$\frac{3}{16}''$ dia. 24 T.P.I.

No. 437
Outside Thread
$\frac{3}{16}''$ dia. 24 T.P.I.



No 239
Outside Thread
.144 dia., 36 T.P.I.

No. 450
Outside Thread
.144 dia., 36 T.P.I.
With Metal
Windshield

Table 14

Classification of BRAY JETS ACCORDING TO JET CONSTANTS

Jet Constants	G Geyser	I Industrial	Rh Regulator H	Rl Regulator L	Sh Side Hole	Cy Cylindrical	Sp Special 201	Sp Special 221	Sp Special 202	Mk Market 219	Mk Market 226	Pi Pilot	Cl Cluster No. 254
½	0000	0000				0						0	
1	000	000	000			1						1	
1½						2						1½	
2	00	00	00		1	3			0			2	35
2½						4	00						
3	0	0	0	00		5	0	1	1			3	41
3½		½				6	1						
4	1	1	1	0	2		2	2	2			4	45
4½		1½											
5	2	2	2	1			3	3	3				50
5½		2½											
6	3	3	3	2	3		4	4	4				56
6½		3½											
7	4	4	4	3			5	5	5				
7½		4½											
8	5	5	5	4			6	6					
8½									6				
9	6	6	6	5	4		7						
9½								7					
10	7	7	7	6			8		7				
10½													
11	8	8		7	5		9	8					
11½									8				
12	9	9		8	6								
12½								9					
13		10							9				
13½					7					10			
14													
14½													
15					8					11	10		
15½													
16													
16½											11		

Heat Inputs of Bray Jets in B.Th.U. Per Hour

Manufacturers of gas appliances in the past have used the calorific value of gas as a basis of jet selection. For example, an appliance consuming 30,000 B.Th.U. per hour might be fitted with ten jets, each passing 3,000 B.Th.U. per hour. The size of the jet would depend upon the calorific value. Thus for a calorific value of 400, a jet to pass 3,000/400=7.5 cubic feet per hour would be required. For 450 gas, the jet would be required to pass 6.7 cubic feet per hour, for 500 gas, 6.0 cubic feet per hour, and for 550 gas, 5·5 cubic feet per hour.

Since the heat input for a given jet and with a given gas pressure varies according to the calorific value divided by the square root of the specific gravity of the gas, a more rational method would be to calibrate the jets according to this factor, which is termed the Wobbe Number. There is every indication that this method will be adopted in the near future, ranges of Wobbe Numbers, corresponding to defined calorific value ranges, with approximate specific gravities being chosen, and the mean Wobbe Number for each range being used for calculating the jet size.

We have therefore included a set of Tables for Bray Jets, in which heat inputs in B.Th.U. per hour have been calculated for various gas pressures and for typical Wobbe Numbers. These are given for all jets, with the exception of Miniature jets, in Tables 15 and 16, and for Miniature Jets in Table 17.

Example. A bar burner is required to pass 30,000 B.Th.U. per hour, when hot, or, it having been found by experience that the consumption reduction upon warming-up, is 15%, 34,500 B.Th.U. per hour cold gas rate. It will incorporate eight burners, so that each must pass 4,300 B.Th.U. per hour. The Wobbe Number of the gas is 670 equivalent to gas of 475 C.V. and 0·50 specific gravity. The gas pressure will be 1·5 inches water gauge.

From Table 15, 4,410 B.Th.U. per hour is the heat input of a jet with jet constant 9, when the operating pressure is 1·5 ins. w.g., and the Wobbe Number of the gas 670. From Table 14 it is seen that the No. 6 size of Geyser or Industrial Jet has a jet constant of 9, and this size would be selected for the burner bar.

Table 15

Heat Inputs of Jets at various pressures and with gases of different Wobbe Numbers: B.Th.U. per hour

Wobbe Number		730	730	730	730	670	670	670	670
Gas Pressure		1·0″	1·5″	2·0″	2·5″	1·0″	1·5″	2·0″	2·5″
Jet Constants see Table 14									
¼	...	120	150	170	200	110	140	160	180
½	...	250	300	350	390	230	280	320	360
1	...	480	590	680	760	440	540	620	690
1½	...	700	860	990	1110	640	790	910	1020
2	...	920	1130	1310	1460	850	1040	1200	1340
2½	...	1150	1400	1620	1810	1050	1290	1490	1560
3	...	1360	1670	1930	2160	1250	1530	1770	1980
3½	...	1580	1940	2240	2500	1450	1780	2050	2300
4	...	1800	2210	2550	2850	1650	2030	2340	2620
4½	...	2020	2480	2860	3200	1860	2270	2620	2930
5	...	2240	2740	3170	3540	2060	2520	2910	3250
5½	...	2450	3010	3470	3880	2250	2760	3190	3560
6	...	2670	3270	3780	4220	2450	3000	3470	3880
6½	...	2880	3530	4080	4560	2640	3240	3740	4180
7	...	3090	3790	4380	4890	2840	3480	4020	4490
7½	...	3300	4050	4670	5220	3030	3710	4290	4790
8	...	3510	4300	4970	5560	3220	3950	4560	5100
8½	...	3720	4560	5260	5880	3410	4180	4830	5400
9	...	3930	4810	5550	6210	3600	4410	5100	5700
9½	...	4130	5060	5840	6530	3790	4640	5360	5990
10	...	4330	5310	6130	6850	3980	4870	5740	6290
10½	...	4540	5560	6420	7180	4170	5100	5890	6590
11	...	4750	5820	6710	7510	4360	5340	6160	6890
11½	...	4950	6070	7010	7830	4550	5570	6430	7190
12	...	5160	6320	7300	8160	4740	5800	6700	7490
12½	...	5370	6570	7590	8490	4930	6030	6970	7790
13	...	5570	6830	7880	8810	5020	6270	7240	8090
13½	...	5780	7080	8170	9140	5310	6350	7500	8390
14	...	5980	7330	8460	9460	5490	6730	7770	8690
14½	...	6190	7580	8750	9790	5680	6960	8030	8980
15	...	6390	7830	9040	10110	5870	7190	8300	9280
15½	...	6600	8080	9330	10430	6060	7420	8560	9570
16	...	6800	8330	9620	10750	6240	7650	8830	9870
16½	...	7000	8580	9910	11070	6430	7870	9090	10160

Table 16

Heat Inputs of Jets at various pressures and with gases of different Wobbe Numbers: B.Th.U. per hour

Wobbe Number		615	615	615	615	560	560	560	560
Gas Pressure		1·0″	1·5″	2·0″	2·5″	1·0″	1·5″	2·0″	2·5″
Jet Constants See Table 14									
¼	...	100	130	150	170	90	120	130	150
½	...	210	260	300	330	190	230	270	300
1	...	410	500	570	640	370	450	520	580
1½	...	590	720	840	930	540	660	760	850
2	...	780	960	1100	1240	710	870	1000	1120
2½	...	970	1180	1270	1530	880	1080	1240	1390
3	...	1150	1410	1630	1820	1050	1280	1480	1660
3½	...	1330	1630	1890	2110	1210	1490	1720	1920
4	...	1520	1860	2150	2400	1380	1690	1950	2190
4½	...	1700	2090	2410	2690	1550	1900	2190	2450
5	...	1890	2310	2670	2990	1720	2100	2430	2720
5½	...	2070	2530	2920	3270	1880	2310	2660	2980
6	...	2250	2760	3180	3560	2050	2510	2900	3240
6½	...	2430	2980	3440	3840	2210	2710	3130	3500
7	...	2610	3190	3690	4120	2370	2910	3360	3750
7½	...	2780	3400	3930	4400	2530	3100	3583	4010
8	...	2960	3620	4180	4680	2700	3300	3810	4260
8½	...	3140	3840	4440	4960	2850	3490	4040	4510
9	...	3310	4050	4680	5230	3010	3690	4260	4760
9½	...	3480	4260	4920	5500	3170	3880	4480	5010
10	...	3650	4470	5160	5770	3320	4070	4700	5260
10½	...	3830	4680	5410	6050	3480	4270	4930	5510
11	...	4000	4900	5650	6320	3640	4460	5150	5760
11½	...	4180	5120	5910	6610	3800	4650	5380	6010
12	...	4350	5320	6150	6880	3960	4850	5600	6260
12½	...	4520	5540	6300	7150	4120	5040	5820	6511
13	...	4700	5750	6650	7430	4280	5240	6050	6760
13½	...	4870	5960	6890	7700	4430	5430	6270	7010
14	...	5040	6180	7130	7970	4590	5620	6490	7260
14½	...	5220	6390	7380	8260	4750	5820	6720	7510
15	...	5390	6600	7620	8520	4910	6010	6940	7760
15½	...	5560	6810	7860	8790	5060	6200	7160	8000
16	...	5730	7020	8110	9060	5220	6390	7380	8250
16½	...	5900	7230	8350	9340	5370	6580	7600	8500

Table 17

Heat Inputs of Miniature Jets at Various Pressures and with Gases of Different Wobbe Numbers: B.Th.U. per hour

Wobbe Number		730	730	730	730	670	670	670	670
Gas Pressure		1·0″	1·5″	2·0″	2·5″	1·0″	1·5″	2·0″	2·5″
Code Letter									
Z	...	120	150	170	200	110	140	160	180
Y	...	240	300	340	380	220	270	310	350
X	...	360	440	510	570	320	400	460	520
W	...	470	580	670	740	430	530	610	680
V	...	580	710	820	920	530	650	750	840
U	...	690	850	980	1090	630	780	900	1000
T	...	800	980	1130	1270	740	900	1040	1160
S	...	900	1110	1290	1440	840	1020	1180	1320
R	...	1020	1250	1440	1610	940	1150	1320	1480
Q	...	1130	1380	1600	1790	1040	1270	1470	1640
P	...	1240	1520	1750	1960	1140	1390	1610	1800
N	...	1350	1650	1910	2130	1240	1510	1750	1960
J	...	1780	2180	2520	2820	1640	2000	2320	2590
E	...	2210	2710	3130	3580	2030	2490	2880	3220

Wobbe Number		615	615	615	615	560	560	560	560
Gas Pressure		1·0″	1·5″	2·0″	2·5″	1·0″	1·5″	2·0″	2·5″
Code Letter									
Z	...	100	130	150	170	90	120	130	150
Y	...	200	250	290	320	190	230	260	290
X	...	300	370	430	480	270	340	390	430
W	...	390	480	560	620	360	440	510	570
V	...	490	600	700	780	450	550	630	710
U	...	580	720	830	920	530	650	750	840
T	...	680	830	960	1070	610	750	870	970
S	...	770	940	1090	1220	700	860	990	1100
R	...	860	1050	1220	1360	780	960	1110	1240
Q	...	950	1170	1350	1570	870	1060	1230	1370
P	...	1050	1280	1480	1650	950	1160	1340	1500
N	...	1140	1390	1610	1800	1030	1270	1460	1630
J	...	1500	1840	2120	2370	1370	1680	1940	2160
E	...	1860	2280	2640	2950	1700	2080	2400	2690

NOTES

COLD GAS RATES: The cold gas rates given in this catalogue have been derived by calculation from the Standard Discharge Rates of the various jets which have been determined experimentally at 1·5 inches w.g. pressure on a gas of 0·5 specific gravity.

Acknowledgment is given to Mr. William J. Gilchrist Davey, B.Sc. for the calculations and nomograms supplied in this connection.

MANUFACTURING TOLERANCES: The tabulated gas rates are subject to tolerances as follows:

No. 1 Geyser (Jet Constant 4) and larger: plus and minus 5%

No. ½ Geyser (Jet Constant 3½) and smaller: plus and minus 10% subject to a minimum of plus and minus 0·15

HOT GAS RATES: These vary widely with particular jet sizes according to the method of application; proximity of jets, type of burner manifold, combustion chamber dimensions, etc. The nominal hot gas rates for burning in free air, given in previous catalogues have therefore been dropped in favour of cold gas rates. It is left to the designer of appliances to determine the percentage of consumption reduction from the cold to the hot rate in his particular appliance, since there is at present no method of relating this quantity to methods of application.

CLEANING THE JETS: Slotted jets should be cleaned by means of a small hard brush (e.g., a tooth brush). The insertion of a metal reamer is likely to damage the sides of the slotted ports and to result in irregular flames. For two hole jets a cleaning needle may be used.

REMOVAL AND REPLACEMENT OF MINIATURE JETS. A special box spanner can be supplied for the removal and replacement of miniature jets. This is slotted near the base for inspection of the slot and to ensure its correct alignment when the jet is screwed into position. It should be remembered that the main axis of the flame is at right angles to the length of the slot. The box spanner is illustrated below.

Special Taps for Bray Jet Threads. Special taps for screwing the housing of miniature jets, ¼″ diameter × 36 T.P.I., for buttress taper threads, 27 T.P.I., and for the standard ⅛″ B.S.P. thread, as illustrated below, can also be supplied. The use of these taps, which have been designed for Bray jet threads, is recommended, to ensure a gas-tight joint.

PRESSURE DROP. In an installation comprising a large number of jets, there may be a pressure drop due to resistances imposed by the jets.

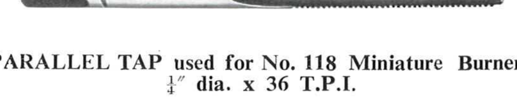
Useful Tools for fitting BRAY BURNERS

TAPER TAP used for all types of "BRAY" Burners with Buttress Taper Thread (27 T.P.I.)

BOX KEY used for Miniature Burners Nos. 115 and 118

Pliers for assembly of jets into burner rails

Tap used for ⅛″ B.S.P. Threaded Burners



PARALLEL TAP used for No. 118 Miniature Burners ¼″ dia. x 36 T.P.I.

The Flow of Gas Through Service Pipes

Users of Bray jets when confronted with problems concerning the flow of gas through service pipes may find the accompanying nomogram useful. It is based on the Table of discharge through straight horizontal pipes from the British Standard Code of Practice CP 331.103 (1947) General Series, "Gas Installation Pipes", and is a slight extension of the nomogram published by William J. Gilchrist Davey in *The Gas World*, 25th October 1947, to which author and technical journal acknowledgments are made for permission to reproduce.

The Table referred to a differential pressure of 3/10″ w.g., and a specific gravity of the gas of 0·5, compared with air. The nomogram deals with specific gravities from 0·35 to 0·70 and with differential pressures from 0·1 to 2·0″ w.g. It refers to gas pipes of steam weight, the diameter scale being calibrated in actual bore areas of such pipes with nominal diameters from $\frac{1}{8}$″ to 4″.

The nomogram consists of seven scales, two of which are ungraduated. From left to right the scales are as follows—(1) the d scale of pipe diameters, (2) an ungraduated scale, (3) the Q scale of gas rates in cubic feet per hour, (4) the L scale of length of pipe in feet, extending from 5 to 300 feet, (5) the S scale of specific gravities of the gas (air = 1), (6) an ungraduated scale, and (7) the h scale of differential pressures.

To determine the pressure loss when a certain quantity of gas of a given specific gravity passes through a horizontal pipe of given size and length, a straight line is first drawn from the diameter of the pipe on the d scale to the length of pipe on the L scale, to intersect the X scale. A straight line is next drawn from the point of intersection of the X scale through the required quantity of gas on the Q scale, to meet the Y scale. A third line is drawn from the specific gravity of the gas on the S scale through the point of intersection of the Y scale to meet the h scale at a point representing the pressure loss.

The broken lines show the solution of a typical problem. It is required to know the pressure loss resulting from the passage of 1000 cubic feet of gas per hour through a 2″ pipe, 70 feet in length, the gas having a specific gravity of 0·50, A straight line is drawn from 2 on the d scale to 70 on the L scale, intersecting the X scale. From the point of intersection of the X scale a second line is drawn through 1000 on the Q scale, to meet the Y scale. Finally, a straight line is drawn from 0·50 on the S scale through the point of intersection of the Y scale to meet the h scale at the point 0·3. representing a pressure drop of 0·3″ water gauge.

Effect of Elbows, Tees and Bends

The resistance imposed by elbows, tees and bends may be translated into terms of extra feet to be added to the horizontal length of pipe for the purpose of calculation. The additional length allowances are shown in Table 23. Thus, if a 100 feet length of 2″ pipe includes two elbows and one 90° bend, the total length for the purpose of calculation will be 100 + (2 x 5) + 2 = 112 feet.

Relative Carrying Capacity of Pipes

The relative carrying capacity of pipes is also given in Table 23. From these figures the data in Table 22 have bee calculated. Supposing, for example, it is required to know the number of $\frac{3}{4}$″ branch pipes that can be taken from a 2″ pipe. This is found by dividing the relative carrying capacity of the $\frac{3}{4}$″ pipe into that of the 2″ pipe, i.e., 710/60 = approximately 12. This figure is given in Table 22.

Table 22

Number of branch pipes that may be taken from a main pipe of larger diameter

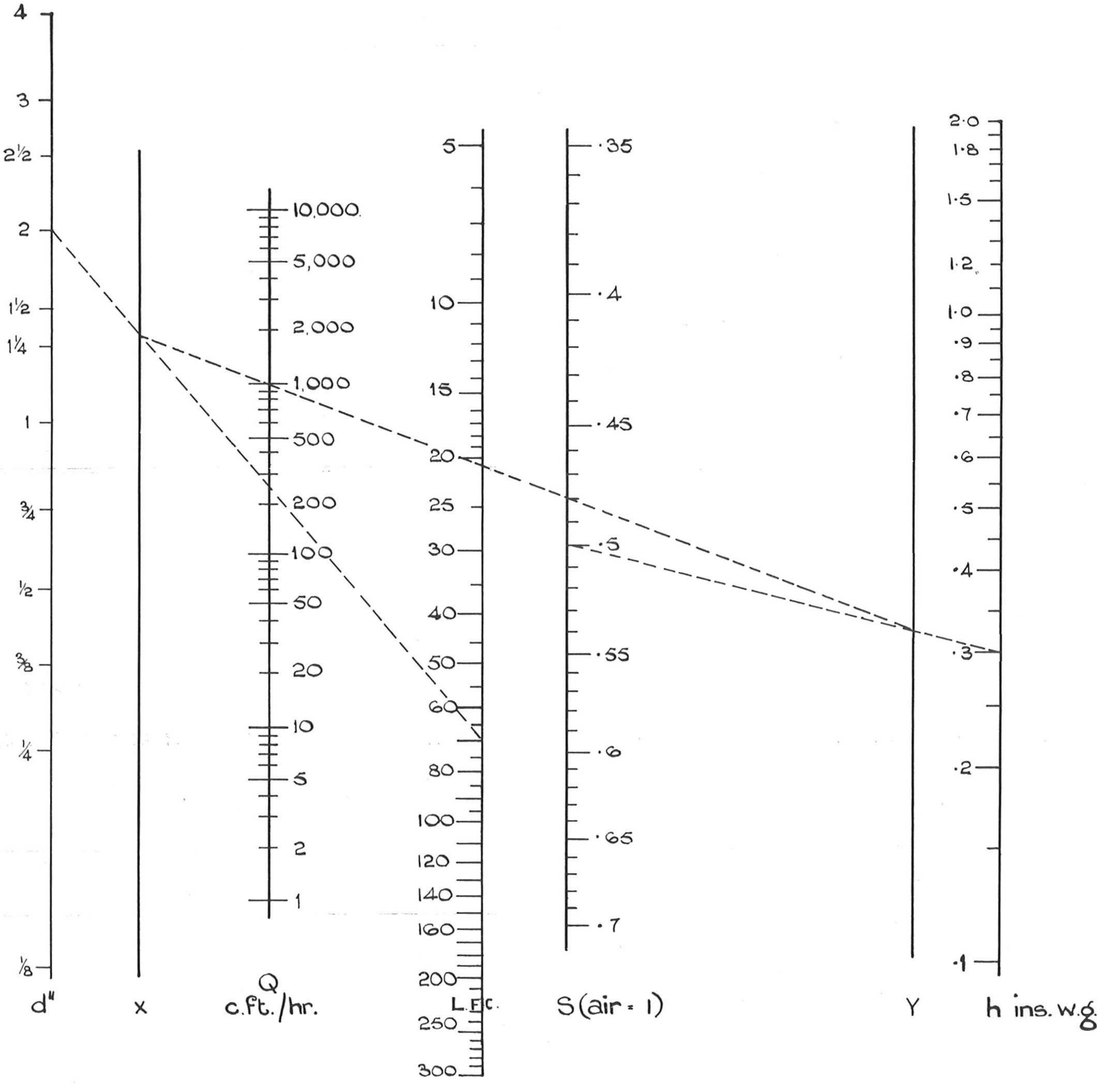
Size of branch pipes	Sizes of Main Pipes									
	3″	2½″	2″	1½″	1¼″	1″	¾″	½″	¾″	¼″
⅛″	2210	1360	710	352	250	127	60	29	15	7
¼″	315	194	101	50	35	18	8	4	2	
⅜″	147	90	47	23	16	8	4	2		
½″	75	47	24	12	9	4	2			
¾″	37	22	12	6	4	2				
1″	17	10	5	2	2					
1¼″	9	5	3	1						
1½″	6	3	2							
2″	3	2								
2½″	1									

Table 23

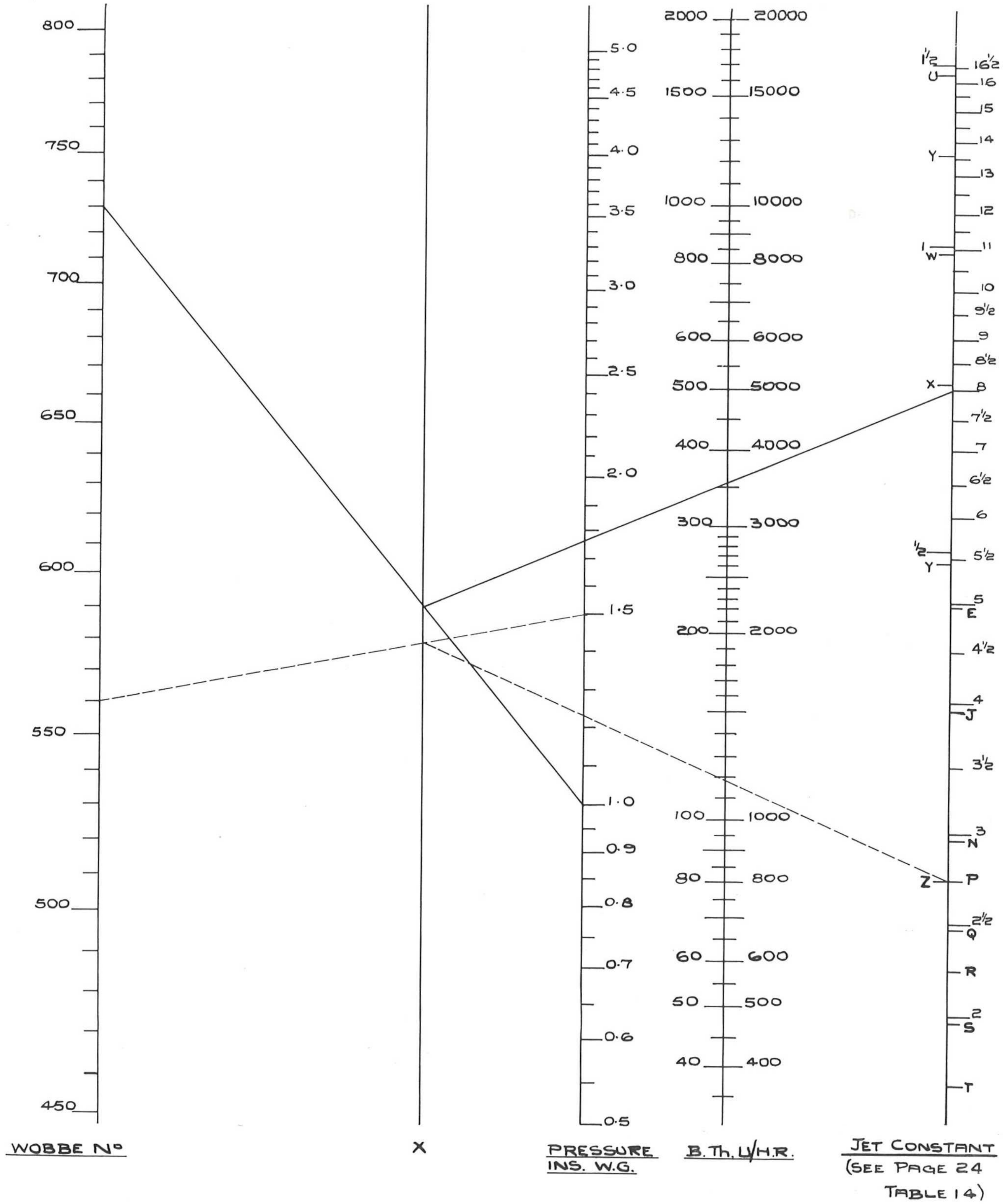
Relative Carrying Capacities of Pipes and effect of elbows, tees and 90° bends

Size of Pipe in inches (nominal internal diameter)	Relative carrying capacity	Additional length in feet to be allowed for the effect of elbows, tees and 90° bends.		
		Elbows	Tees	90° bends
⅛″	1	2	2	1
¼″	7	2	2	1
⅜″	15	2	2	1
½″	29	2	2	1
¾″	60	2	2	1
1″	127	2	2	1
1¼″	250	3	3	1
1½″	352	3	3	1
2″	710	5	5	2
2½″	1360	6	6	2
3″	2210	8	8	3

Nomogram for Flow of Gas through Service Pipes



Nomogram for Calculation of Heat Inputs



Nomogram for Calculation of Heat Inputs from Slotted Port Jets

The nomogram, page 33, is reproduced by permission from *The Gas World,* 17th November 1951, where it illustrates an article by Wm. J. Gilchrist Davey, on "Heat Input Computation for Non-Aerated Jets" No. VI, in the Series "Further Aspects of Space Heating".

It extends the calculations given in Tables 15-17 on pages 26 to 28, allowing for the calculation of Heat Inputs with gas of Wobbe Number varying by ten units from 450 to 800 at pressures varying by 0·1″ water gauge from 0·5 to 5·0.

The nomogram consists of five vertical scales including one ungraduated scale, the scales reading from left to right, including Wobbe Numbers, the ungraduated X scale, pressures in inches water gauge, heat inputs in British Thermal Units per hour, and Bray Jet sizes, in terms of Jet constants (see page 24, table 14) for the larger slotted port jets, and Code Letters for the Miniature Jets.

To determine the jet size for a given heat input (cold) a straight line is first drawn from the Wobbe Number on the first scale to the pressure on the third scale, intersecting scale X. From the point of intersection of this scale a straight line is drawn through the required heat input to meet the fifth scale at a point representing the jet size.

The unbroken line shows that for a heat input of 3600 B.Th.U. per hour, with gas of Wobbe Number 730 and a gas pressure at jet inlet of 1·0″ water gauge, a jet with Jet Constant 8 is required. Reference to Table 14 shows that this is equivalent to a No. 5 Industrial Jet.

The broken line, on the other hand shows that for a heat input (cold) of 115 B.Th.U. per hour with gas of Wobbe Number 560 and a gas pressure 1·5″ water gauge, a Bray Miniature Jet size Z will be required.

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