A VERTICAL WATER TUBE BOILER

With Paraffin Burner and Automatic Control.

DESCRIPTION

A quick-steaming, simply made boiler, w.p. 250 p.s.i., suitable for use with a 2-cylinder double-acting, simple expansion slide valve engine of bore 2½in. and stroke 3½in. Steam is superheated to a total temperature of 500 deg. F. approximately for use with a "D" slide valve engine, if a positive mechanical cylinder lubricator is used a larger superheater can be fitted. In any case, it is essential to use a good cylinder oil with flash point not less than 800 deg. F., e.g., Vacuum Oil Company's "Hecla" or "Extra Hecla."

CENTRAL DRUM—

Shown by Fig A, solid drawn mild steel tube, 5in. o.d., 16¼in. long, 3/16in. wall thickness. Drum ends, circular steel discs, 5in. o.d., ½in. thick, welded to each end of tube. Eight tubular cross-arms, solid drawn mild steel 1½in. o.d., total length 4¾in. (giving min. 4 7/16in. outside drum), 14 gauge (approximately 5/64in. thick), each outer end sealed by mild steel plate 1 5/16in. dia., ¼in. thick, welded in. Cross-arms are welded into drum, as indicated in Fig. A. Before assembly of top drum end, it is drilled and tapped ¼in. Gas thread, as are cross-arm ends. Central drum assembly is tested to 600 p.s.i. cold hydraulic pressure (test pump delivery is connected to one cross-arm, pressure gauge to another, remainder of holes are temporarily plugged), all joints should be perfectly dry. Test pressure should be kept up for at least half-an-hour, during which time a sharp look-out should be kept upon the various joints and cover plates for any signs of weakness.

STEAM GENERATING COILS—

Shown by Fig. B, which also shows longitudinal section of coil and drum assembly. Coils consist of three elements, viz.: "W," "X" and "Y." "W" contains 2 coils wound left-handed, "X" and "Y" have 2 and 3 coils, respectively, "X" wound right-handed and "Y" left-handed. Tube is mild steel, best solid-drawn "close-annealed," ½in. o.d., 17 gauge.

Coil bending is accomplished by hand without any filling of tubes with lead or sand. Recommended—obtain wooden cylinders (3) of dias. ⅜in. less than internal dias. of coils, round which coils are wrapped by hand, as follows:—Each coil for "W" is 9ft. long, allow extra 9in. for working margin. O/Dias. of coils "W," "X" and "Y" are 6⅝, 9 and 11½ins., respectively.

Method of Winding.—Place length of tube horizontally on level floor—place appropriate wooden cylinder (or old paint drum of correct size) upright at centre of tube length, place your right foot on top of cylinder, take hold of tube with left hand, your assistant takes hold of opposite end of tube, and both together bend tube round and over wooden cylinder, care being taken to ensure elements "W" and "Y" are wound left-hand and "X" right-hand. Repeat operation until coils are complete—make no attempt during the winding to keep coil laps to correct pitch, laps are pulled apart by hand to pitch shown in Fig. B after each coil is wound. Completed in this way coil winding presents no difficulty whatsoever.

Coil Assembly: Coil in "W" (shown black in Fig. B) is threaded over top cross-arms on central drum, top and bottom ends of coil are bent and cut to length, to join cross-arms as shown in Fig. B. Mark upper and lower cross-arms and drill ½in. clearance hole, fit coil ends and weld in. Then thread second coil (shown white in Fig. B) over upper cross-arms and between the laps of the first coil and weld ends into cross-arms, as above. Repeat the operation for coils of elements "X" and "Y."

SUPERHEATER.

Shown in Fig. C (5), is solid drawn "close-annealed" mild steel tube, ½in. o.d. by 14 gauge, a length of 9ft. 3ins. will be sufficient. Tube is bent by hand to dimensions shown in figure, ends are screwed ¼in. gas thread, as shown. To the flat coil are welded three supports of ⅜in. dia. steel rod, 2½in. long. Assembly is shown in Fig. C (6).

BOILER CASING.

Shown in Fig. D, 20 gauge soft steel sheet, 14⅜in. dia., 22¾in. long. Casing top plate is flanged to give good press fit into casing shell. Steel stiffening bands, 1in. by ⅛in., are riveted to top and bottom of casing.

Burner lighting hole, with sliding door, is made and door riveted on. Central drum and coil assembly is lowered into casing to position shown dotted in Fig. D, and 4—9/16ins. dia. holes marked off and drilled where upper cross-arms meet casing sides, repeat for 4 holes for lower cross-arms. The boiler assembly is supported by 8 ¼in. "gas" nipples, which pass through these holes in casing and are screwed into the cross-arm end plates. All above nipples, except the two used for water column connection, are blanked off by hexagon malleable iron caps. Three of the lower cross arm nipples form useful apertures for washing out the boiler. Boiler casing top plate is drilled for steam outlet pipe. The casing is internally lined with ¼in. thick asbestos millboard (damped before bending to place) ,held by 3/16in. round-headed store screws. Casing top-plate is similarly lined with asbestos.

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WATER COLUMN.

Shown in Fig. D, solid drawn mild steel tube, 1½in. o.d. by 14 gauge, 17½in. long. End plates are mild steel ¼in. thick, 1½in. o.d., welded on, the top late is tapped ½in. gas thread for safety valve, and bottom ¼in. gas thread for blow-off cock. Two holes are drilled and tapped ¼in. gas at 12in. centres down one side, into which are screwed ¼in. gas nipples, a ¼in. Jefferson union being used to connect these nipples to those projecting from two of the boiler cross-arms, ¼in. gas connections are made for the feed-water delivery check valve and for the steam delivery to the " automatic fuel regulator."

AUTOMATIC FUEL REGULATOR.

Shown in Fig E. This regulator governs the supply of fuel to the burner, so that the steam pressure in the boiler does not vary more than a few pounds from the pressure for which the instrument has been set. It is not complicated and is easily made. The two circular flanged discs are of brass, between which is clamped the steel diaphragm plate. The whole is held together by eight 3/16in. Whitworth steel screws. The diaphragm plate is that used by the Budenberg Gauge Co., Ltd., Broadheath, Altrincham, Cheshire, England (No. 1 size, 2⅞in. dia., 26 gauge), from which firm it should be purchased. Steam from the boiler enters the lower disc and presses upon the diaphragm, which is deflected more or less according to the degree of steam pressure. The upper brass disc is slightly hollowed at " B " and fuel passes through to the burner via inlet " C," past valve " E," through outlet " F " to burner. " G " is the adjustable valve seat. In fuel valve " E " is cut a small slot or file-cut through which enough fuel passes with valve " E " on its seat, to just keep the burner alight, enabling the burner instantly to reach full power as soon as valve " E " is again opened.

BURNER.

Shown in Fig. F (9 to 13). This burner is of the Bunsen type, using paraffin as fuel and arranged with one induction tube. This type of burner works very silently, and when once the correct size for the jet, which projects the gas into the mouth of the induction, or mixing tube is found, the combustion should be with blue flames tipped with orange. Note, this quality of flame is much hotter than a purely blue one, and the orange-tipped flame, being longer, reaches higher up among the water tubes of the boiler, thus giving a greater steam production.

Burner face consists of six 1½in. by 1¼in. steel angle bars of ordinary commercial quality. They are cut to approximate length and each angle bar is then marked off along the ridge for the saw cuts, spaced ⅜in. apart and ⅜in. depth, as shown in Fig. F (9). These saw cuts form the orifice for the paraffin-air mixture, which is forced into the burner through the jet via the induction or mixing tube. They are made with a thin-bladed hacksaw, having 32 teeth per inch, to give a fine slot. The burner angle bars are then arranged, as shown in Fig. F (10), on a level iron plate and welded at their meeting edges. The complete burner face is sawn to a circle 12⅞in. dia. A strip steel ring, 2in. deep, ⅛in. thick, 12¾in. dia., is bent up and welded on the vertical joint, to this ring is welded a circular steel plate, 13in. dia., 12 gauge, forming the bottom of burner box (Fig. F, 11). The mixing tube is of seamless steel, 1½in. o.d. by 16 gauge, dimensions as shown in Fig. F (12), and is welded to the burner box ring, the mouth of the tube is slightly " belled " to allow free passage of air round the fuel jet. The burner face is now welded to the top of the ring.

Vaporising Coil : Shown in Fig. F (13), is formed from seamless steel tube, ⅜in. o.d. by 16 gauge, the ends are screwed ⅛in. gas thread for connection to the automatic regulator fuel outlet and to the burner gas nozzle, shown in Fig. F (9), respectively. The jet is made from a ⅛in. gas square-headed brass plug, drilled .023in. (No. 74 drill). Vaporising coil elbow is a standard ⅛in. malleable iron fitting. When starting up from cold a small wad of asbestos millboard is soaked in methylated spirit, placed beneath the exit end of the vaporising coil and lighted. This provides sufficient heat for vaporising the paraffin at starting. Working air pressure on the paraffin fuel should be 40-50 p.s.i.

STORAGE OF BOILER.

The boiler is of robust construction and will last for many years with but little attention. If it is required to place it out of use for any length of time it should be blown down until quite empty and the burner turned on to half-power for about 30 seconds, so as to dry completely the interior surfaces. This drying-off process will not in any way damage the boiler provided reasonable discretion is observed in the manipulation of the burner.

Issued by " LIGHT STEAM POWER,"
KIRK MICHAEL, ISLE OF MAN.

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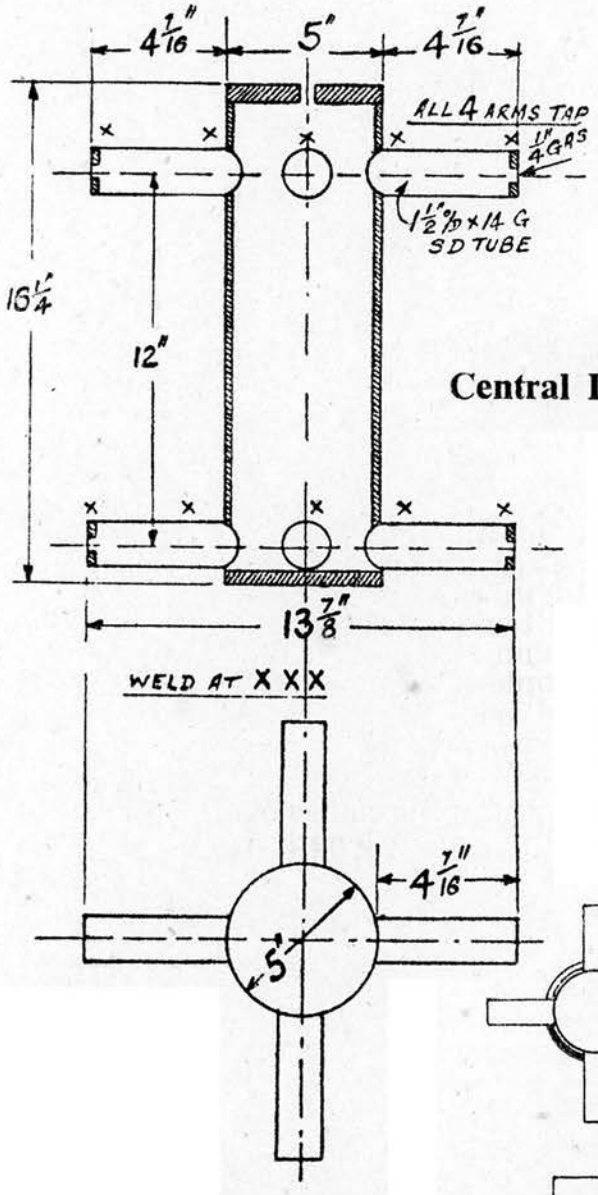

Fig. A.
Central Drum and Cross-Arms.

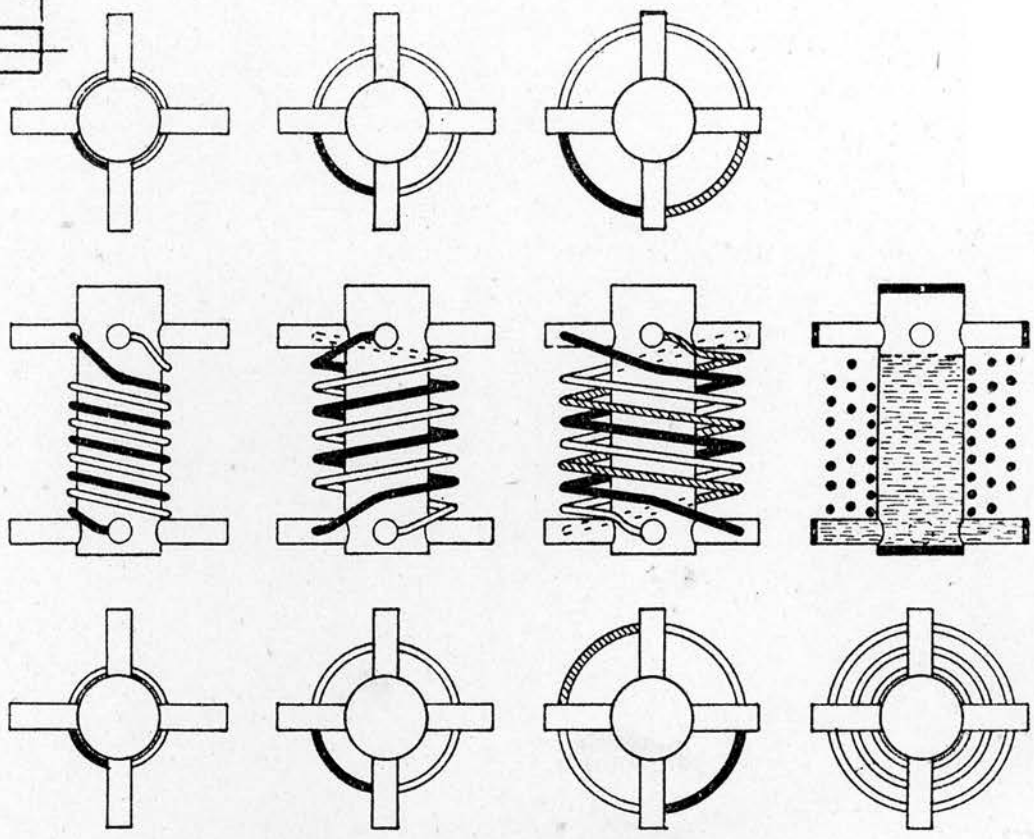

Fig. B.—Assembly of Steam Generating Coils.

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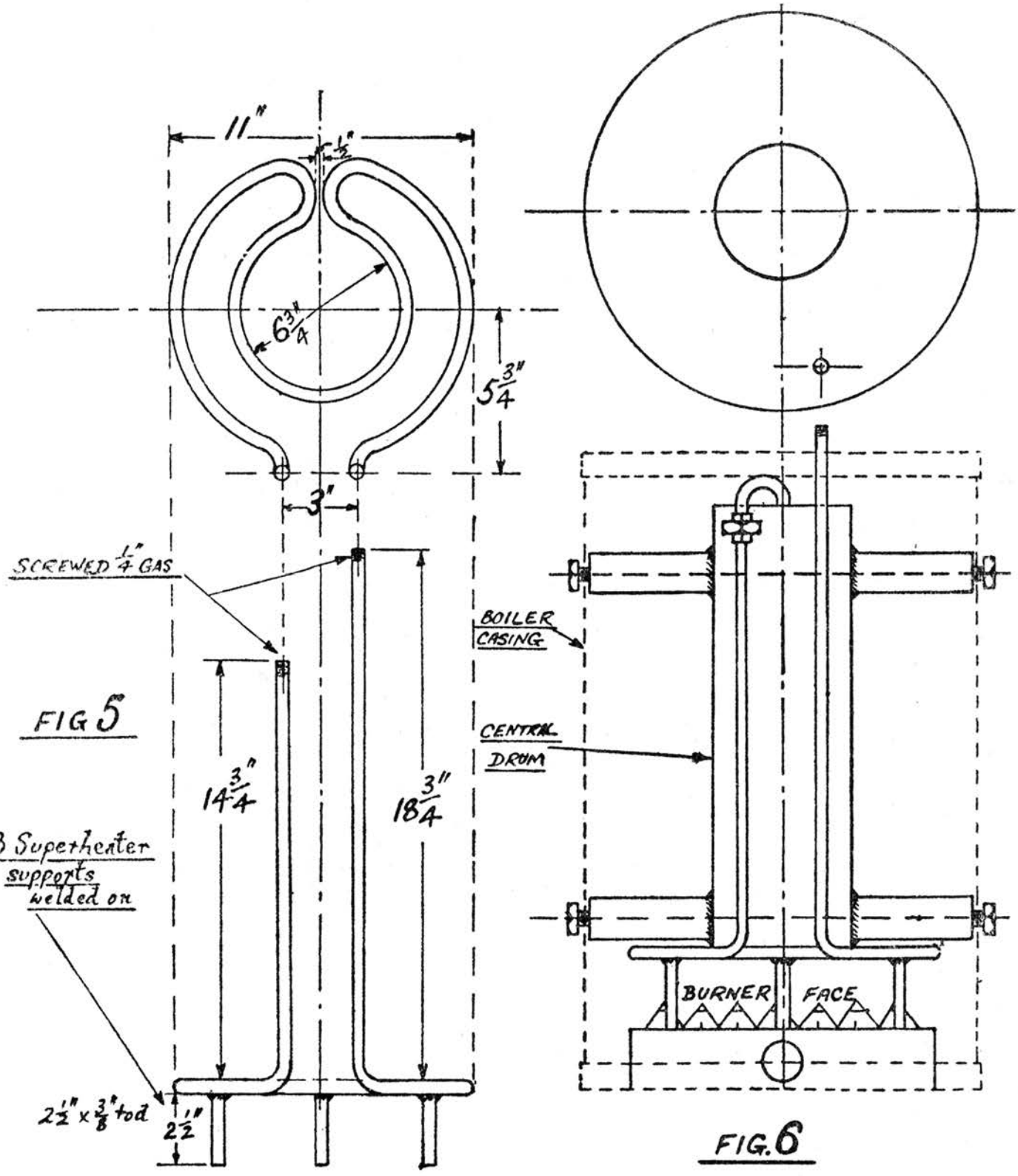

Fig. C.—Superheater Coil and Assembly.

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designed by the late Mr. R. H. Bolsover

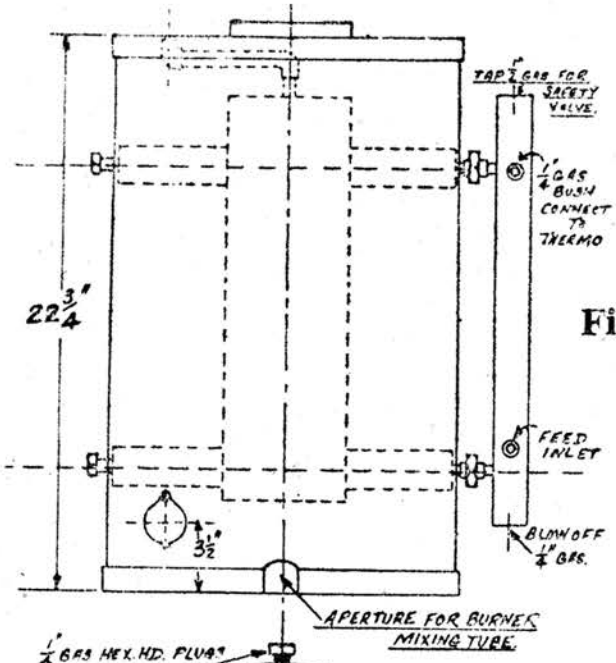
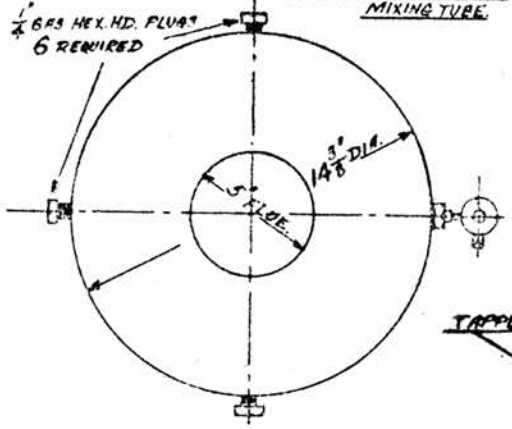
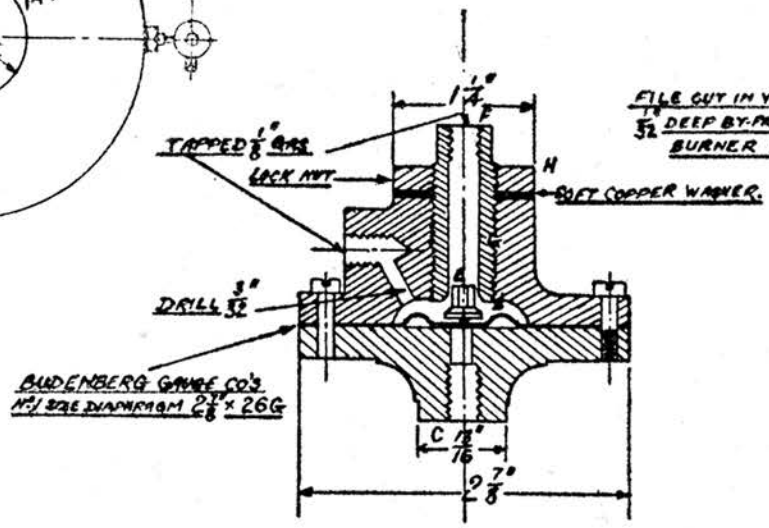
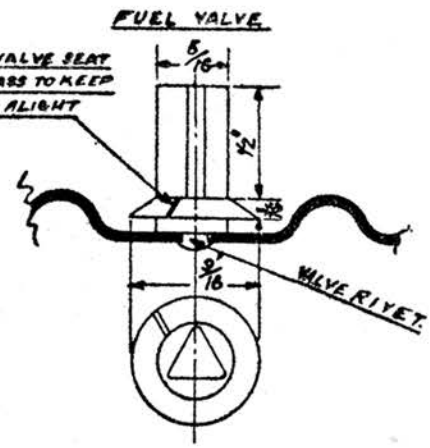


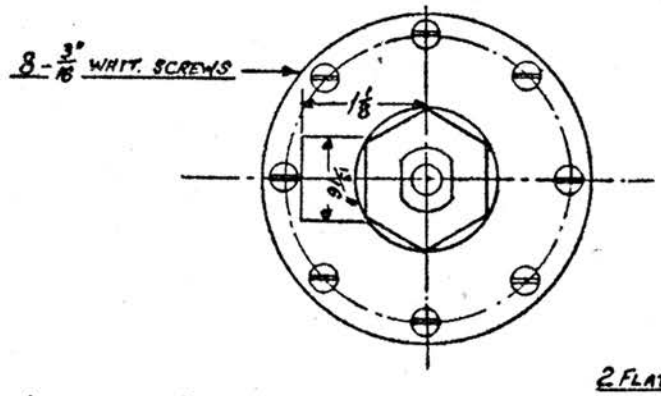
Fig. D.—Casing and Water Column.







ENLARGED VIEW SHOWING VALVE RIVETED TO DIAPHRAGM PLATE.



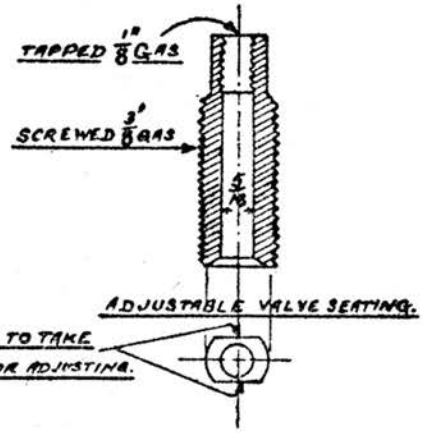


Fig. E.—Automatic Fuel Regulator.

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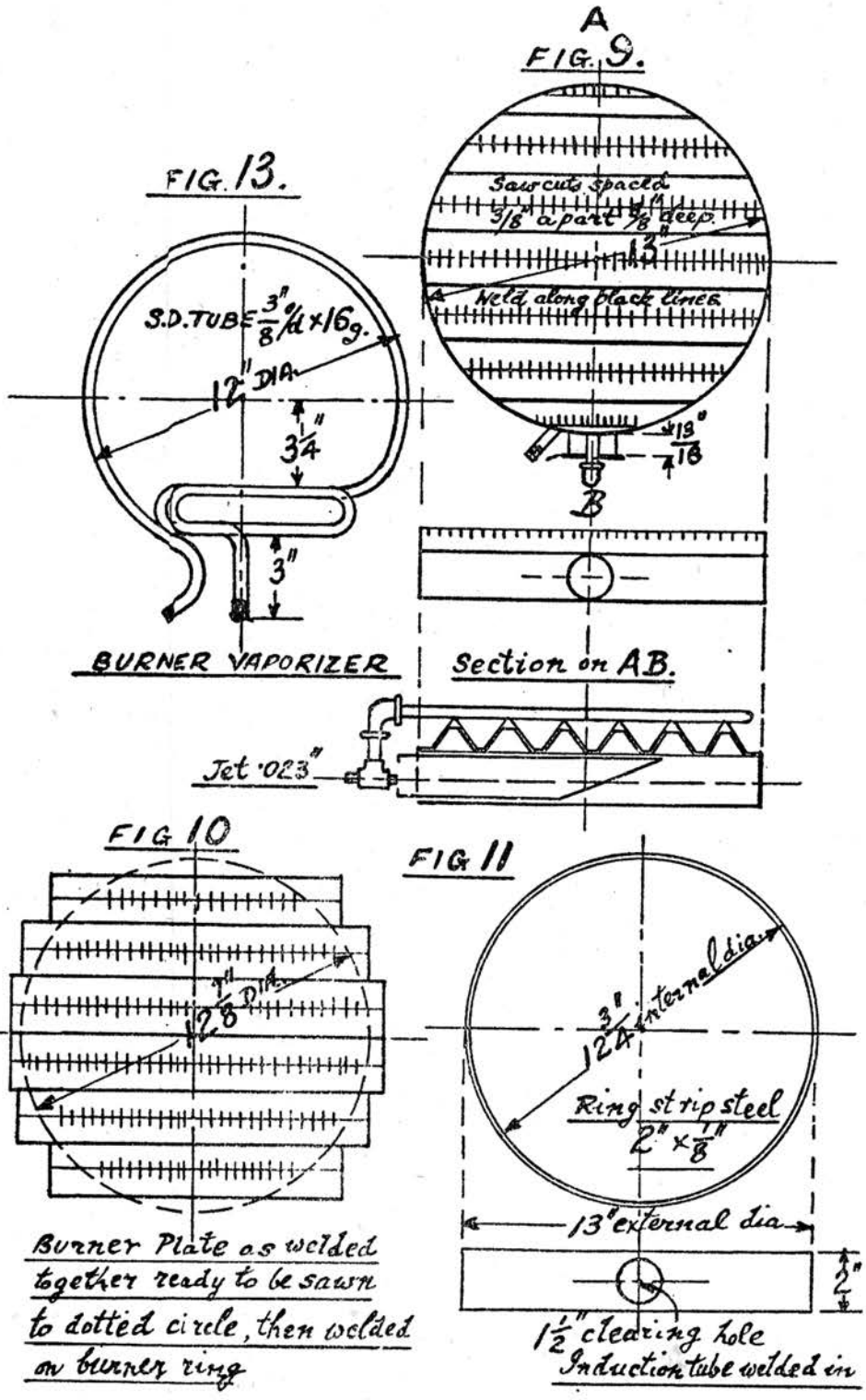

Fig F.—Burner and Assembly.