

CHAPTER 20

Lighted Aids to Navigation—Acetylene Apparatus

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20-1 GENERAL

20-1-1 Use of Acetylene Apparatus—

A. Considerable acetylene apparatus is in use by the Coast Guard. Although no new acetylene buoys are being purchased and but few acetylene installations are being made, it is expected that this type apparatus will continue to be used for a number of years to come. The apparatus described herein is that used by this Service and does not necessarily embrace all acetylene apparatus in commercial use.

20-1-5 Definition—

A. Acetylene aids to navigation apparatus, consisting of cylinders, lanterns, flasher-regulators, lenses, shades, burners, pilots, sunvalves, tubing and connections, forms the component parts of acetylene-operated lighted buoys and minor lights including range lights. The abbreviation A. G. A. used extensively throughout the chapter means American Gas Accumulator Co., manufacturers of acetylene apparatus.

20-1-10 Selection of Equipment—

A. In view of the great diversity of apparatus and combinations in use, the Service is not restricted to particular designs or makes. However, a full description of the physical characteristics of the particular type that is wanted shall be included in all work authorization requests involving the use of acetylene lighting apparatus.

20-2 MINOR LIGHTS

20-2-1 Description—

A. An acetylene minor light is designed to operate automatically for a relatively long period of time without attention. The light apparatus is powered by acetylene gas and can display various flashing characteristics. These lights are for the purpose of marking rivers, harbors, and other waterways where a light of low candlepower is required and are exhibited from fixed structures which may be located either on shore or on a marine site.

20-3 LIGHTED BUOYS

20-3-1 Description—

A. The acetylene apparatus of lighted buoys is substantially the same as is used for minor lights with minor modifications as necessary to secure the lantern and piping system to the buoy structure and to store the acetylene cylinders within the body of the buoy.

B. Lighted buoys serve the same purpose as minor lights but are utilized in locations where the erection of a fixed structure is not feasible. Various sizes and types of lighted buoys are available to meet all conditions encountered, from exposed off-shore waters to sheltered harbors and rivers.

C. A structural description of all standard and the more prevalent existing nonstandard types of lighted buoys may be found in Chapter 24, Buoys, Mooring Appendages, and Minor Structures.

20-4 ACETYLENE GAS

20-4-1 Description.—

A. The acetylene gas used for aids to navigation is usually generated from calcium carbide and is stored under high pressure in steel tanks or cylinders, also known as accumulators. Acetylene is **HIGHLY EXPLOSIVE** under certain conditions and only a small amount need be present in a confined space to create a serious hazard. It is readily ignited by a spark, match, or cigarette. Free acetylene when under pressure may also be set off by concussion. Since it is a compound that reacts to heat, it becomes unstable when compressed to more than 15 p. s. i. gage pressure. Care must be exercised in the field to strictly avoid working pressures of over 15 p. s. i., and sudden jars. Acetylene gas when below 15 p. s. i. pressure is reasonably safe *if handled with care*. Acetylene is easily lighted and burns in the open air with a thick black smoke filled with carbon flakes. Acetylene is nearly as heavy as air and has a tendency to gather and hover in more or less compact "clouds" or strata, which is a particularly dangerous condition in lanterns, tankhouses of minor lights, buoy pockets, etc.

B. *Easily recognized.*—Acetylene has no color but has a sweet, not unpleasant odor, and is easily recognized. Although acetylene is not respirable and may suffocate by entirely replacing the oxygen in the body, a small concentration has no toxic effect.

C. *Forms copper-acetylide.*—Acetylene when in contact with pure copper forms an easily ignited compound known as copper-acetylide, therefore the use of *pure* copper tubing and fittings is prohibited. Copper-covered steel high pressure tubing used in buoy cylinder pockets, when in the presence of leaking acetylene gas, may become coated with copper-acetylide crystals and will emit sparks even when struck by an ordinarily nonsparking material such as wood. A stainless steel tubing has been developed to eliminate this hazard.

20-5 ACETYLENE CYLINDERS

20-5-1 Description—

A. *How stored.*—Acetylene gas may be safely stored under high pressure in approved steel tanks containing acetone and completely filled with a monolithic porous mass of charcoal, diatomaceous earth, and binding constituents, which have a porosity of about 80 percent. The cylinder is filled to approximately 40 percent by volume with acetone, which is used as a solvent for the acetylene. Acetylene dissolves freely in acetone, the solubility increasing with the pressure applied.

The amount of acetone, by weight, introduced into each size cylinder is as follows: A-25, 16 pounds; A-50, 32 pounds; A-300, 191 pounds. After the

introduction of acetone, the cylinders are charged with acetylene gas to a settled pressure of 15 atmospheres (221 pounds) at a temperature of 70° F. By settled pressure is meant that the gas is given time to become completely dissolved and permeated throughout the mass.

B. Fusible or safety plugs.—All cylinders are provided with fusible or safety plugs. In the A-25 and A-50 cylinders, one is installed in the shoulder and one in the bottom. In the A-300 cylinder, two are installed in the shoulder and two in the bottom. Normally the plugs are screwed into the cylinder wall and sawed off flush, except in the case of the bottom plugs of the A-300 cylinder where the plugs are installed in recesses. Flush fusible plugs are generally spotted with aluminum paint for identification. All fusible plugs are made of cold-rolled steel, completely tinned and filled with a fusible metal, the melting point of which is 220°–230° F. The size of the plug in a new cylinder is $\frac{1}{8}$ -inch standard pipe thread (A. G. A. part 175-A5). An oversize plug is available for use, if necessary, when damage occurs to the wall threads in the cylinder. This plug is $\frac{1}{4}$ -inch standard pipe thread (A. G. A. part 175-A15). *Fusible plug replacements should be made only at recharging plants where adequate facilities are available.*

C. The use of acetylene cylinders and methods of handling for recharging minor lights and lighted buoys is discussed under parts 20-14, 15, and 16, as well as sections 20-5-45 and 27-5-55 of this manual.

20-5-5 Specifications—

A. For acetone: Federal Specification No. O-A-51-a.

For acetylene: United States Coast Guard Specification MSC-12.

For cylinders: Interstate Commerce Commission Contract Specification No. 8.

20-5-10 Sizes—

A. The standard sizes of cylinders used in the Coast Guard are:

Name	Nominal capacity	Average tare weight	Outside diameter	Over-all length
	<i>Cubic feet</i>	<i>Pounds</i>	<i>Inches</i>	<i>Inches</i>
A-25	100	140	$8\frac{1}{16}$	47
A-50	200	245	$9\frac{1}{8}$	69
A-300	1,060	1,250	$22\frac{1}{8}$	75

B. The A-25 (100-cubic-foot) cylinder is used in small buoys and for temporary installations in larger buoys and minor lights, or at other installations where a small quantity of gas easily handled is required.

C. The A-50 (200-cubic-foot) cylinder is used at most minor lights, in the 6 x 20A buoy, and in the 7 x 18A, 6 x 18A, 5 x 15A and other older type buoys.

D. The A-300 (1,060-cubic-foot) cylinder is used in some of the larger old-type buoys and at some

important unwatched shore lights where facilities for handling the heavy weights are available.

NOTE: The A-25 and A-50 cylinders were formerly considered to contain 88 and 180 cubic feet of gas, respectively.

20-5-15 Marking—

A. Cylinders are marked by stamping letters and figures on the shoulder of each with their registration (serial) number, cubic feet capacity, tare weight, the month and year of manufacture, and the Government stamp of approval.

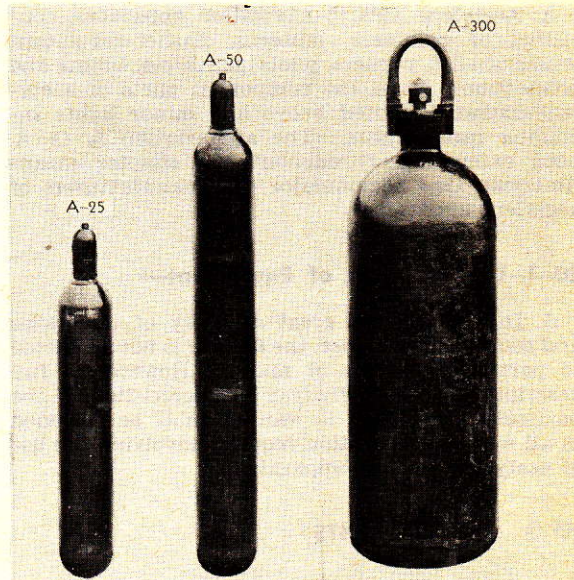


FIGURE 20-1.—Acetylene cylinders.

20-5-20 Protection Caps and Valves—

A. Caps—Lifting cylinders.—Steel screw-on caps, provided for all except A-300 cylinders, should be kept screwed in place at all times during handling and when not actually in service. The A-300 cylinder is equipped with a forged steel bail to protect the valve and to be used in lifting. The A-25's and A-50's have no such bail and must be handled with a sling around the body or by the special screw-on lifting cap (an ordinary cap may be modified in the field by cutting side holes or slots to take a hook, or by welding a padeye on the top). For cylinders with worn or nonstandard threads on the neck ring, split adjustable protection and lifting caps are available from the A. G. A. Co. (See fig. 20-4.) Pulling, twisting, or lifting cylinders by making fast around the neck of the valve should be avoided.

B. V-10 and V-70 valves.—A diaphragm-type stud valve having a female outlet tapped with a $\frac{3}{4}$ -inch straight Whitworth pipe thread is provided for each cylinder. These valves are built so that there is no leakage around the valve stem either when open or closed. The valve body is steel and the internal

A-300																				
TEMPERATURE IN DEGREES FAHRENHEIT	GAUGE PRESSURE IN ATMOSPHERES																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
110	58.8	117.0	177.0	234.0	291.0	353.1	407.4	469.5	527.4	581.4	636.0	690.0	739.2	787.2	838.2	888.0	933.6	978.0	1019.4	1056.0
105	61.2	126.0	186.9	250.8	310.8	374.4	433.2	498.0	561.0	616.2	673.8	732.0	785.4	835.2	886.8	938.4	985.2	1032.0	1074.0	1114.8
100	66.0	132.6	198.0	264.0	330.6	397.2	462.0	528.6	595.2	654.0	716.4	778.2	834.0	886.8	939.0	993.6	1041.0	1090.2	1133.4	1173.0
95	70.5	140.7	211.5	281.1	351.3	421.2	492.0	561.7	631.2	697.8	760.2	823.2	886.2	943.2	996.6	1051.8	1101.6	1150.2	1194.0	1236.0
90	73.5	148.8	224.1	294.6	373.2	449.4	525.0	595.8	666.6	737.4	804.6	871.8	934.2	996.0	1055.4	1111.2	1162.8	1212.6	1261.8	1304.4
85	77.7	153.9	239.1	313.2	397.2	479.4	558.0	632.4	706.8	780.0	851.7	924.0	990.0	1054.2	1118.4	1176.0	1229.4	1282.2	1321.8	1377.6
80	83.4	168.6	254.4	335.4	423.0	510.0	581.6	670.8	748.8	827.4	900.6	977.4	1050.6	1116.6	1183.8	1246.2	1297.8	1356.0	1407.6	1455.6
75	89.7	180.6	270.6	358.2	450.0	540.0	627.6	711.6	793.2	876.6	953.4	1034.4	1111.8	1183.2	1255.2	1320.6	1376.4	1437.0	1491.6	1539.0
70	96.0	192.0	288.0	382.2	479.4	571.2	664.8	753.6	841.2	930.0	1011.6	1094.4	1180.2	1252.8	1330.8	1398.6	1458.6	1523.4	1584.0	1632.6
65	102.9	203.1	304.5	406.8	507.6	604.8	702.6	798.6	892.8	985.2	1074.0	1159.8	1241.6	1326.6	1410.0	1483.2	1550.4	1618.2	1681.8	1735.8
60	108.0	216.0	324.0	432.0	535.8	640.8	746.4	848.4	947.4	1045.8	1140.6	1231.8	1321.8	1411.2	1499.8	1578.6	1650.6	1722.6	1786.8	1847.4
55	115.2	232.5	343.8	459.6	568.8	679.2	792.6	900.6	1006.8	1110.6	1210.2	1311.6	1407.6	1502.4	1592.4	1677.0	1759.2	1836.6	1905.0	1969.2
50	123.0	249.0	369.6	492.0	604.8	724.8	844.8	957.6	1071.0	1183.2	1290.0	1396.8	1505.4	1602.0	1692.0	1785.0	1873.8	1960.2	2040.0	2103.6
45	131.4	264.3	392.4	519.6	642.6	768.6	896.4	1018.8	1138.2	1253.4	1366.8	1483.2	1593.6	1699.8	1800.0	1891.8				
40	137.7	279.0	418.2	551.4	684.0	819.0	953.4	1084.2	1212.0	1335.0	1455.6	1578.6	1698.6	1806.0	1912.8	2005.2				
35	148.2	297.6	445.2	585.6	729.0	873.6	1015.2	1153.2	1291.8	1423.2	1551.0	1682.4	1811.4	1918.8	2030.4	2122.8				
30	159.0	316.8	473.4	623.4	779.4	931.2	1083.0	1230.0	1380.0	1519.2	1655.4	1796.4	1931.4	2056.2	2180.4					
25	168.0	336.6	504.6	664.2	832.2	994.8	1153.8	1311.0	1473.0	1623.0	1768.8	1921.2								
20	177.0	360.0	540.3	713.4	889.2	1065.0	1234.2	1405.2	1572.0	1732.2	1892.4	2058.0								
15	188.7	387.6	581.4	769.2	954.0	1144.2	1321.2	1504.8	1680.0											
10	205.5	417.6	627.0	829.2	1029.6	1231.8	1422.0	1616.4	1802.4	1981.2										
5	225.4	450.9	675.6	894.0	1113.0	1326.0	1537.2	1743.0	1938.0	2113.8										
0	243.6	487.2	732.0	969.0	1203.6	1426.8	1661.4	1881.6	2091.0											
- 5	264.3	528.0	795.0	1051.2	1300.8	1536.0	1792.8	2035.8	2259.0											
- 10	287.4	570.0	859.2	1137.6	1407.0	1656.0	1931.4													
- 15	312.3	616.2	928.8	1224.0	1515.6	1785.0														
- 20	343.8	670.8	1004.4	1315.2	1626.0	1923.6														
- 25	381.6	742.8	1089.0	1422.0																
- 30	430.8	844.8	1179.0	1554.0																

FIGURE 20-2B.—Cubic feet of gas available at various temperatures and pressures in acetylene cylinders.

parts are of such composition as to be unaffected by either acetone or acetylene gas. Cylinder valves are commonly referred to as a V-10 for the A-25 and A-50 cylinders, and a V-70 for the A-300 cylinder. See section 20-11-25 for further description. Chain plugs are provided as temporary security against leaking acetylene around the valve stem. These plugs should be secured before handling cylinders.

(1) *Opening valves.*—Special small T-shaped socket wrenches are provided for opening valves. Use only this wrench as other wrenches with increased leverage may damage the valve. All acetylene cylinder valves open by turning the valve stem to the left. When opening valves, back the stem one-fourth turn from the full open position to avoid jamming it open. Close the valves on empty cylinders.

(2) *Aligning cylinder.*—Before inserting a cylinder all the way into the buoy pocket, care should be exercised in aligning the valve of the cylinder with the pocket connection to eliminate the potentially dangerous procedure of twisting the cylinder in the pocket with a forked tee wrench on the valve. Keep the cylinders free from rust and well painted.

C. Old-type cylinders have different valve taper.—Certain old type cylinders may be found with valves having a Whitworth double taper 1½-inch pipe thread on the valve spud, i. e., instead of the standard U. S. or Whitworth ¾-inch pipe taper, a taper of 1½ inches per foot was used. Valves are not interchangeable between cylinders with these two different tapers. Therefore, when a valve needs replacement, it is necessary to check the taper on the spud. Using the following information, it is unne-

cessary to remove the valve to check the taper. Valves with double (1½-inch) tapered threads will be found on cylinders bearing the following numbers:

(1) A-25: Numbers to and including A. G. A. No. 15987; L. H. 30333 to L. H. 30784, inclusive, and L. H. 30986 to L. H. 31688, inclusive.

(2) A-50: Numbers to and including A. G. A. No. 45576; L. H. 6308 to L. H. 6709, inclusive, and L. H. 8213 to L. H. 8816, inclusive.

(3) All other A-25 and A-50 cylinders will carry valves with a standard pipe thread taper of three-quarters inch per foot.

D. Leaking valve.—If a valve is found to be leaking, open and shut the valve quickly a couple of times. The blast of gas may dislodge any foreign matter in the valve that prevents its closing tightly. If this procedure fails, another cylinder should be substituted, and in all cases the defective cylinder should be tagged and the condition reported. When it is necessary to blow down a cylinder because of a defective valve, it should be removed to an open place, warning signs posted, and the valve opened slightly until all the acetylene has slowly escaped.

20-5-25 Inspection—

A. To inspect a cylinder, remove the protection cap, and test for leaks around the fusible plug and valve stem with liquid soap solution.

B. *Determining amount of gas.*—Check quantity and quality of acetylene as follows:

(1) Weigh cylinder in pounds. Subtract tare weight stamped on cylinder from actual weight; remainder is weight of acetylene in pounds. To ar-

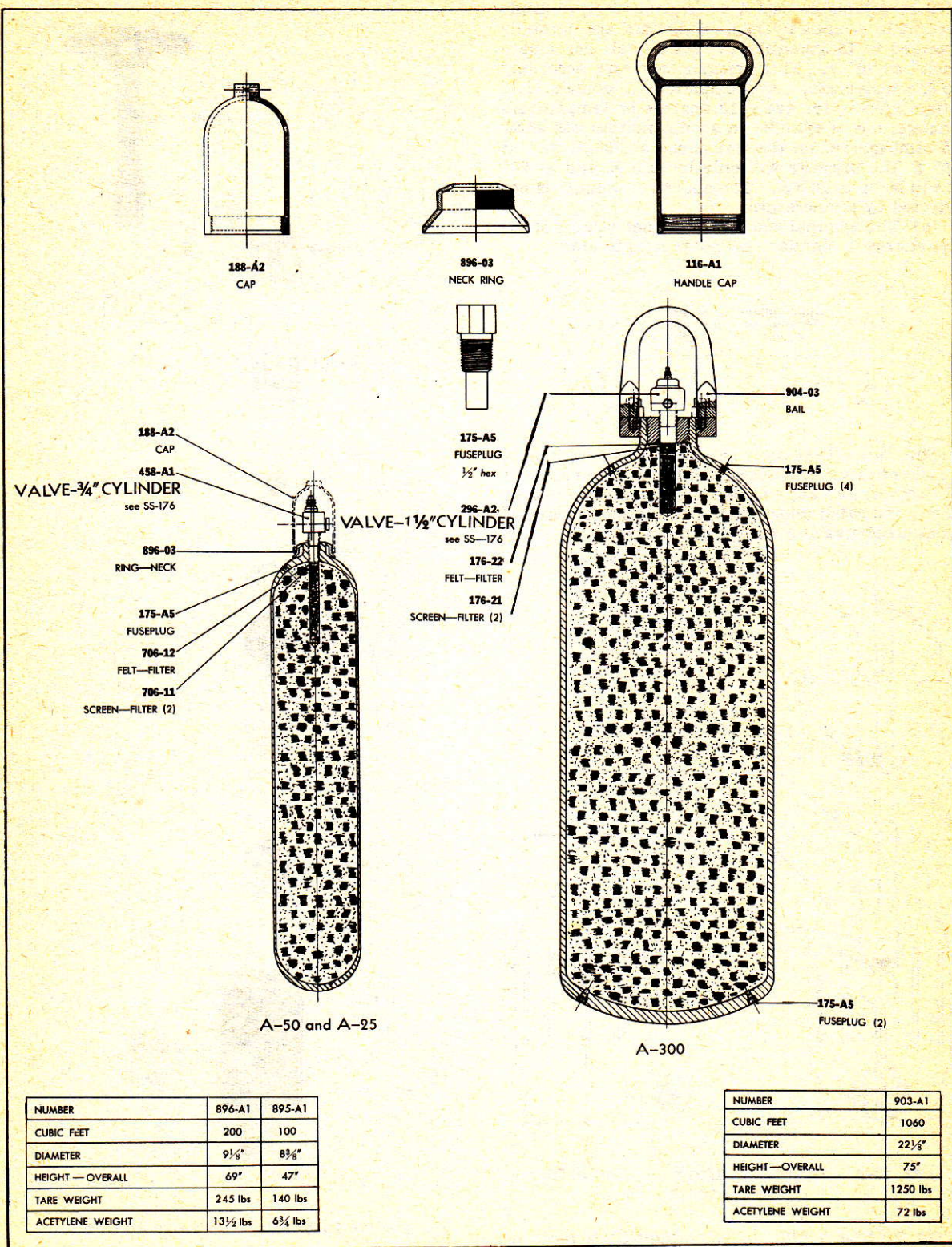


FIGURE 20-3.—Acetylene cylinders.

rive at volume of acetylene in cubic feet, multiply weight in pounds by 14.5. Cylinders are normally charged to 15 atmospheres (221 pounds per square inch) at 70° F. This pressure will vary according to the temperature, approximately 25 pounds (1.72 atmospheres) for every 10 degrees of temperature change; i. e., a cylinder in good condition will show 15 atmospheres on the test gauge at 70° F., but at 50° F. the pressure will only be 11.5 A. and at 90° it will be up to 18.5 A. The quantity (weight) is not affected by temperature.

(a) The nominal and maximum net weights of the gas charge in standard cylinders is as follows:

Type	Approximate nominal net weight	Stated maximum weight	Cubic feet
A-25	6.1	7.5	100
A-50	12.4	15.0	200
A-300	73.1	80.0	1,060

This means that these cylinders, when containing a mass of specified porosity and the specified amount of acetone, will accept the stated maximum weight of gas indicated above with a resultant pressure of 15 atmospheres at a temperature of 70° F.

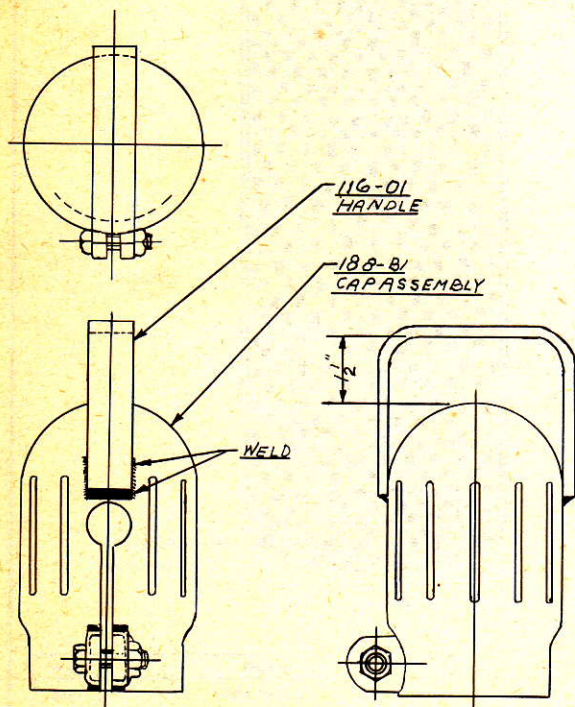


FIGURE 20-4.—Adjustable lifting cap for A-25 and A-50 cylinders.

(2) *Testing quality of gas.*—Moisten a piece of filter paper or white blotting paper with 5 percent solution of silver nitrate (available at any pharmacy). Open the valve gently, using the valve socket T wrench. Hold the paper in front of the

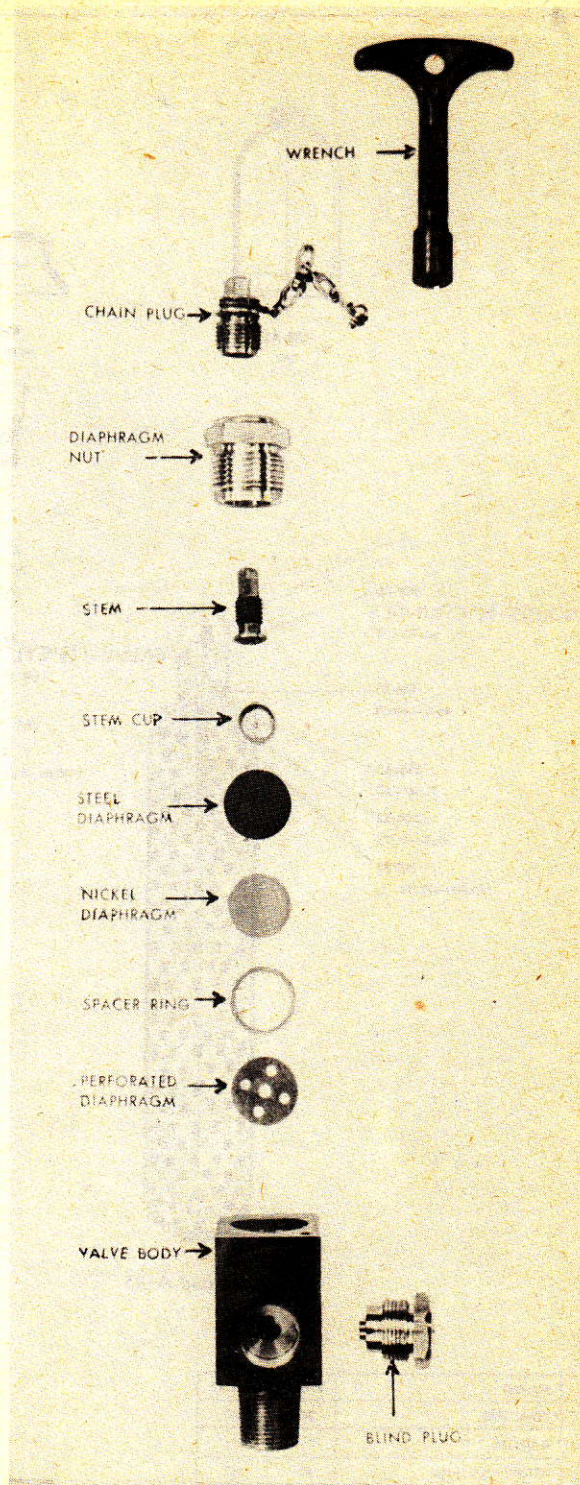


FIGURE 20-5.—Cylinder valve and parts.

escaping acetylene for about 10 seconds. If the paper remains white, or turns only slightly yellow, the gas is acceptable. Close the valve.

C. Overcharging cylinders.—After a period of years of service a cylinder may reach a condition where it will not accept its normal capacity of gas without resorting to excessive pressure. The overcharging of cylinders is not permitted. Where cylinders, after proper acetoning, fail to accept within 20 percent by weight of the stated gas charge, they shall be withheld from service and the proper authorities notified. Some indication as to the condition of the cylinder may be had by checking the weight and pressure; if upon return from the plant, the weight is normal and the pressure excessively high, or, the pressure is normal and the weight excessively low, there is an indication that the cylinder has failed to accept its normal charge at normal pressure. In this event the cylinder should be marked and sent to the A. G. A. Co. for reconditioning.

D. Reconditioning cylinders.—Cylinders are reconditioned by blowing down the gas and rebaking, after which they are reacetoned and recharged. In actual service, cylinders registering as low as 2 atmospheres should be replaced, as there is danger of liquid acetone being carried through the lines to the lighting apparatus and interfering with operation of the flasher.

E. Record.—A complete record is kept of the location of each cylinder or bank of cylinders, the size of flasher, burner or burners, the characteristic of the light, and the date of the installation. From these records the service time (number of operating days) is computed and the probable reservicing time is determined in advance.

20-5-30 Testing Pressure—

A. Test gage.—Special gages are provided for testing the acetylene gas pressure in cylinders and *are not to be used for any other purpose*. They are graduated from 0 to 30 atmospheres (1 atmosphere is equal to 14.7 pounds per square inch). As a measure of safety against possible explosion, pressure gages used in connection with acetylene are provided with steel springs, and no copper alloy is used on any acetylene high pressure equipment. In testing acetylene cylinders for pressure, the following precautions shall be taken:

(1) The gage should be turned away from the face of the person testing to afford protection from flying glass in case the gage bursts under pressure.

(2) When opening acetylene cylinder valves, turn the valve stem to the left.

B. Jammed valves.—Occasionally valves will be found to have been closed excessively tight and will be difficult if not impossible to open by hand alone. In this event the use of a short bar through the hole in the handle of the valve socket T wrench is permissible. Apply opening pressure gradually and slowly (as should be done on all occasions) so as to avoid jamming the valve in the open position.

After the valve is open, and if it is to be left in this position, turn stem to the full open position and

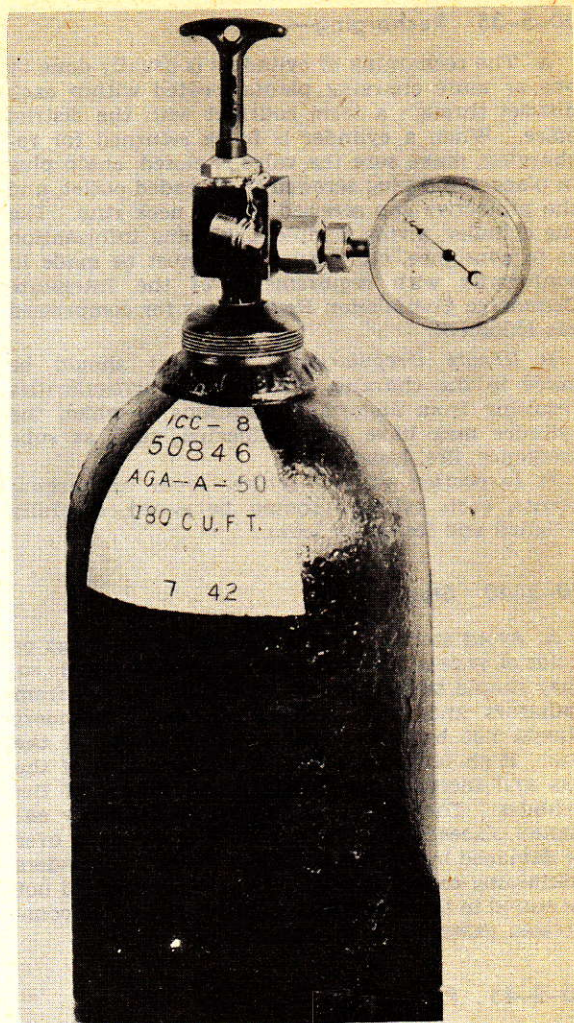


FIGURE 20-6.—Cylinder and pressure gage.

then back toward closed position about a quarter of a turn. If the stem is jammed hard in open position, there may be occasions when it is difficult to determine whether a valve is open or closed.

C. Pressure testing procedure.—Check pressure as follows:

(1) With the protecting cap removed and the valve closed, remove the blind plug. Connect the pressure gage, using a pressure gage adapter if necessary.

(2) Remove the chain plug over the cylinder valve stem. Open the cylinder valve.

(3) Record the pressure.

(4) Close the valve; replace the chain plug.

(5) Remove the pressure gage. Replace the protecting cap on A-25 and A-50 cylinders.

20-5-35 Recharging—

A. The recharging of cylinders is usually done by one or more charging plants located within each district through a term contract with the district office. When a cylinder is to be returned for recharging, make sure the valve is closed, chain plug in place, blind plug screwed in threaded outlet, and the protective cap screwed on the neck ring. Tag the cylinder, giving complete shipping information as to consignee, etc. Shipments must be made in conformity with requirements of the Interstate Commerce Commission Regulations for compressed gas shipment.

B. *Report irregularities.*—A report should be made to the charging plant of any irregularities resulting from abnormal conditions to which the cylinder may have been subjected, such as submergence, fire, leaks, etc.

C. *Inspection.*—Upon return from recharging plants, each cylinder should be gaged, carefully weighed and tested for leaks.

20-5-40 Storage—

A. Avoid storing cylinders inside of buildings or holds of vessels. However, if it is necessary to do so, they should be well ventilated and kept away from radiators and other sources of heat. Cylinders should not be exposed to the direct rays of the sun. High temperatures raise the pressure of the gas and increase the possibility of failure of the cylinder. They should be stored in definitely assigned places where they will not be knocked over or damaged by passing or falling objects. Cylinders containing oxygen, acetylene or CO₂ gas should not be stored in the same compartment with other compressed gases.

20-5-45 Precautions—

A. *When an A-25 or A-50 cylinder is not in use,* the protective cap should be screwed in place at all times. Keep the threads of the protective cap well greased.

B. *Do not use cylinders as rollers* for moving heavy objects; avoid all kinds of rough handling or falls.

C. *Close the valves on all empty cylinders,* especially when handling or shipping, to avoid the loss of acetone and as a safety precaution. Keep chain and blind plugs installed on all cylinders when valve is not in use.

D. *Do not permit smoking* around acetylene cylinders.

E. *Never attempt to peen shut a leak,* no matter how small, in an acetylene cylinder.

F. *Do not bleed gas from a charged cylinder to an empty or nearly empty cylinder* as a means of replenishing gas in a buoy or other installation. This does not mean that cylinders of varying pressures cannot be connected together in a common bank, providing the low cylinder is not more than 25 percent below the high cylinder in the bank. This is not considered a transfer of gas in the strictest sense, but rather an equalizing of pressures in a bank. Care should be taken however, when selecting a cylinder

for installation in a bank, that cylinders with nearly equal pressures be chosen where possible. Since recharging specifications permit a variation of up to twenty percent from the nominal charge, a variety of pressures will be encountered under certain temperature conditions.

G. THE PRECAUTIONS TO BE OBSERVED IN HANDLING ACETYLENE APPLY TO CYLINDERS THAT ARE APPARENTLY EMPTY, OR NEARLY SO, AS WELL AS TO THOSE FULLY CHARGED. ALTHOUGH ACETYLENE GAS IS A DANGEROUS EXPLOSIVE SUBSTANCE, ANY ACCIDENT THAT OCCURS IN ITS USE CAN ONLY BE BLAMED ON CARELESSNESS. REMEMBER TO KEEP YOUR HEAD AND THINK WHEN WORKING WITH ACETYLENE.

H. Repeated emphasis on the care and precautions in connection with the use of acetylene as stated in this text is not intended to convey the impression that acetylene gas is unsafe to use. Acetylene apparatus similar to that used by this Service is widely used throughout the world for aids to navigation and for other commercial use. However it must be remembered that **ACETYLENE GAS IS SAFE TO USE ONLY IF YOU ARE CAREFUL.**

20-6 LANTERNS**20-6-1 General Description—**

A. *Construction.*—Acetylene lanterns are the inclosures which house the light source apparatus and the lens. They are made of bronze or aluminum, and are designed to withstand severe weather conditions. All types and sizes of bronze lanterns are provided with copper hoods. Aluminum lanterns have an aluminum hood.

B. *Lantern ventilation.*—All lanterns are arranged with a ventilating system that takes in fresh air around the eaves, carrying it downward past the glass lens to the bottom of the pot. The products of combustion are carried up through the center tube and the burnt gases escape at the top of the hood. The thermal syphon system of ventilation keeps the lens clean, otherwise the burnt gases would deposit a grey ash that would soon obscure the light. With the exception of the 300-mm. Service-type lantern and range lanterns, all other acetylene lanterns are interchangeable between lighted buoys and minor lights. The lantern base houses the flasher-regulator assembly and is provided with a lantern valve with a pressure gage connection and drain (except the 150-mm. lantern which does not have the pressure gage connection). On the outside of the base, bosses are tapped to receive mounting bolts.

C. *Types of lanterns in use.*—There are three sizes of standard acetylene lanterns (150, 200, and 375 mm.) now used by the Coast Guard, manufactured by the A. G. A. Co. Several older "Service" types (200 and 300 mm.) lanterns are also in use. Replacement parts for these lanterns are still procurable through Coast Guard Supply Centers. A few 350 mm. A. G. A. range lanterns are also in use.

D. Two sets of tapped holes will be found on the bottom in the interior of all lantern bases (except

the 150 mm. lantern). The outside set (pitch circle 6-11/16 inches) is for all flashers now in use. The inside set of holes was intended for older type flashers with shorter lugs, which are now obsolete.

20-6-5 Specific Types—

A. Following is a description of each type of lantern now in use including several nonstandard types which are no longer being manufactured but which may be expected to remain in service for a number of years.

B. *150-mm. types.*—This A. G. A. lantern consists of a base, lens section, and hood. The base houses a small flasher-regulator (50 mm.) with a clear or colored glass shade. The base is provided with an inlet connection for a standard F-10 (3/4-inch Whitworth) fitting. Variations in detail of construction of this lantern will be encountered as follows:

(1) The lantern in current manufacture contains a flasher-regulator which carries a shade holder ring upon which a shade, either clear, red, or green in color, is mounted. The shade is mounted in a holder which fits into the flasher ring by means

of a bayonet type of arrangement. At the top of the shade holder is located a ventilator hood, the shade and hood forming an integral part of the lantern ventilating system.

(2) Lanterns of older design carry a shade, larger in diameter, in spring clips fastened to the bottom of the lens rings. The ventilation of this lantern is achieved by a series of baffles in the hood.

(3) Older type lanterns are provided with a hinge between the base and lens section and are held closed by a screw or bolt opposite the hinge. In lanterns of recent design the hinge has been eliminated, the base and lens section being held together by use of three screws.

(4) The inlet connection in all designs is provided with filters made up of felt disks. These inlet connections are threaded into the base casting and are prevented from unscrewing by use of a set-screw. The lugs for the holding-down bolts are drilled for 3/8-inch bolts in a bolt-hole circle of 9 1/8-inch diameter.

(5) In the newer type lanterns, the lens is held in place between the top and bottom rings by six round tie rods. Flat bars are used in older types.

(6) In all designs, flat cork gaskets are placed at the top and bottom of the lens with the void around the lens filled with putty. A standard T socket wrench is required for the hood and base clamping screws. The lens is made of pressed glass and is directly exposed, there being no stormpanes on this lantern.

The latest design 50-mm. flasher-regulator provides for a sunvalve installation. There is no Service-type counterpart of this lantern.

C. *200-, 300- (A. G. A.), and 375-mm. lanterns.*—These lanterns are of the same fundamental design, consisting of a base, stormpane section and top or hood section. The base contains the flasher-regulator unit and is provided with a combination inlet and test manifold. Bosses are cast in the bottom and threaded for hold-down bolts. The stormpane section consists of a glass housing made up of segments or heavy plate glass set into a framework by use of a specially prepared putty and holding strips. (The 300-mm. Service lantern does not have stormpanes.) This section contains the lens. The hood serves as a ventilator and is fastened to a ring which is hinged to the top of the stormpane section to provide access to the inside of the lantern.

(1) *Interchangeable.*—With the exception of the 300-mm. lantern, all lanterns in current Coast Guard use may be used interchangeably on buoys or minor light structures.

(2) The 200-mm. lantern is a stormpane lantern containing a 360° drum-type 200-mm. pressed glass lens and a 130-mm. flasher-regulator. There are two types in use, the A. G. A. and the Service lanterns (See figs. 20-11 and 20-12.)

(a) *Comparison of 200-mm. A. G. A. and Service types.*—The component parts, such as the base, stormpane section, and the top sections are not interchangeable between the two types. However, they do use the same flasher-regulator, stormpane glass and lens. The holding down bolts are three-fourths inch and are located on a 7 1/8-inch pitch circle.

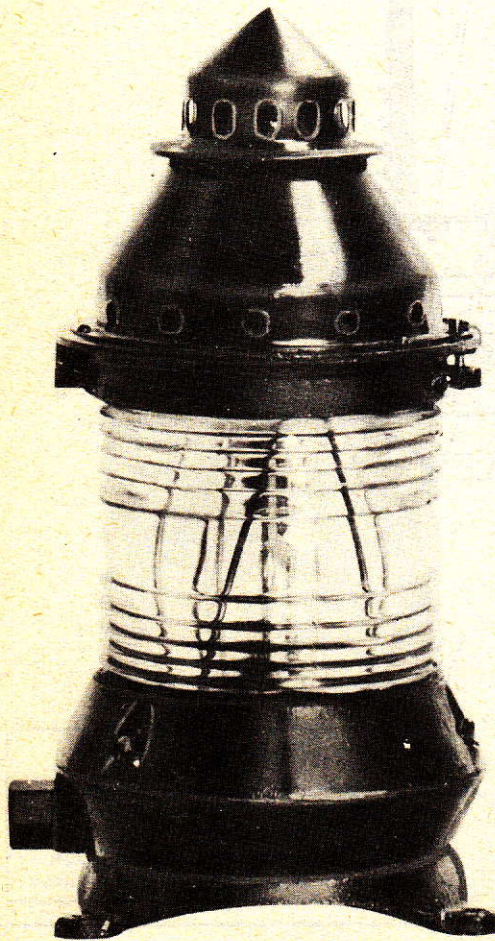


FIGURE 20-7.—150-mm. lantern.

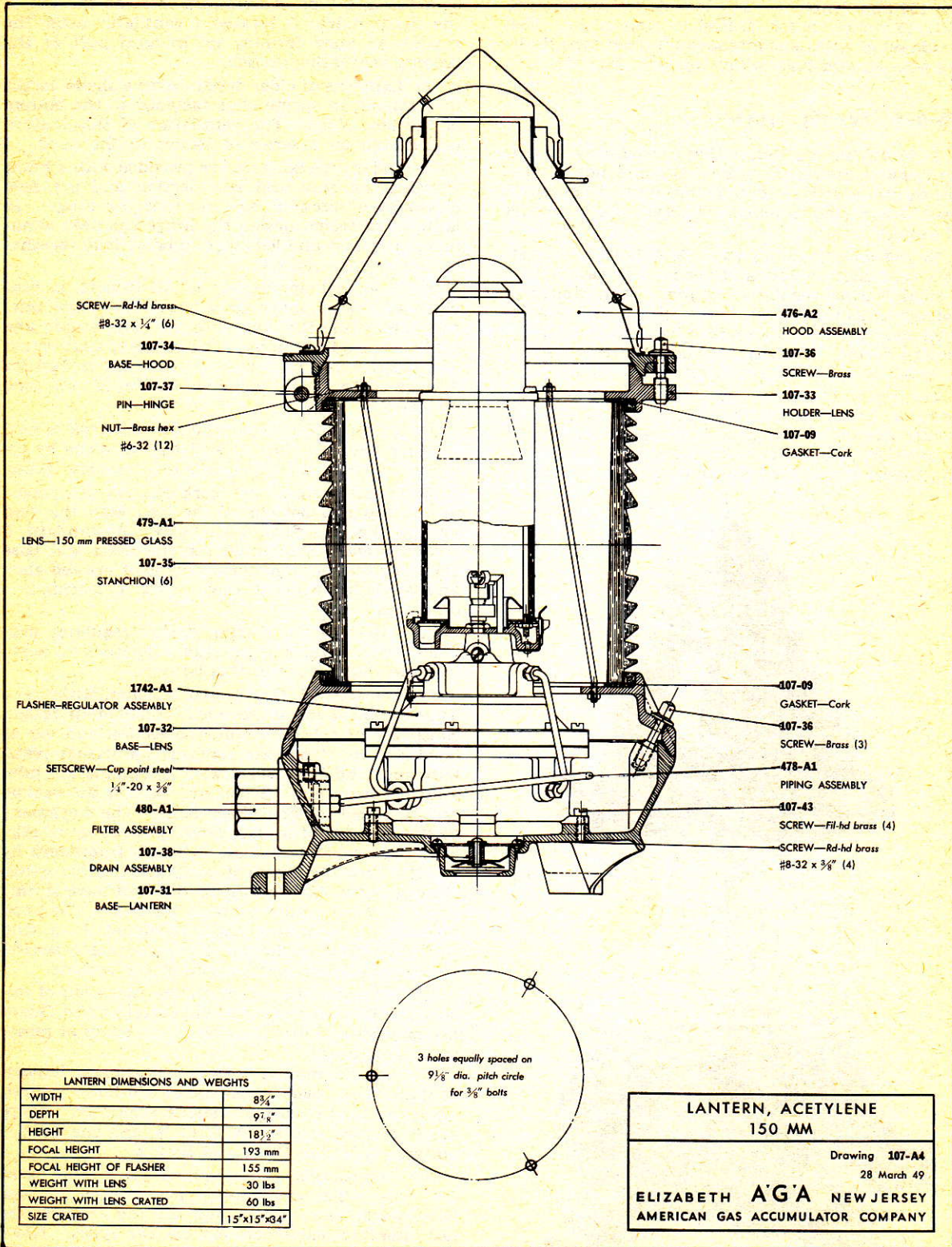


FIGURE 20-8.—150-mm. A. G. A. lantern.

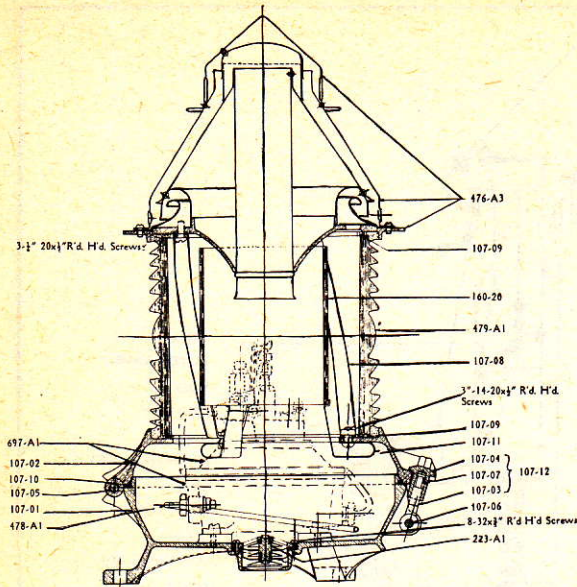


FIGURE 20-9.—150-mm. A. G. A. lantern, old type.

(b) Color shades for the Service lanterns may be used in the A. G. A. lantern but not vice versa.

(c) The inlet valves are not interchangeable.

(d) A sunvalve cock may be installed in the A. G. A. lantern but not in the Service-type.

(e) The A. G. A. lantern is provided with a large ring which fits in the lower part of the stormpane section and carries the 200-mm. lens (and color shade when used).

(f) The Service-type ring also fits into the lower part of the stormpane section, but carries the lens only. The color shade is fitted inside the lens. A spring arrangement is located underneath the hinged lantern top which serves as a holding clamp for the lens.

(3) *Comparison of 300- and 375-mm. types.*—The 300-mm. A. G. A. lantern is similar in construction to the 200-mm. A. G. A. lantern but is larger and is not used on buoys. It uses the same size color shade as the 200-mm. lantern but has a 300-mm. cut glass lens. The 300-mm. Service lantern is the only lantern currently in use, other than the 150-mm. lantern, which does not have stormpanes. Like the A. G. A. 300-mm. lantern, it is used on fixed structures only. The 375-mm. A. G. A. and Service lanterns are stormpane lanterns similar to their 200-mm. counterparts. The holding down bolts are 1 inch size on a pitch circle $11\frac{13}{16}$ inches.

D. *200- and 350-mm. range type.*—Range lanterns differ from the 360° drum lens type in that they are provided with a "bulls-eye" type lens which gives a directional concentrated or spread beam. There are two types currently in use; the 200- and 350-mm. A. G. A. lanterns.

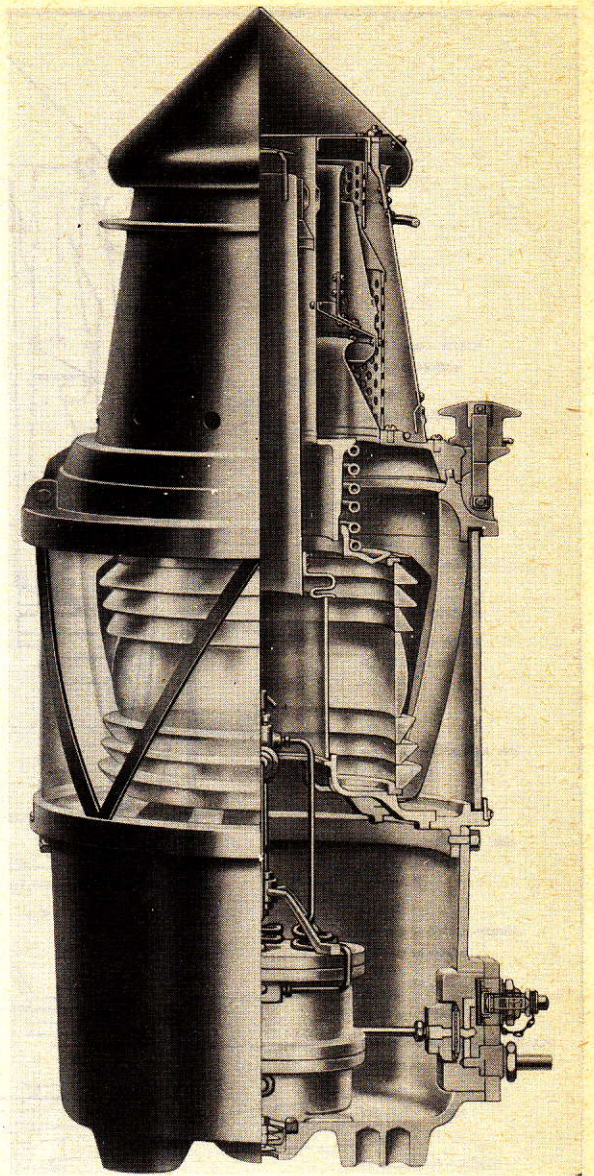


FIGURE 20-10.—Cutaway of 200-mm. A. G. A. lantern.

The lantern consists of a base, body, lens, and hood. The base contains the flasher unit and provision for the installation of a sunvalve. The body is a cylindrical casting with an opening on one side containing a hinged lens holder ring. A spherical glass reflector is mounted opposite the lens. Access to the interior of the lantern is through the hinged lens ring. A 130-mm. flasher is mounted in front of the reflector. The color of the light is determined by the color of the pressed glass lens. Older cut glass lenses required a color disk shade when red or green color was necessary.

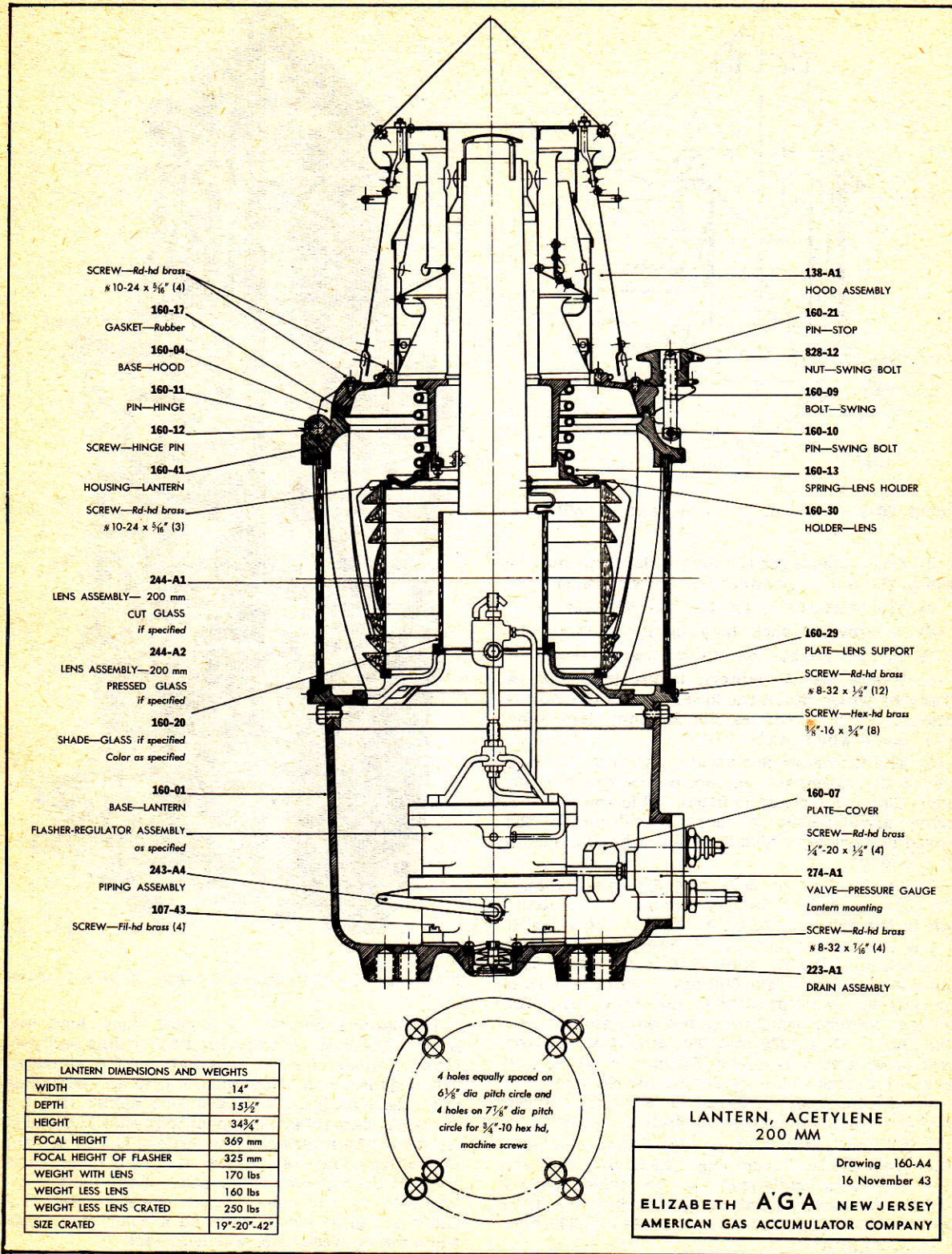


FIGURE 20-11.—200-mm. A. G. A. lantern.

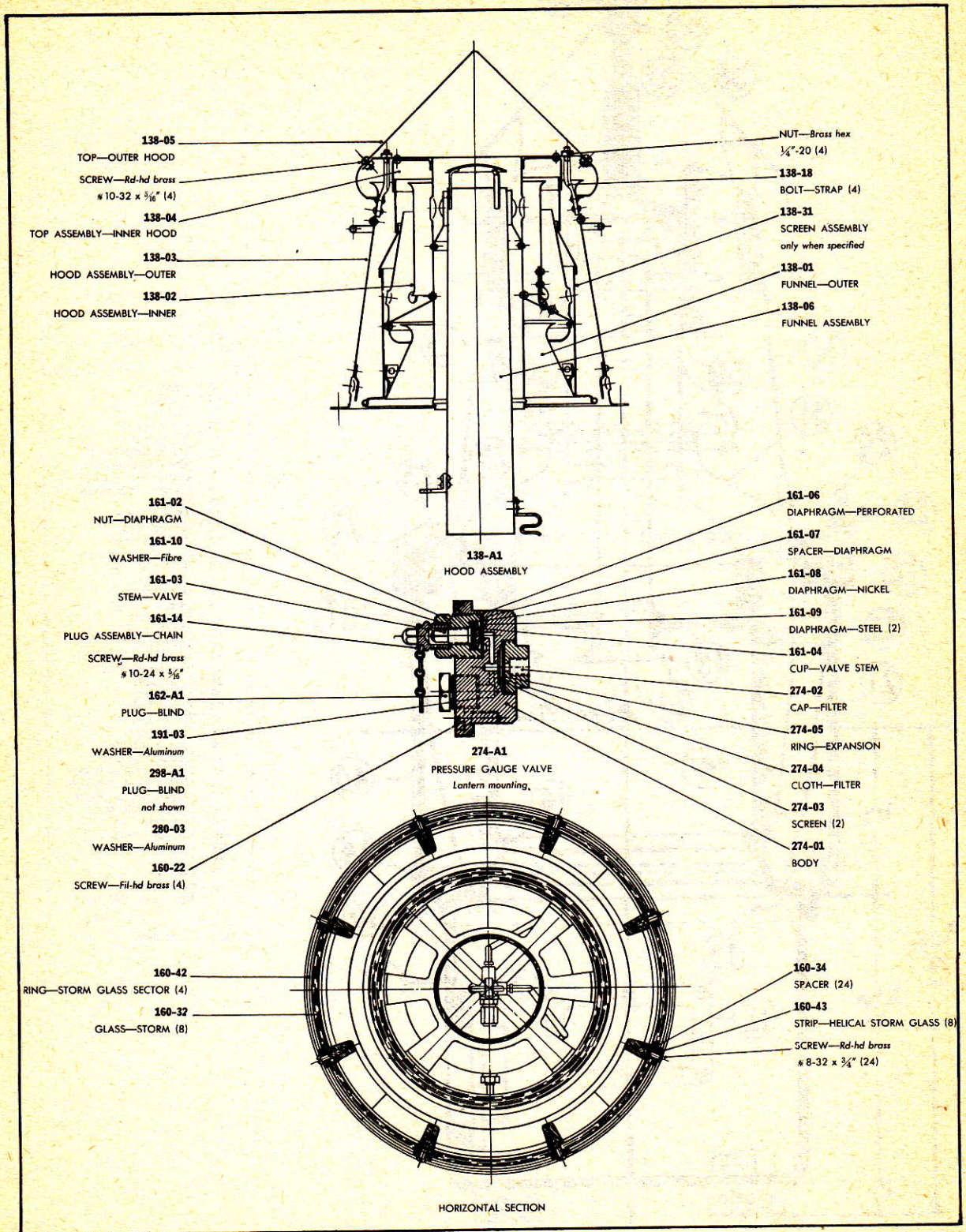
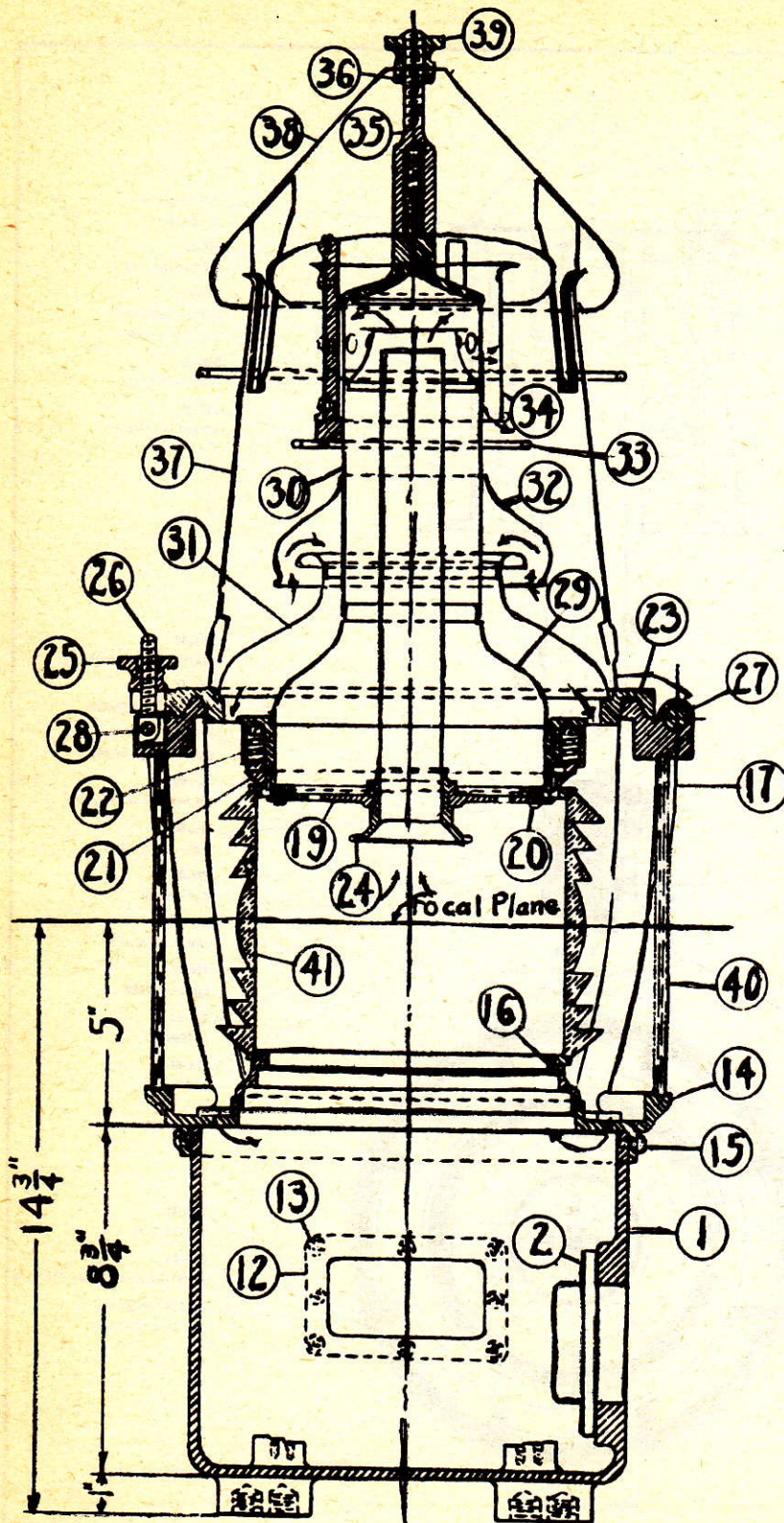


FIGURE 20-11A.—200-mm. A. G. A. lantern parts assemblies.



LIST OF PARTS	
Part No.	Name
1	Base
*2	Valve body
*3	Valve
*4	Valve plug
*5	Valve cap
6	Tank conn. nut
7	Tank connection
8	Gauge conn. nut
9	Gauge connection
*10	Plug
*11	Mach. Screw
12	Cover plate
13	Mach. screw
14	Storm glass frame
15	Mach. screw
16	Lens base
17	Glass clamp*
18	Mach. screw
19	Flue plate
20	Mach. screw
21	Lens ring
22	Lens ring spring
23	Top hinge ring
24	Draft flue
25	Latch nut
26	Latch bolt
27	Hinge pin
28	Latch pin
29	Lower int. flue
30	Upper int. flue
31	Lower inlet deflector
32	Upper inlet deflector
33	Outlet def. support
34	Outlet deflector
35	Cap bolt
36	Cap bolt lock nut
37	Outer hood
38	Cap
39	Cap nut
40	Storm pane
41	Buoy lens 200 mm.

*Valve complete.

FIGURE 20-12.—200-mm. Service-type lantern.

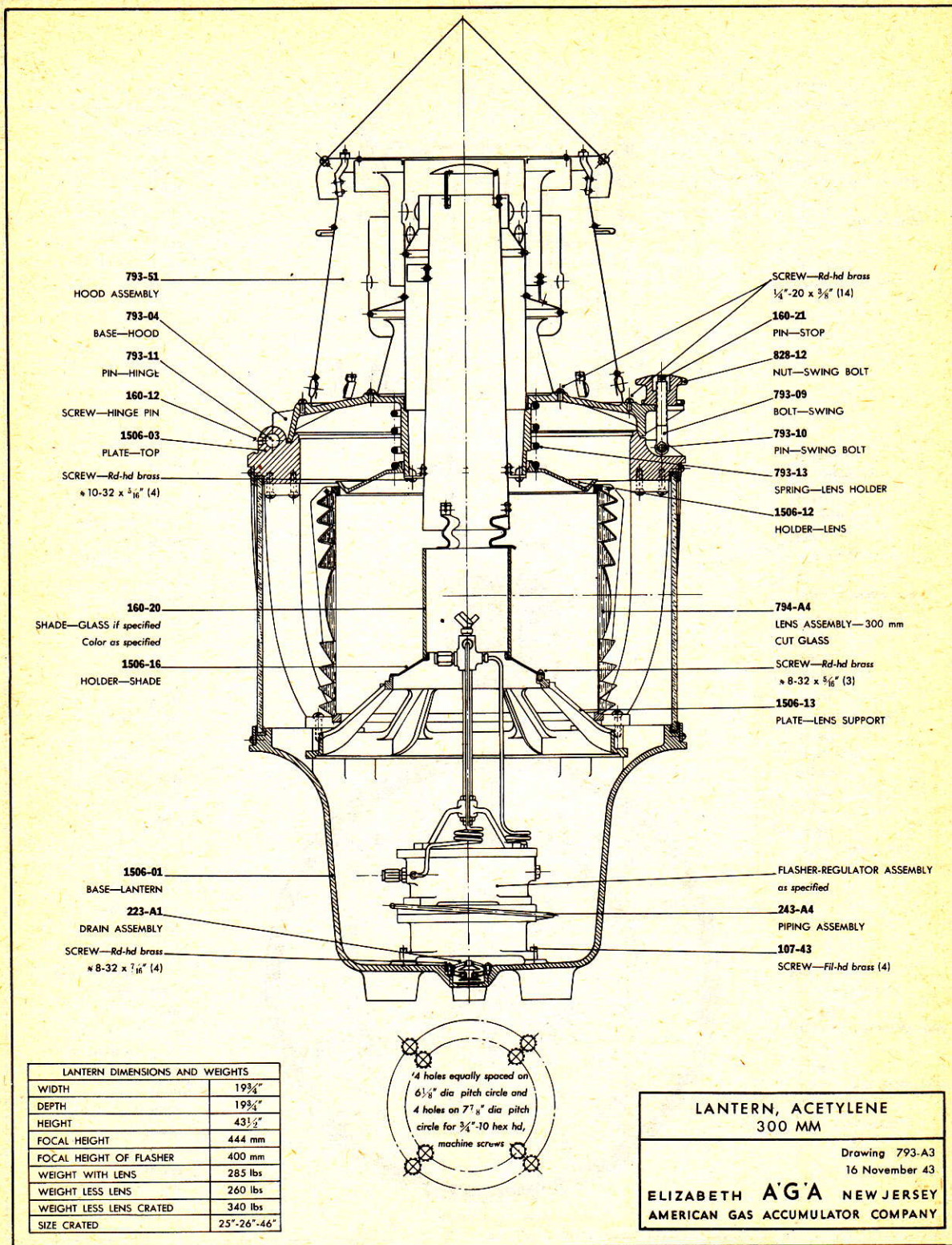


FIGURE 20-13.—300-mm. A. G. A. lantern.

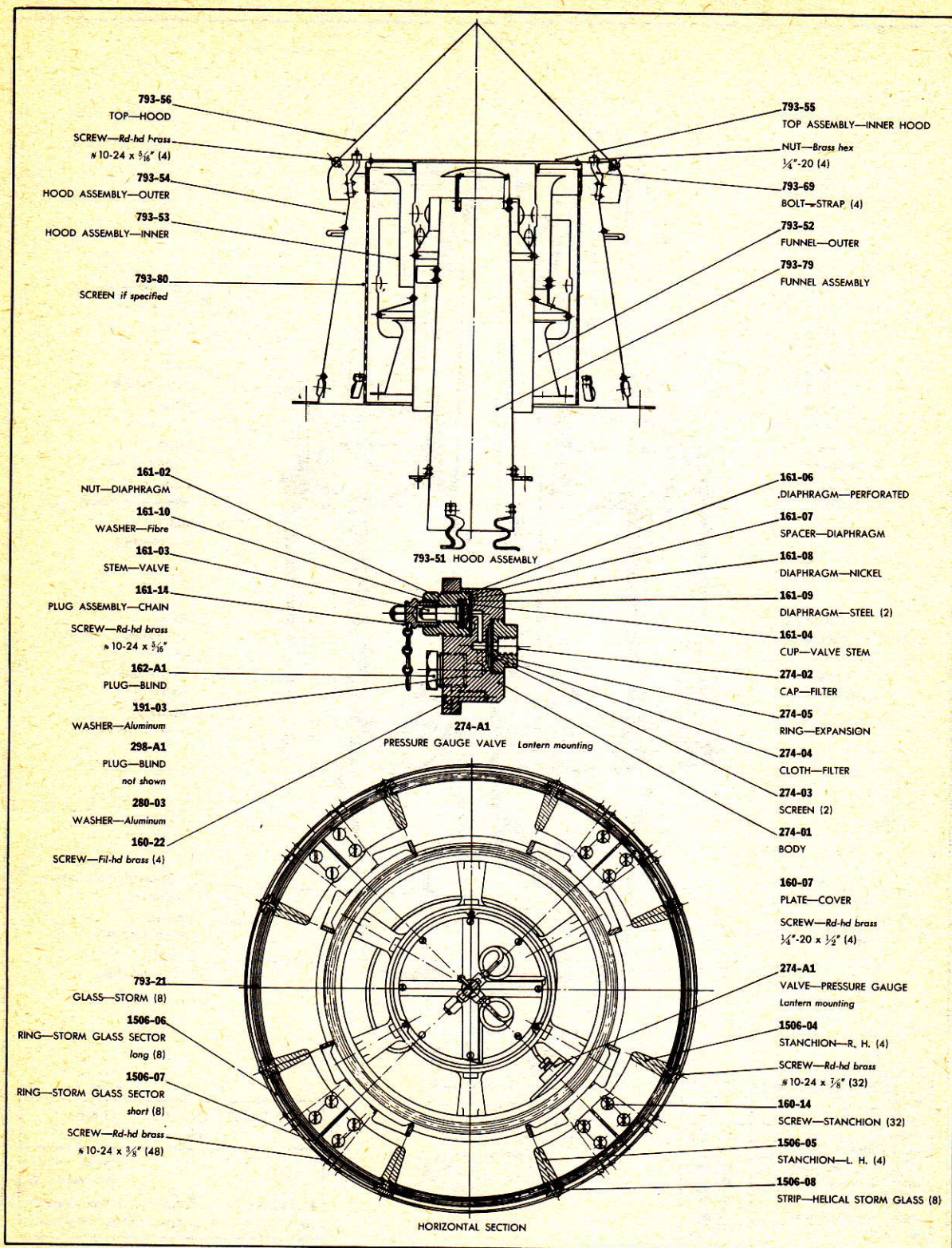
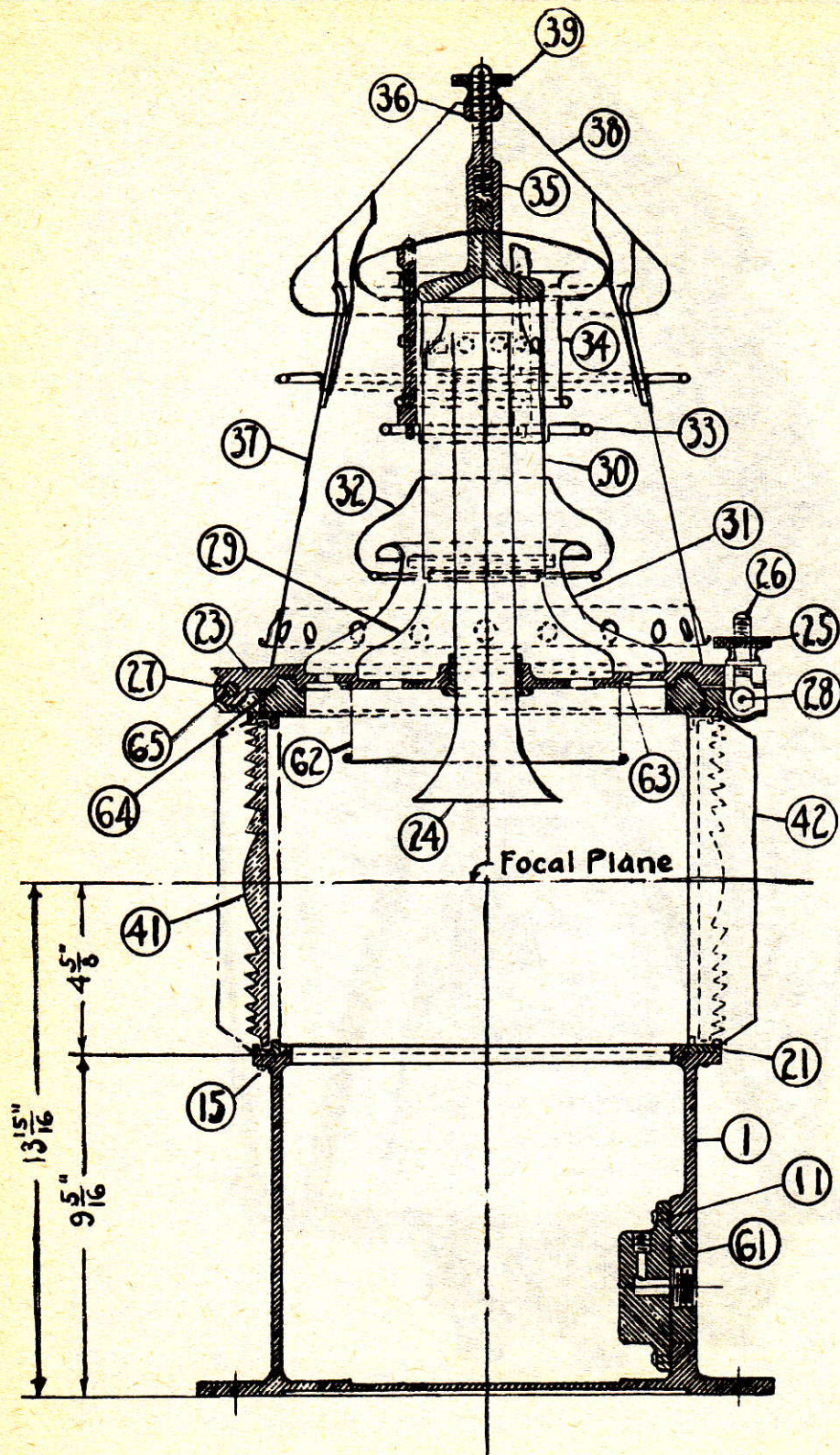


FIGURE 20-13A.—300-mm. A. G. A. lantern parts a ssemblies.



LIST OF PARTS

Part No.	Name
1	Base
61	Manifold
62	Vent ring
63	Mach. screw
11	Mach. screw
15	Mach. screw
21	Lens ring
23	Top hinge ring
24	Draft flue
25	Latch nut
26	Latch bolt
27	Hinge pin
28	Latch pin
29	Lower int. flue
30	Upper int. flue
31	Lower inlet deflector
32	Upper inlet deflector
33	Outlet def. support
34	Outlet deflector
35	Cap bolt
36	Cap bolt lock nut
37	Outer hood
38	Cap
39	Cap nut
41	Lens 300 mm.
42	Lens ring astragal
64	Mach. screw
65	Bottom hinge ring

FIGURE 20-14.—300-mm. Service-type lantern.

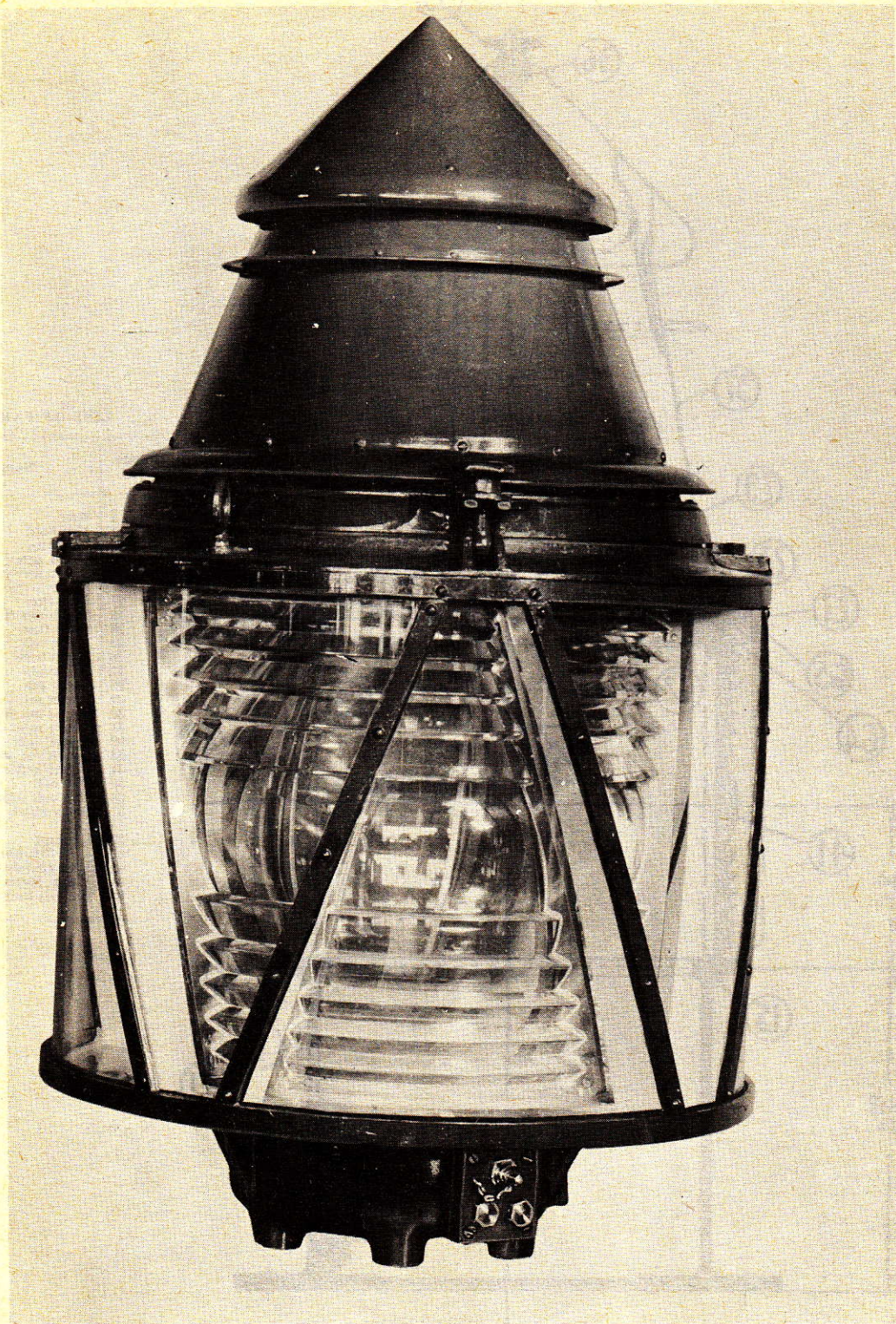


FIGURE 20-15.—375-mm. A. G. A. lantern.

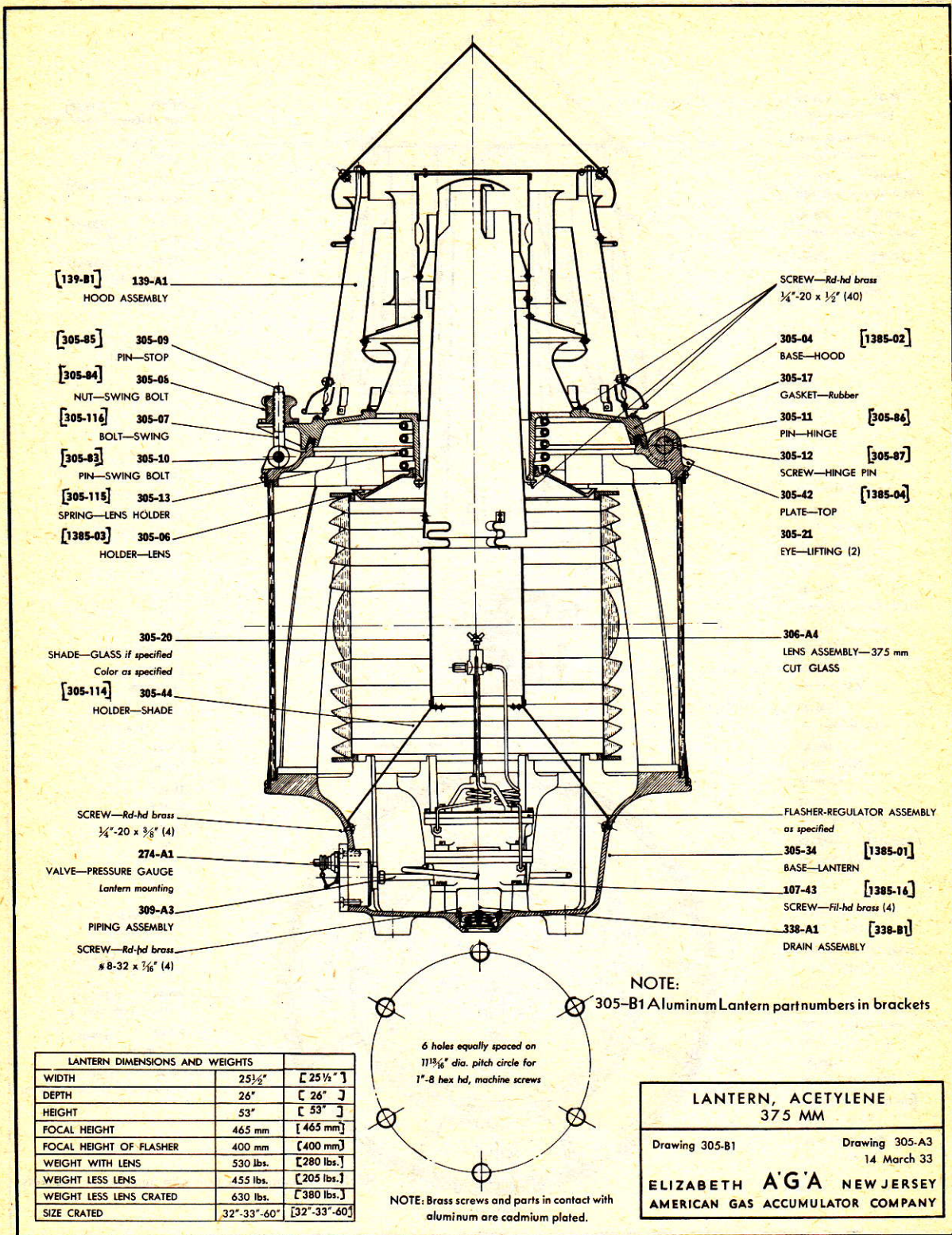


FIGURE 20-16.—375-mm. A. G. A. lantern.

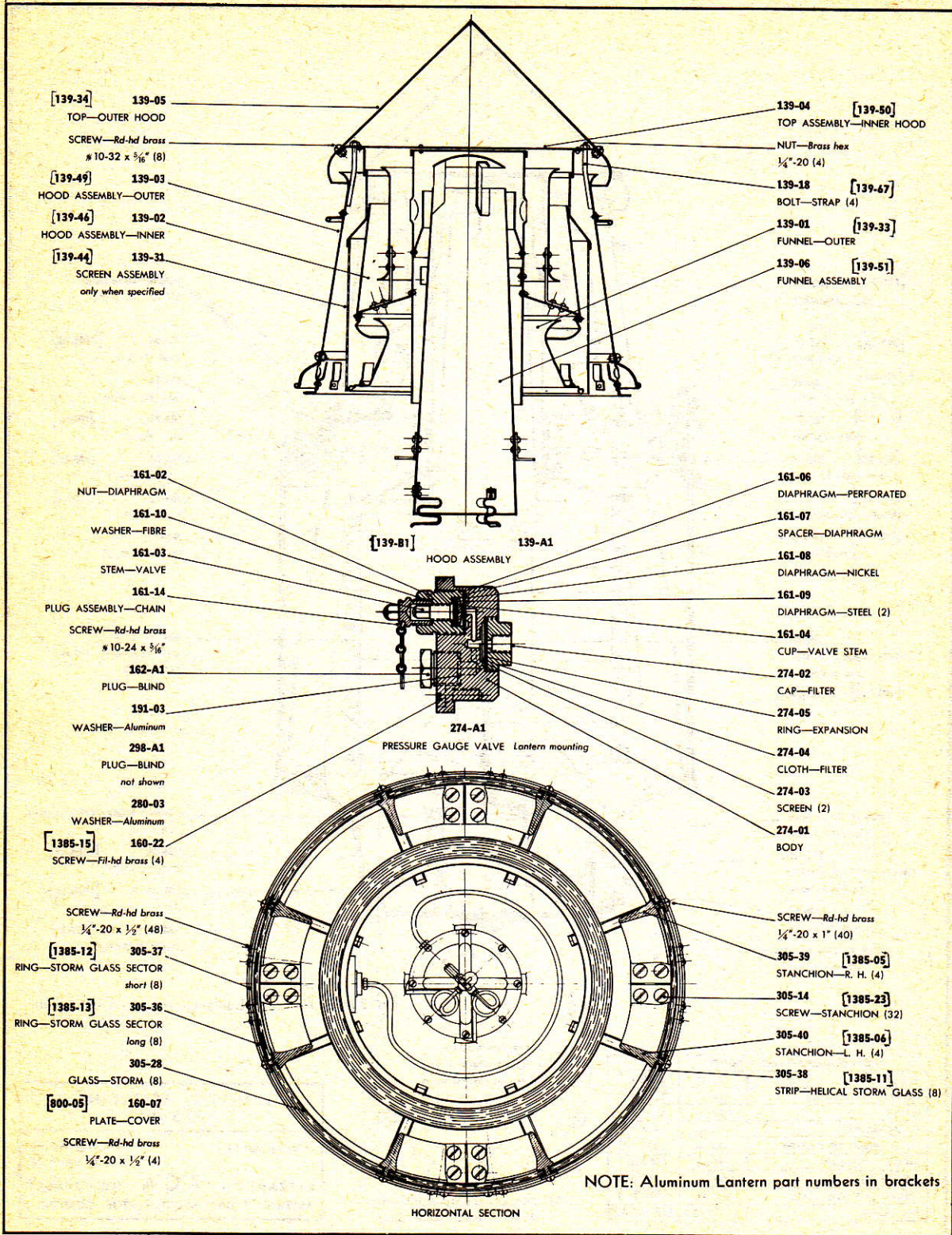
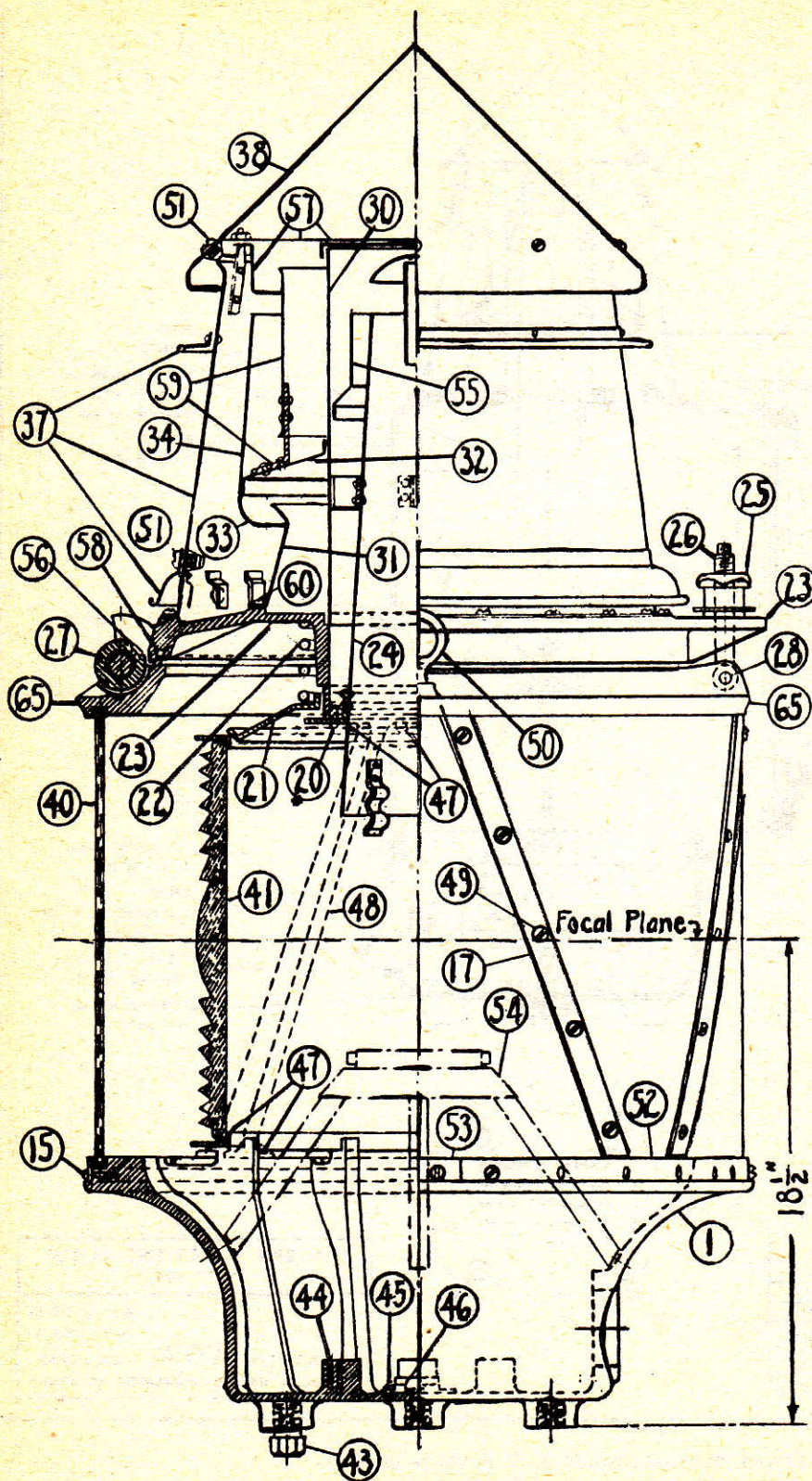


FIGURE 20-16A.—375-mm. A. G. A. lantern parts assemblies.



LIST OF PARTS

Part No.	Name
1	Base
*2	Valve body
*3	Valve
*4	Valve plug
*5	Valve cap
6	Tank conn. nut
7	Tank connection
8	Gauge conn. nut
9	Gauge connection
*10	Plug
*11	Mach. screw
51	Knurled screw nut
52	Long ring band
65	Bottom hinge ring
15	Mach. screw
53	Short ring band
17	Glass clamp
54	Shade holder
55	Flue brace
20	Mach. screw
21	Lens ring
22	Lens ring spring
23	Top hinge ring
24	Draft flue
25	Latch nut
26	Latch bolt
27	Hinge pin
28	Latch pin
56	Hinge pin lock screw
30	Upper int. flue
31	Lower inlet deflector
32	Upper inlet deflector
33	Outlet def. support
34	Outlet deflector
37	Cap base
38	Gasket
59	Outer hood
40	Middle flue
41	Storm pane
41	Buoy lens 375 mm.
60	Mach. screw
43	Bottom bolt
44	Mach. screw
45	Mach. screw
46	Baffle
47	Mach. screw
48	Helical bar
49	Mach. screw
50	Eye bolt

*Valve complete.

FIGURE 20-17.—375-mm. Service-type lantern.

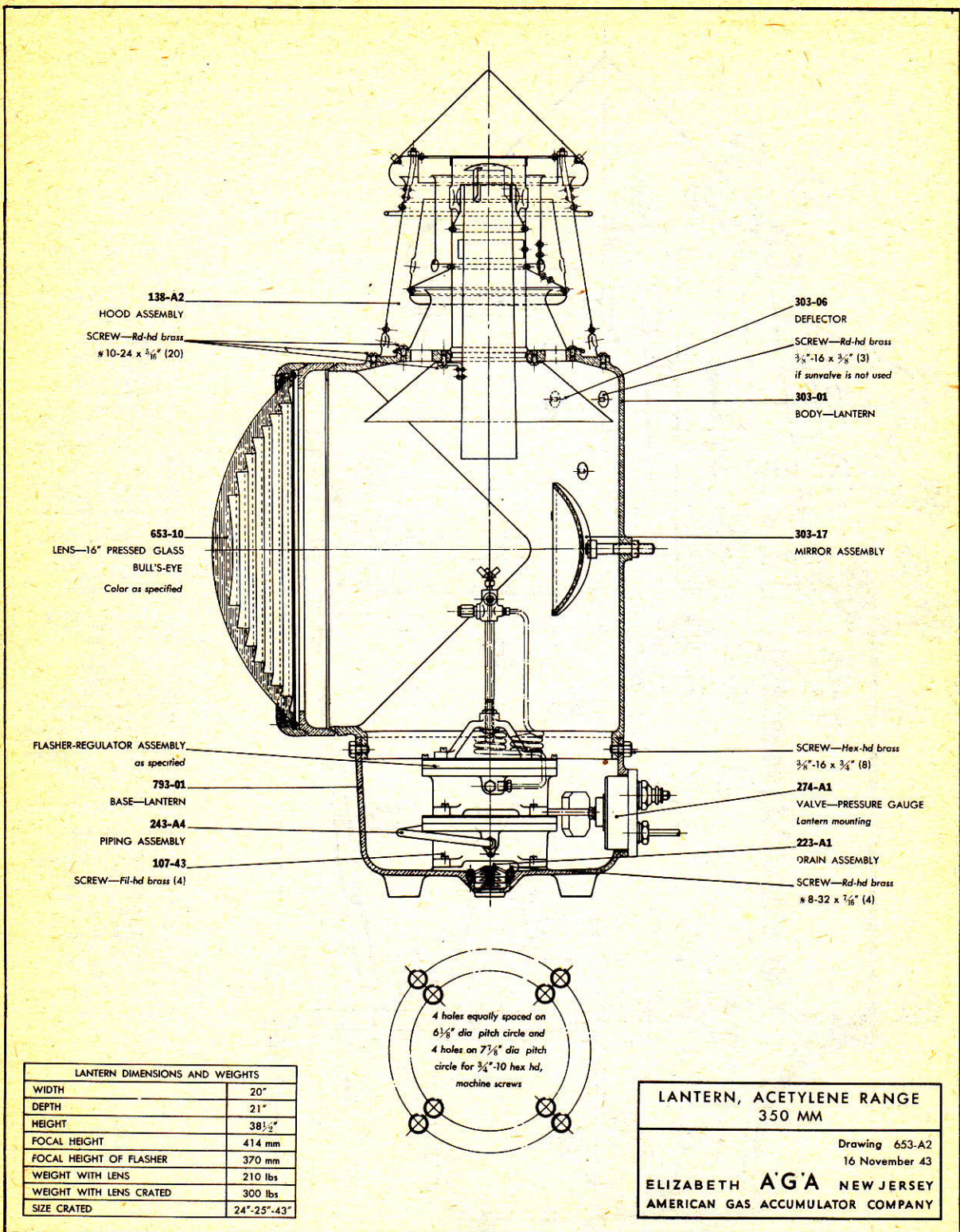


FIGURE 20-18.—350-mm. A. G. A. range lantern.

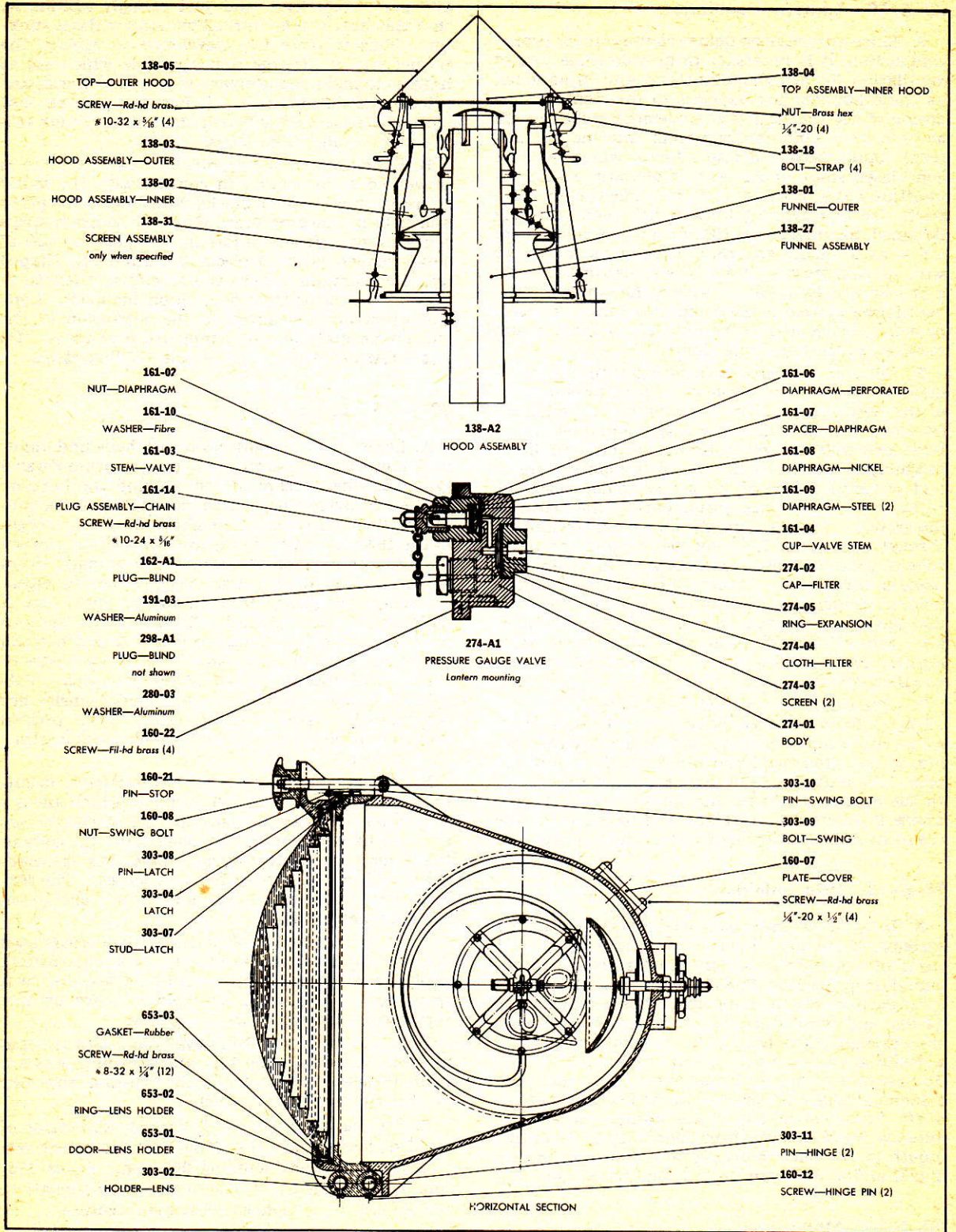


FIGURE 20-18A.—350-mm. A. G. A. range lantern parts assemblies.

20-6-10 Lantern Ventilation—

A. Since an acetylene flame requires air for proper combustion, it is necessary to provide some sort of ventilation for acetylene lanterns, and in as much as these lanterns are exposed to the weather, the design of the ventilating arrangement must be such as to prevent wind and rain from entering the lantern. Condensation is also a factor which must be considered since under certain climatic conditions moisture has a tendency to form inside the lanterns. Each size and type of lantern has been carefully designed to provide ventilation and circulation of air so as to assure an unflinching light during heavy wind or rain storms, and at the same time, provide a proper circulation of air within the lantern. The ventilating system is made up of a series of baffles or deflectors located in the head of the lantern and fastened to the top hinge ring.

B. *150-mm. lantern.*—A variation of this arrangement is found in the 150-mm. lantern wherein part of the ventilation system is contained in the burner housing. In addition to the baffles contained in the hood assembly of the 150-mm. lantern, an inner assembly is located at the top of the lantern shade and serves as a part of the shade holder assembly. In fact, the shade itself forms part of the ventilating system. In operation, the air enters the lantern through a series of holes located around the lower edge of the outer hood, passes down into the lantern base, up through the perforated bottom of the shade holder, through the top of the shade holder assembly and finally out through the top of the outer assembly. Since the shade forms part of the ventilating system, clear shades are used when no color is specified for the light.

C. *Circulation of air.*—The circulation of air in all cases follows the same pattern. That is, fresh air enters a series of holes located around the bottom of the outer hood and passes on down into the base. From there it is drawn up around the flasher by the heat of the flame, up through the lens, from where it enters the draft flue and passes on out to the atmosphere under the edges of the top cap.

20-6-15 Drip Shield—

A. In spite of the excellence of the ventilating systems, there are climatic conditions in certain parts of the country which cause moisture to accumulate in the draft flue of the lantern. This moisture, particularly in shore lights, has a tendency to gather and drop on the flasher, burner, and pilot, thus extinguishing the light. This is prevented by a device known as a drip shield. It is a cast bronze disc about 3 inches in diameter which, by means of attachment lugs, is fastened to the lower end of the draft flue directly above the flasher burner and extends down about three-fourth inch from the mouth of the flue. Moisture thus falls on the drip shield and is deflected away from the burner.

20-6-20 Stormpanes—

A. The stormpane glass, figure 20-20, is imbedded in place with a mixture of common putty, pure white lead, and whiting in the ratio of three parts putty,

one part white lead, and just enough whiting so that the mass can be worked by hand without sticking. This mixture was developed to replace the former use of litharge and glycerine which set so hard as to make replacement of a broken stormpane a long and difficult task. It has been proven that plain putty has not sufficient staying power for satisfactory results in lanterns.

B. *Expansion of stormpane glass.*—The glass is prevented from coming in contact with the metal frame by small wooden blocks embedded in the putty and held in place by brass strips. The brass strips are prevented from contacting the glass by use of small wooden blocks or pieces of brass tubing slipped over the clamping screws and of sufficient length to prevent the strips from bearing on the glass. Consideration must be given to the expansion of the stormpane glass due to temperature changes. Do not screw down too tight on the holding strips.

20-6-25 Lenses—

A. Lenses used in connection with buoy and minor light lanterns (see fig. 20-21) are of the drum Fresnel type, showing a beam of 360° around the horizon. In these lanterns the emitted light appears as a narrow vertical beam the full height of the lens. Lenses in the 150-mm. lanterns are of pressed glass and are an integral part of the lantern. Standard drum lenses used in the 200-mm. lanterns may be either pressed or cut glass, although the cut glass type is no longer being purchased. Each pressed glass lens is fitted with a thin brass ring on top and bottom, imbedded in a putty substance such as Vulcatex or equal, to protect the edges against chipping. Vulcatex is a nonhardening cement of putty consistency commercially used in setting glass. The pressed glass lens is now available on term contract in clear, red or green.

B. *Directional drum lens.*—A directional drum-type lens is available in 200-mm. size which emits a high intensity beam of light through a narrow arc of the lens and a lower intensity light throughout the remainder of the drum. This lens is interchangeable with standard 200-mm. lenses. The 200-mm. directional lens is available in red and green colors as well as clear.

C. *375-mm. lantern.*—The majority of lenses used in the 375-mm. lantern are of cut-glass construction, made up of concentric rings and held together by a framework. The lenses are held in place by lens spring rings located in the hood base.

D. *Range lantern.*—Bull's-eye-type lenses are used in range lanterns. The 150- and 200-mm. sizes are made of pressed glass, while the 350-mm. size may be either pressed or cut glass.

E. *Pressed glass.*—Pressed glass lenses consist of molded glass in one piece. They are used extensively in sizes up to and including 200-mm. A few 375-mm. lenses made up of pressed glass segments are in service but are no longer being manufactured.

F. *Cut glass.*—A cut glass lens is made up in separate sections and assembled into a unit. These sections have been ground and polished after molding.

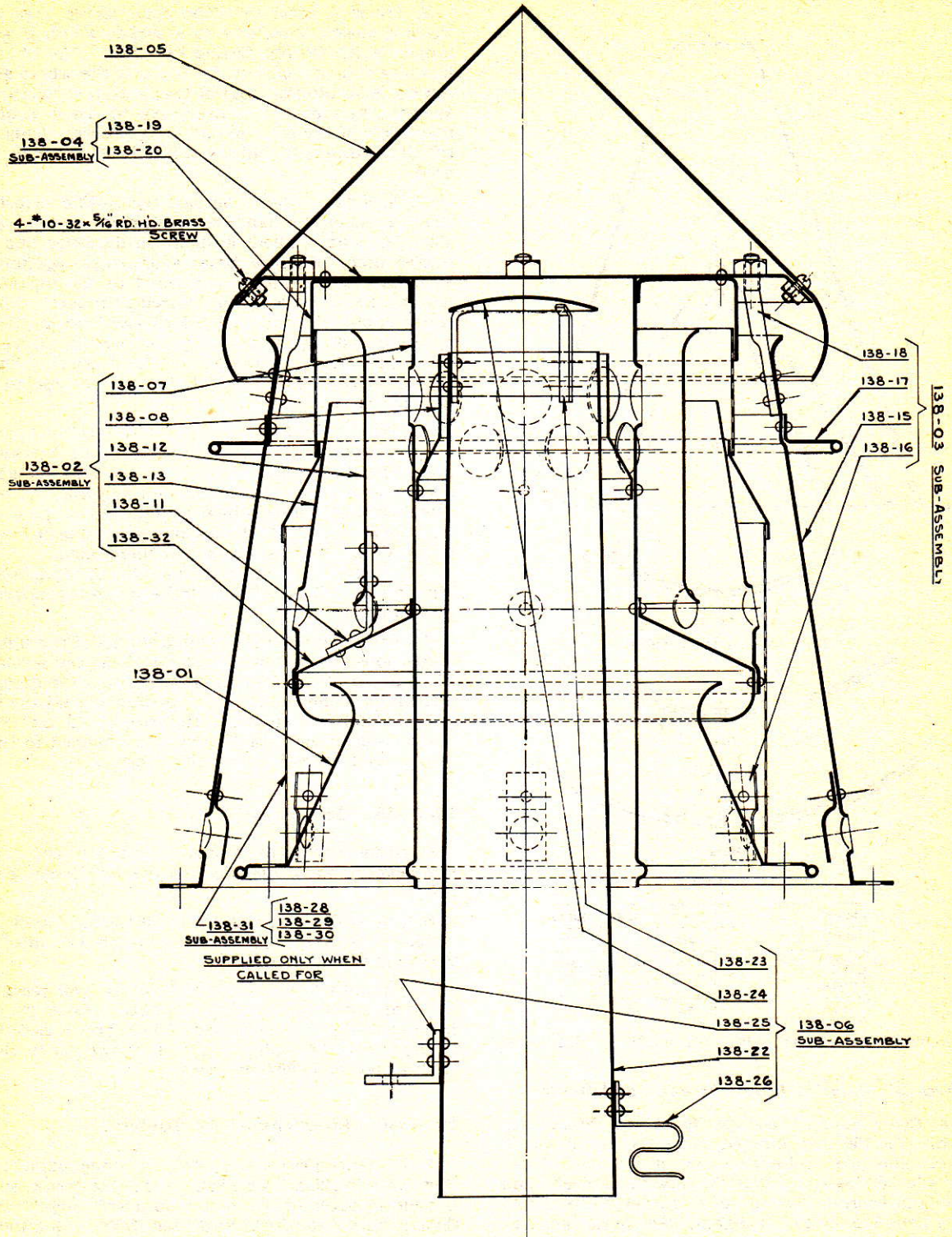


FIGURE 20-19.—Hood for A. G. A. L-200 and L-350 R lanterns.

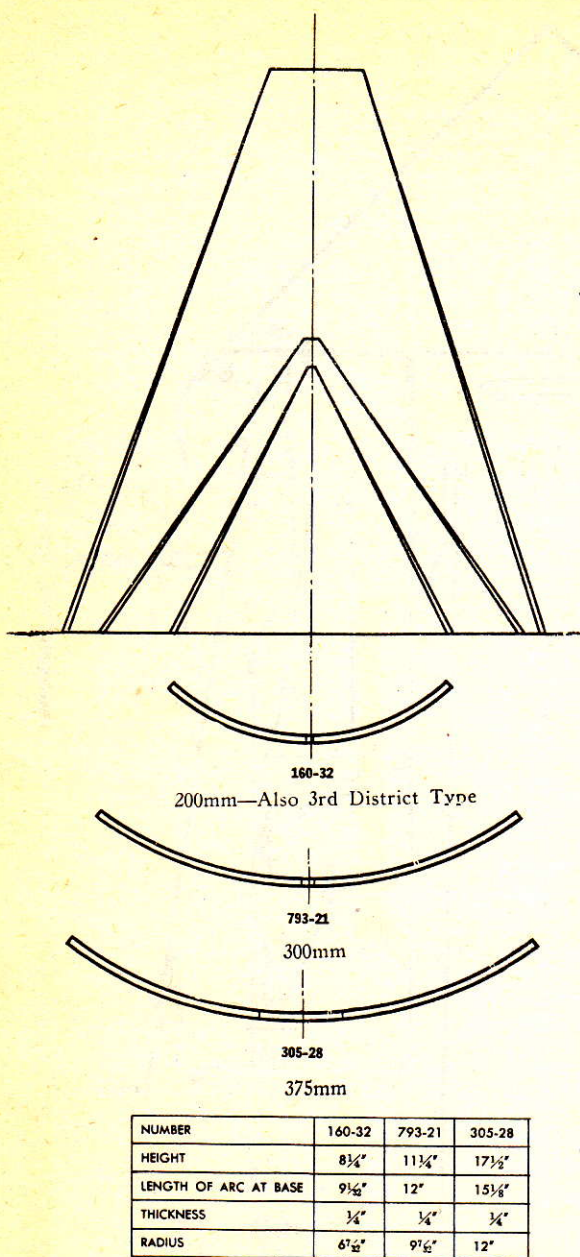


FIGURE 20-20.—Storm glass for acetylene lanterns.

20-6-30 Shades (Color Screens or Filters)—

A. Color shades (see figs. 20-23 and 20-24) are (white for 150-mm. lantern only), red and green in color and are cylindrical or disc-shape. They are placed inside the lantern between the lens and the light source. The use of a colored shade results in a light loss up to 80 percent. See paragraph 20-6-45 (B) for transmission factor. Types of shades used with acetylene lanterns previously described are discussed in the following paragraphs.

B. 150-mm. lanterns.—The color shade used in these lanterns is secured to a socket which is attached to the 50-mm. flasher-regulator. The shade has a ventilating cap at the top and the whole assembly is an integral part of the lantern ventilating system, therefore, it is necessary to use a shade regardless of the color of the light desired. This is the only lantern in which a white or clear shade is used.

C. 200-mm. lantern, Service-type.—The colored shade used in this lantern is commonly known as Type "C" and is about 6 inches in diameter and 5 inches high. Shallow brass spun rings, equipped with flat spring fingers, are fitted to the top and bottom of this shade, being secured with putty. The shade is placed inside of the lens and held in place by the tension of the spring fingers (see fig. 20-24). This type shade, without the flat springs mentioned above, is also used in the Service-type 300-mm. lanterns.

D. 200-mm. lantern, A. G. A.-type.—This lantern takes a shade approximately 3 $\frac{3}{4}$ inches in diameter and 5 inches high which rests on the lens support plate and is held in place by brass spring fingers attached to the draft tube protruding from the lantern hood. Type "C" shades may be used instead of the A. G. A. shade as previously mentioned.

E. 300-mm. A. G. A. lantern.—This shade is also used in the A. G. A. 300-mm. lantern and is similarly held in place.

F. 375-mm. lanterns.—Colored shades of the same dimensions are used in both the A. G. A. and service 375-mm. lanterns. The shade is 5 $\frac{5}{8}$ inches in diameter and 9 inches high. It rests on a special shade holder which is fastened to the base of the lantern and is held in place by flat springs attached to the draft tube located in the lantern top.

20-6-35 Gaskets—

A. In some lanterns, rubber gaskets are used as a seal between the hinge ring and the stormpane section.

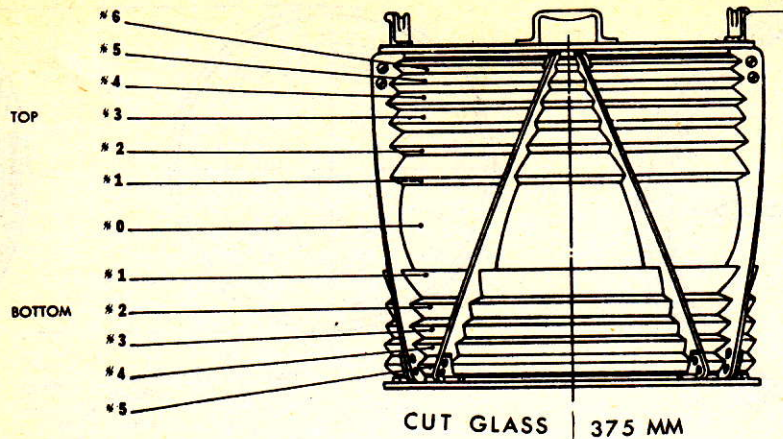
B. The gasket in the A. G. A. 200-mm. lantern is a square sectioned rubber ring which fits into a groove in the hinge ring.

C. The gaskets in both the A. G. A. and service 375-mm. lanterns are square rubber strips fitted into grooves in the hinge ring. There are no gaskets in the 150- or 300-mm. A. G. A. lanterns nor in the service 200- and 300-mm. sizes.

20-6-40 Maintenance of Lanterns—

A. This includes ordinary care, cleaning, painting, and replacing damaged parts. Dust the inside and outside surfaces of the lens with a soft, dry cloth. Sponge with clear fresh water and then with either wood alcohol, or a solution of powdered chalk and wood alcohol, or a commercial glass cleaner. When dry, polish with a soft cloth.

ELEMENTS—LENS



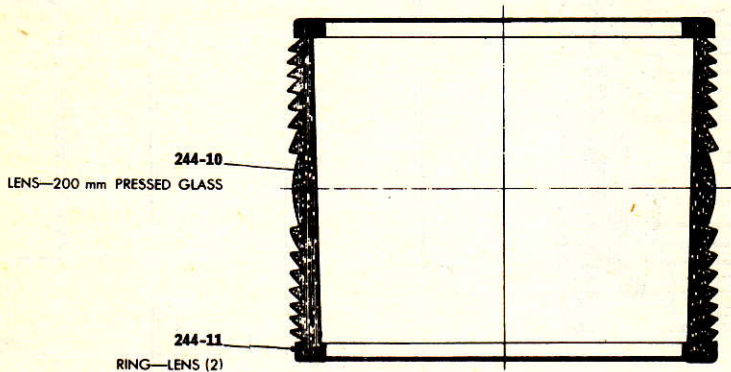
306-04

HANDLE (4)

306-09

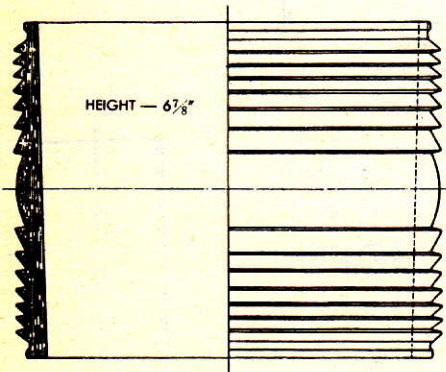
SCREW (8)

Not used on 244-A1
and 794-A4.



244-A2

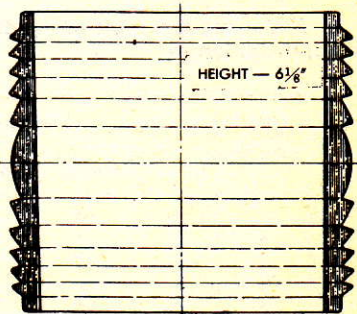
200 mm PRESSED GLASS LENS ASSEMBLY



244-10

200 mm PRESSED GLASS LENS

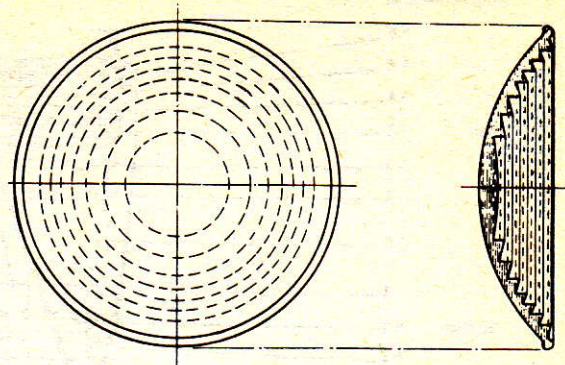
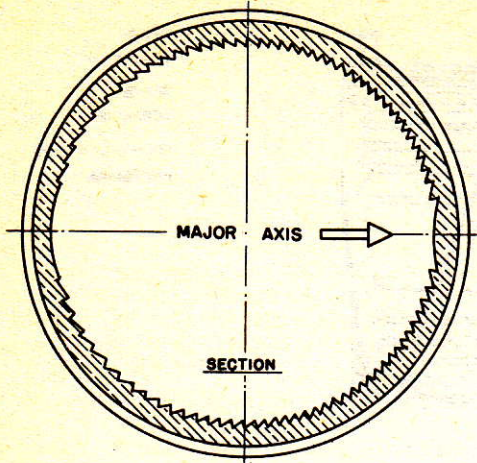
PART NUMBER	WEIGHT LBS.
244-A2	7½
244-10	6
479-A1	5
636-52	12
828-20	5½



479-A1

150 mm PRESSED GLASS LENS

FIGURE 20-21.—360-degree lantern drum lenses.



PRESSED GLASS BULL'S-EYE LENS

	150 mm	200mm	350mm
BULL'S-EYE LENSES	512-03	678-23	653-10
OUTSIDE DIAMETER	6"	8 $\frac{3}{8}$ "	7 $\frac{1}{8}$ "
FOCAL DISTANCE	3 $\frac{3}{4}$ "	5"	9"

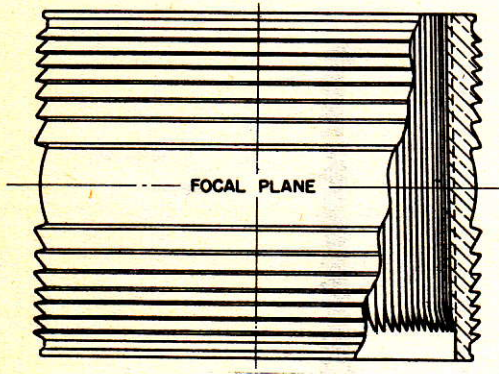


FIGURE 20-22.—Directional drum lens.

20-6-45 Candlepowers for Small Drum Lenses—

A. Following is a table of candlepower ratings for small drum lenses:

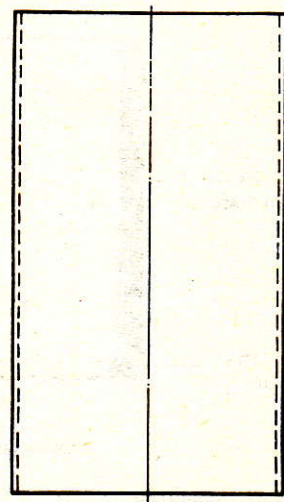
Burner size in cubic feet	Lens size			
	150 mm.	200 mm.	300 mm.	375 mm.
3 $\frac{1}{8}$	12	*15	-----	-----
1 $\frac{1}{4}$	20	*30	-----	-----
3 $\frac{1}{16}$	30	*35	-----	-----
3 $\frac{1}{8}$	45	*50	-----	-----
1 $\frac{1}{2}$	-----	70	-----	-----
3 $\frac{1}{4}$	-----	130	200	-----
1	-----	160	250	400
1 $\frac{1}{4}$	-----	-----	300	450

*Not ordinarily used.

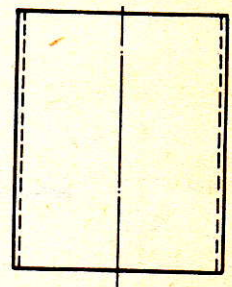
NOTE.—Candlepowers are computed for use with stormpanes, therefore no further reduction is to be made.

B. To obtain candlepowers of colored lights apply the following average transmission factors to the above listed candlepowers.

- (1) For red color, use .25
- (2) For green color, use .18



305-20
GLASS SHADE

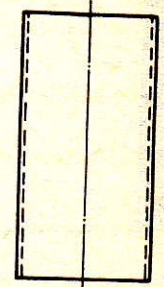


160-20
GLASS SHADE
200 and 300mm

375mm

DRAWING NUMBER	H. T.	DIAMETER	
		O D	I D
160-20	4 $\frac{7}{8}$ "	3 $\frac{3}{16}$ "	3 $\frac{11}{16}$ "
160-61	5 $\frac{9}{16}$ "	6 $\frac{13}{16}$ "	6 $\frac{9}{16}$ "
305-20	9 $\frac{1}{16}$ "	5 $\frac{33}{64}$ "	5 $\frac{3}{16}$ "
626-10	5"	2 $\frac{1}{2}$ "	2 $\frac{3}{8}$ "
828-14	8"	5"	4 $\frac{13}{16}$ "
1506-17	7"	7 $\frac{3}{16}$ "	7 $\frac{1}{16}$ "
1582-07	5 $\frac{13}{16}$ "	5 $\frac{1}{2}$ "	5 $\frac{3}{16}$ "
1583-06	5 $\frac{7}{8}$ "	6 $\frac{13}{16}$ "	6 $\frac{9}{16}$ "

COLORS, — RED, GREEN, OR CLEAR



626-10
GLASS SHADE

150mm

FIGURE 20-23.—Shades for A. G. A. lanterns.

Example.—A 3 $\frac{1}{8}$ -cubic-foot burner in a 200-mm. lantern showing 50 cp. white beam will show 12 cp. red or 9 cp. green.

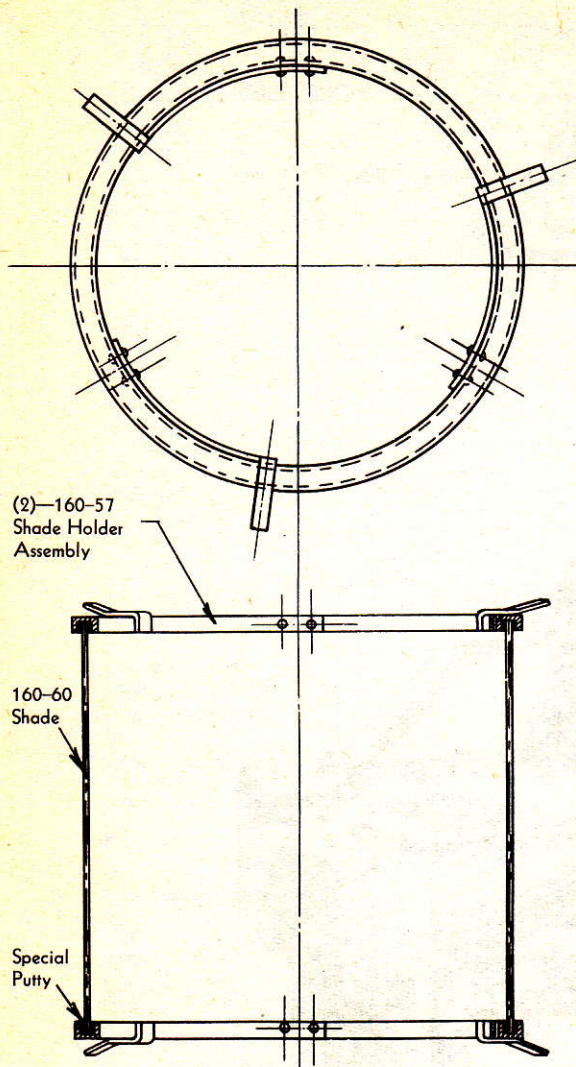


FIGURE 20-24.—Shade assembly for direct attachment to 200-mm. lens (USLHS type C).

20-7 FLASHER-REGULATORS

20-7-1 General Description—

A. All acetylene buoy and minor light lanterns are equipped with a flasher-regulator, commonly referred to as a flasher, which is a gas-operated device to provide a flashing light of adjustable characteristic. The A. G. A. flasher-regulator assembly consists of two chambers, one set upon the other; a stand which holds the burner head and pilot assembly; and the necessary piping. The lower chamber houses a pressure regulating or reducing assembly which serves to reduce the varying cylinder pressure down to a constant pressure of approximately 20 inches water column. (Approximately two-thirds pounds per square inch.) The upper

chamber houses a magnetic valve flasher assembly. A cutaway view of the flasher-regulator is shown in figure 20-25.

B. *The regulator* (lower chamber) is a pot-like chamber (part No. 151-01 of fig. 20-31) of bronze construction. Over the top of this chamber is located a tight leather diaphragm (150-04), the outer edge of which is held securely in place by use of a brass retaining ring (150-02). The leather diaphragm is linked to a lever arm (151-05) through a diaphragm eye (151-02). The lever arm is fulcrumed on two pointed screws (150-16) and operates a spindle valve assembly (151-04) against the inlet valve seat assembly (174-22) which is threaded into a boss in the chamber from inside.

(1) In operation, the gas under cylinder pressure enters the chamber thru the inlet valve seat assembly, causing the leather diaphragm to expand and lift the lever arm; this transmits a horizontal motion to the spindle valve assembly, causes the valve end to press against the orifice of the valve seat assembly, ultimately shutting off the flow of gas at the adjusted pressure.

(2) A tension is maintained on the spindle assembly by a pressure actuating spring (151-06) and diaphragm spring (150-11). This tension is adjustable within certain limits.

(3) The shut-off point, as in all regulating valves, is in proportion to the resistant spring pressure, which as previously mentioned, is 20 inches of water pressure for this regulator. Gas is piped from the regulator to the flashing chamber above and to the pilot valve at the burner holder.

C. *The flashing mechanism* is housed in a chamber similar in construction to the regulator and is known as a magnet valve assembly. In construction, the assembly consists of a flat L-shaped magnetized steel valve bracket (part No. 150-09 of fig. 20-30) on one end of which is located a C-shaped valve assembly (150-32). The valve assembly consists of two valve seats threaded into the C-shaped holder so that the seats are opposite to and facing each other. The top valve is the inlet, and the bottom valve the outlet.

(1) The upper (inlet) valve is connected by pipe (part No. 150-44 of fig. 20-29) to an adjusting valve through which gas flows from the regulator. The valve consists of a series of paper and bronze disks assembled in sequence. The lower end is connected by pipe (150-45) to an outlet connection from which the gas flows to the burner at a pressure of 5 inches of water pressure, adjustable by means of a diaphragm spring (150-07). Between the faces of the valve seats in assembly (150-32) is located the thin end of a T-shaped lever arm (150-64) which is ground and lapped so as to provide a clearance of from 0.003 to 0.004 inch.

(2) The opposite end of the lever arm is fulcrumed (pivoted) on two pointed screws (150-16) and retained in place by a lever arm spring (150-42). This arrangement provides a free up and down movement of the thin end of the lever arm between the valve seats. Then the valves are alternately opened and closed as the lever arm moves up and down. The lever arm is linked to a leather diaphragm (150-04) by a diaphragm eye (151-02)

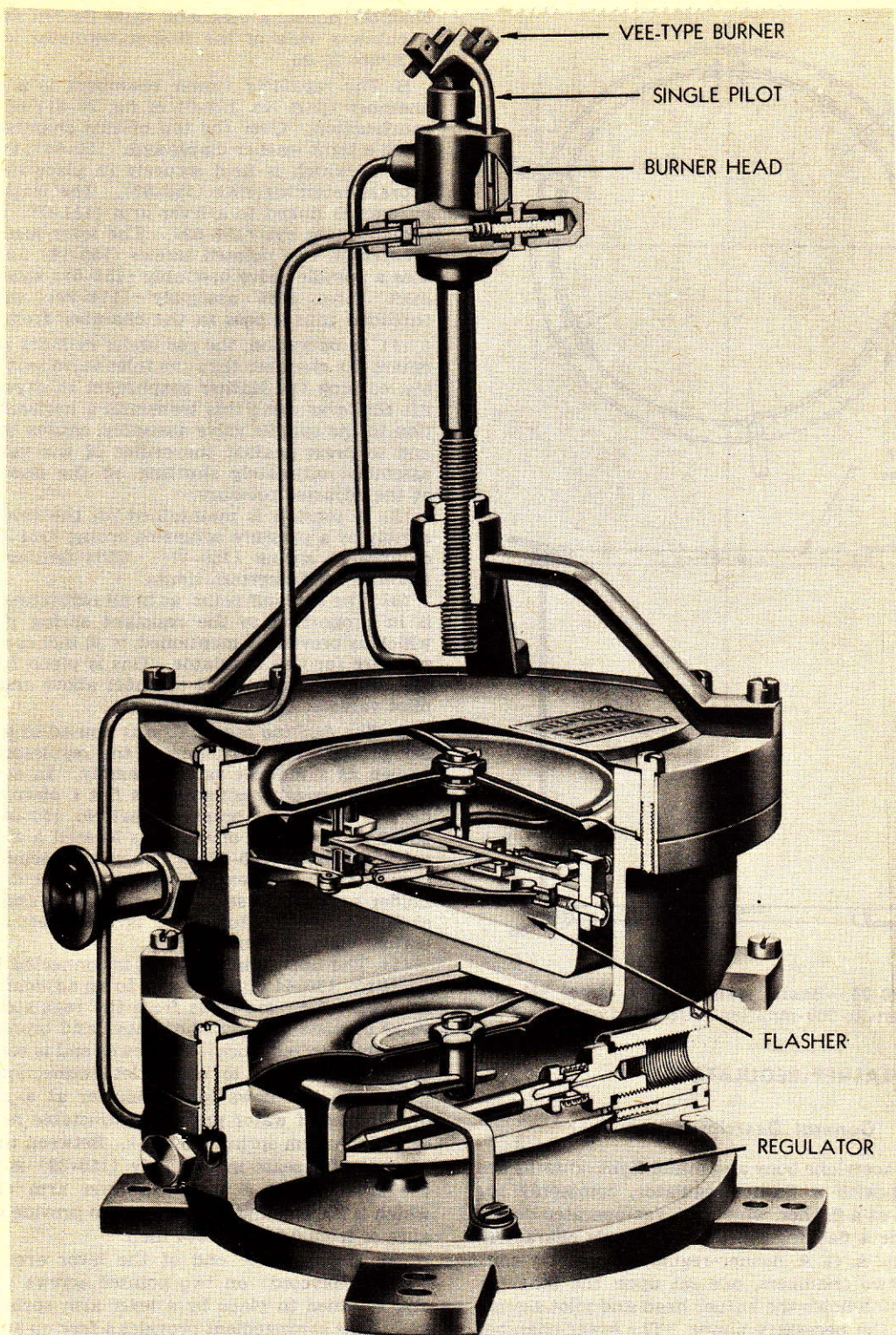


FIGURE 20-25.—Cutaway of 130-mm. flasher-regulator.

which is hooked to a lifting arm (150-24), and lifting eye (150-65) attached to the lever arm. A downward tension is maintained on the lifting arm by lifting arm spring (150-22).

(3) A clearance of approximately three-sixteenths inch is provided lifting eye (150-65) for a free up and down movement of lifting arm (150-24). This clearance can be regulated by the operation of a regulating lever assembly (150-27) which is actuated by regulating screw (150-35). The regulating lever assembly carries a tapered wedge which is inserted in the clearance between lifting arm (150-24) and lifting eye (150-65). Through the medium of this wedge the free up and down motion of the lifting arm can be varied from approximately five-thirty-seconds inch to zero.

(4) A tension is maintained on the regulating lever assembly arm against the end of the regulating screw by regulating lever spring (150-26); thus the movement of the wedge will follow the in and out adjustment of the regulating screw. As the regulating screw is screwed in and out, the free up and down movement of the diaphragm is decreased accordingly.

D. Operation of the flasher.—The gas enters the flashing chamber from the regulator through an inlet valve. This is the *dark period* or *eclipse adjusting screw*. After passing through the throttle valve the gas enters inlet pipe (150-44) and passes on out into the chamber through the upper valve in assembly (150-63). This is possible since the arm lever is held down due to the pressure of the lifting arm spring. Upon entering the chamber, the pressure of gas causes the diaphragm to expand (rise), carrying with it the linkage to the lever arm which, when sufficient pressure is exerted, is lifted from the lower to the upper valve seat in the valve assembly, closing off the inflow. As this happens, gas immediately begins to flow out through the lower valve seat into the outlet pipe and on to the burner, where it is ignited by the pilot.

(1) The distance the diaphragm rises depends upon the amount of clearance existing in the lever arm lifting eye, which clearance is adjusted by the position of the adjusting arm wedge previously explained. The rate of rise, or the time it takes for the lifting arm to reach the uppermost limit of clearance, is determined by how fast the gas is permitted to flow through the throttle valve. Since the outlet valve remains closed during the rise of the diaphragm and until the lever arm action takes place, this phase is the *eclipse*.

(2) As soon as the upward lever arm action takes place, the pressure in the flasher chamber begins to fall as the gas flows out through the lower valve and outlet pipe. With the drop in pressure the diaphragm lowers (recedes) allowing the lifting arm to fall until the lower limit of clearance is reached. At this point, the lever arm is caused to snap downward, shutting off the flow to the burner and again opening the inlet, permitting gas to flow into the chamber, repeating the cycle. The period during which the

diaphragm is falling is the period during which the light is burning, and therefore is called the *flash*. The duration of light depends upon the clearance in the wedge arrangement, which is the distance the lifting arm must fall before snapping the lever arm and shutting off the outlet valve.

(3) *Summarizing.*—As stated above, there are two adjusting screws which control the *flash (light period)* and *eclipse (dark period)* respectively. The eclipse is the time it takes for the flasher chamber to be replenished with gas to replace that previously burned and expand the diaphragm to a point of tripping the magnetic valve. The flash is the time it takes for the gas to burn sufficiently for the pressure to drop and allow the diaphragm to lower and again trip the magnetic valve. These intervals may be adjusted to long or short duration for producing various light characteristics by turning the flash and eclipse adjusting screws.

20-7-5 General Adjustment—

A. Flash.—To shorten the duration of the flash, turn the flash adjustment screw to the right. This enters the wedge and lessens the up and down movement. To lengthen the flash, turn the screw to the left. This allows the wedge to back out and increase the clearance.

B. Eclipse.—To shorten the duration of the eclipse, turn the eclipse screw to the left. This allows the gas to flow more freely. To lengthen the eclipse, turn the screw to the right. This restricts the rate of flow. Note that turning the flash adjusting screw to the right shortens the flash, but turning the eclipse adjusting screw to the right lengthens the eclipse.

C. Air in flasher.—When a flasher has been out of operation for some time, it will be up to 20 minutes or more before the pilot and full flame is had at the burner. This is due to the presence of air in the flasher and *no adjustment should be made* until all of the air has worked out of the mechanism. The presence of air may be detected by a hissing sound during the flashing period and a partial flame.

D. Adjustment of pilot.—After the air has been fully worked out, the pilot is adjusted as described in paragraph 20-9-20 and the desired characteristic may then be set.

E. Caution.—Although instructions are given in subsequent paragraphs for the specific adjustment of all types of flashers, *adjustment of single flashers only shall be attempted on station*. Complex, interrupted quick and multiple flashers shall be adjusted only in the shop, and then only by specially qualified persons. The flashers should be operated several days for "seasoning," to assure constancy of characteristic, after which they may be tagged and stored in readiness for use.

F. See part 20-17 and section 20-7-30 for detailed instructions for setting flasher characteristics.

20-7-10 General Types—

A. There are five types of flasher-regulators in common use.

(1) The single flash 50-mm. flasher, formerly referred to as the K-50, used in 150-mm. lanterns.

(2) The standard single flash 130-mm. flasher, formerly referred to as the K-130, normally used in 200-, 300-, and 375-mm. lanterns.

(3) The multiple or double flash 130-mm. flasher formerly referred to as the KK-130, used in 200-, 300-, and 375-mm. lanterns.

(4) The short-long or complex flash 130-mm. flasher, formerly referred to as the KKL-130 used in 200- and 375-mm. lanterns.

(5) The interrupted quick or compound flash 130-mm. flasher, formerly referred to as the KG-130, used in 200- and 375-mm. lanterns. This flasher has been recently re-designed. See paragraph 20-7-15 (G) below.

The numbers 50 and 130 indicate the size of the flasher diaphragm in millimeters.

20-7-15 Specific Types—

A. Following are descriptions and adjustment procedure for all specific types of flasher-regulators now in use.

B. *50-mm. flasher.*—This flasher-regulator is designed for use generally with crescent-shaped burners. The pilot burner is the same for all crescent-shaped burners regardless of size. The gas does not pass through an internally controlled valve as in the 130-mm. flasher and the adjusting screws will be found in relatively different locations from those of the more commonly used 130-mm. flasher. The 50-mm. single flasher has three external adjustments (see fig. 20-26). The flash screw regulates the duration of the flash, the eclipse screw regulates the duration of the eclipse, and the pilot screw regulates the pilot. Assume the desired characteristic to be 0.3 second flash, 2.7 seconds eclipse, or a total period of 3 seconds (20 flashes per minute). To adjust, proceed as follows:

(1) Adjust the pilot burner for proper blue flame. See section 20-9-20 below.

(2) Remove the cap and turn the flash screw to the left, increasing the duration of the flash as much as possible but keeping it a convenient multiple of the final desired flash length, i. e., in this case the flash length is set at 1 second which is the multiple 3.33×0.3 .

(3) Remove the cap on the eclipse screw and adjust the screw until the duration of the eclipse equals 3.33 times the final desired eclipse (3.33×2.7) which is 9 seconds.

(4) Check the two adjustments. In this example, the characteristic should now be 1 second flash, 9 seconds eclipse, or a total of 10 seconds.

(5) Turn the flash screw to the right until the flash rate is 20 flashes per minute. This speeds up the flash to 0.3 second and the eclipse to 2.7 seconds maintaining the proper ratio.

(6) Replace the caps.

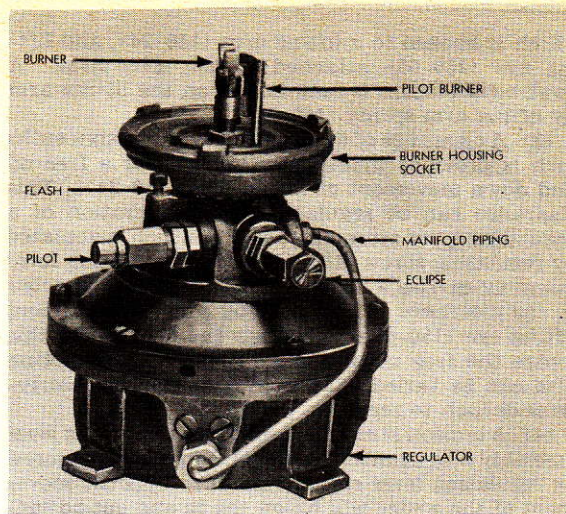
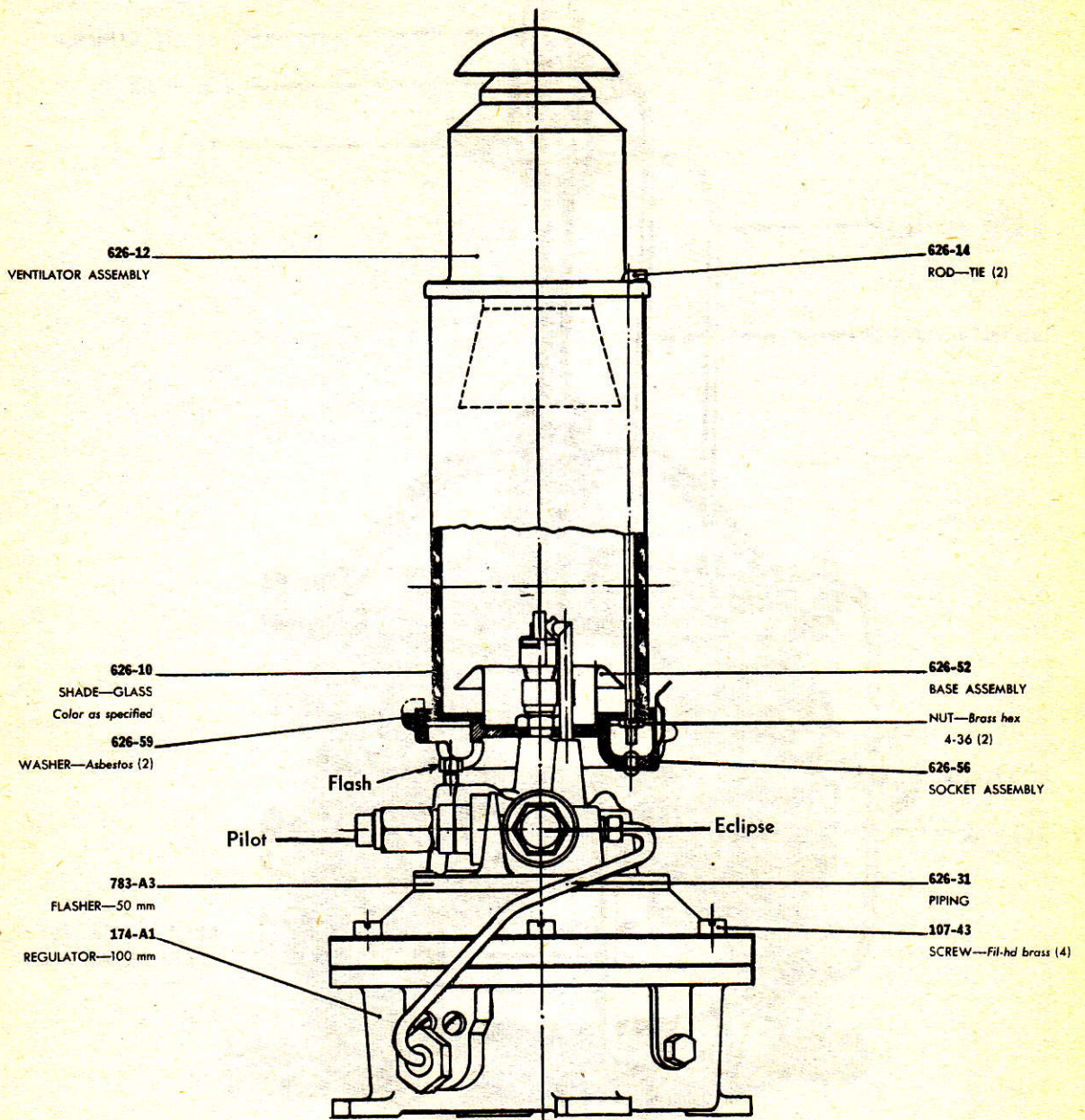


FIGURE 20-26.—50-mm. flasher-regulator.

C. *130-mm. single flasher-regulator.*—This flasher produces a series of single flashes of equal duration separated by eclipses of equal duration. It generally uses a V-type burner of from $\frac{1}{2}$ to $1\frac{1}{4}$ cubic foot capacity per hour and provides for a wide range of characteristics. This flasher will accommodate a cluster of burners up to 3 cubic feet gas consumption. Facing the adjusting screws, the flash adjusting screw will be on the left and the eclipse screw on the right. A hexagonal socket protective cap with which to make the adjustments will be found on one of the screws. The pilot burner is the same for all V-shaped burners when used singly, regardless of their size. A modified pilot burner of the same general design is used in a cluster of burners. The 130-mm. single flasher has 3 external adjustments. (See fig. 20-28.) The flash screw regulates the duration of the flash, the eclipse screw regulates the duration of the eclipse, and the pilot screw regulates the pilot. Adjustment procedure is the same as that given above for the 50-mm. single flasher.

D. *130-mm. multiple flasher-regulator.*—This flasher produces groups of two or more flashes of equal duration separated by eclipse of equal duration and the group separated by a longer eclipse. The same principle is used in adjusting the characteristic of this flasher as applies to the 130- or 50-mm. single flash flasher. There is an additional adjusting screw on this flasher to govern the long eclipse. Adjustment of one eclipse screw will affect the other, so they must be adjusted alternately. See figure 20-33 for the location of the adjusting screws. The physical appearance of this flasher is similar to the 130-mm. flasher except for the additional eclipse adjusting screw, changes in the adjusting screw locations, and the run of the piping from the flasher to burner which passes through an attachment on the side of the flasher body. This attachment contains an auxiliary leather diaphragm which is connected to a ratchet and pawl arrangement inside the flasher. The diaphragm



626-A4 ASSEMBLY WITH BURNER HOUSING

FIGURE 20-27.—50-mm. flasher-regulator assembly with burner housing.

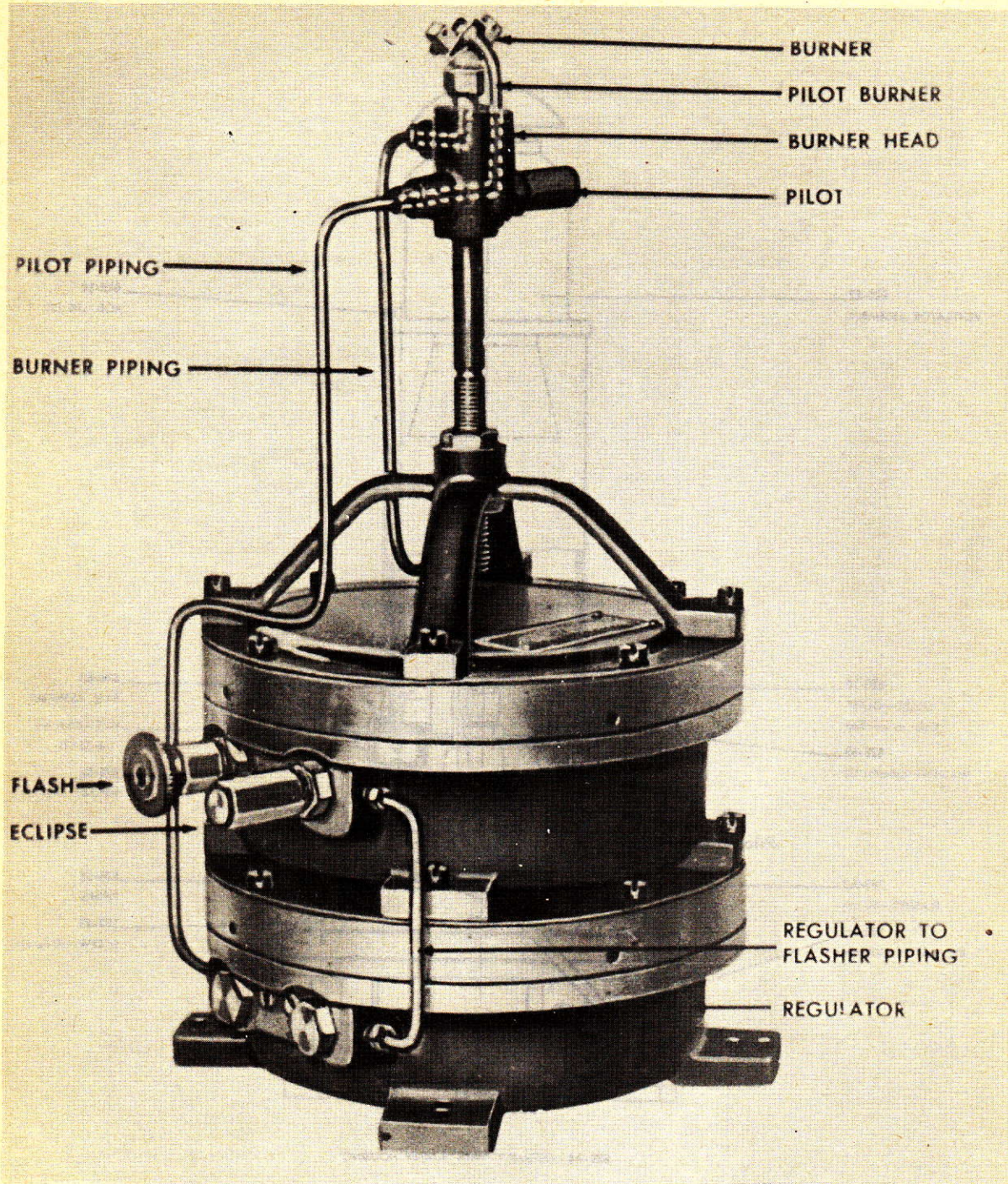


FIGURE 20-28.—130-mm. single flasher-regulator.

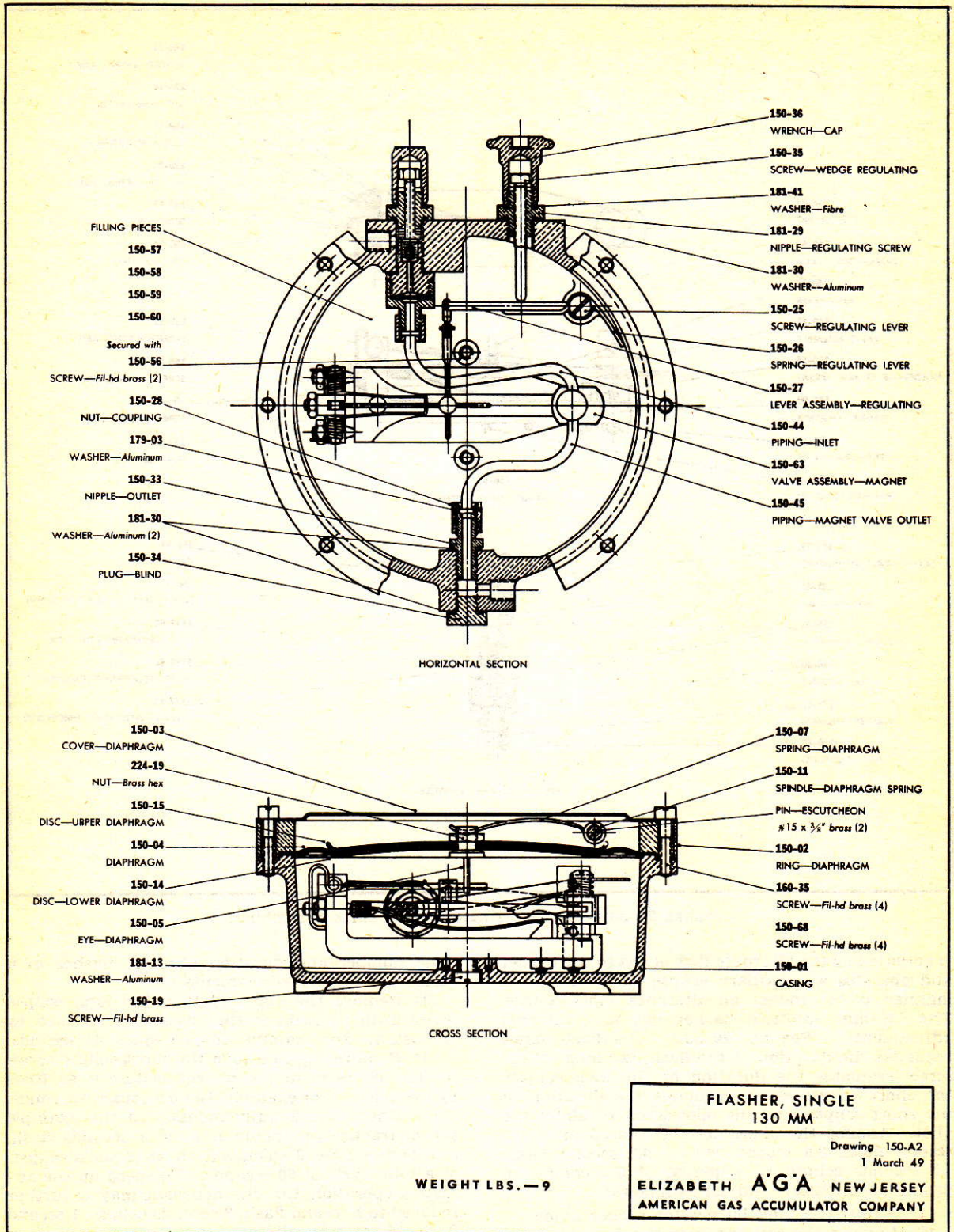


FIGURE 20-29.—130-mm. single flasher.

FLASHER, SINGLE
130 MM

Drawing 150-A2
1 March 49

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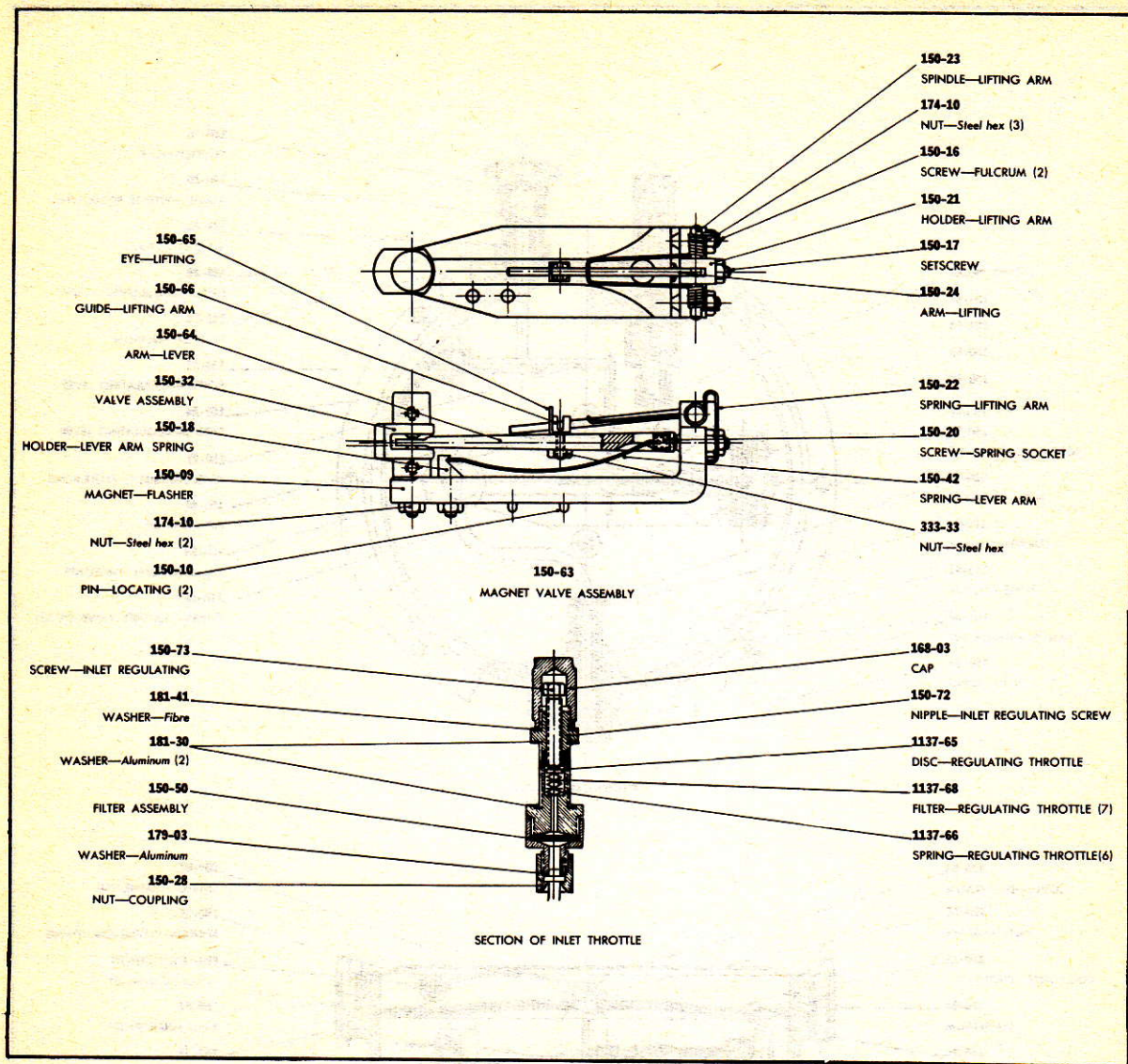


FIGURE 20-30.—130-mm. single flasher parts assemblies.

is actuated by the alternate flow of gas to the burner and operates an auxiliary eclipse valve in such a manner as to produce an alternate short eclipse. The 130-mm. multiple flasher has four external adjustments. (See fig. 20-33.) The flash screw regulates the duration of the flash, the long eclipse screw regulates the duration of the long eclipse, the short eclipse screw regulates the duration of the short eclipse, and the pilot screw regulates the pilot. Assume the characteristic desired to be 0.3 second flash, 0.9 second eclipse, 0.3 second flash, 4.5 seconds eclipse, or a period of 6 seconds (10 flashes per minute). Adjust as follows:

- (1) Adjust the pilot burner for proper flame.
- (2) Remove the cap and turn the flash screw to the left until the duration of the flash approaches the maximum and is a convenient multiple of that desired. For example, 3 seconds equals 10×0.3 .

(The number and duration of short flashes in a period are factory adjustments.)

- (3) Remove the cap and turn the long eclipse screw until its ratio to that desired is as fixed by (5) below. For example, 10×4.5 equals 45 seconds.

- (4) Remove cap and turn the short eclipse screw so that its ratio to the desired eclipse is as fixed by (5) below. For example, 10×0.9 equals 9 seconds.

- (5) Check the 3 adjustments. In the example the characteristic should now be 3 seconds flash, 9 seconds eclipse, 3 seconds flash, 45 seconds eclipse, or a total cycle of 60 seconds. To speed up the adjusting operation, this characteristic may be further reduced to 1 second flash, 3 seconds eclipse, 1 second flash, 15 seconds eclipse.

- (6) Turn the short eclipse screw to the right until the flash rate is 10 double flashes per minute.

- (7) Replace the caps.

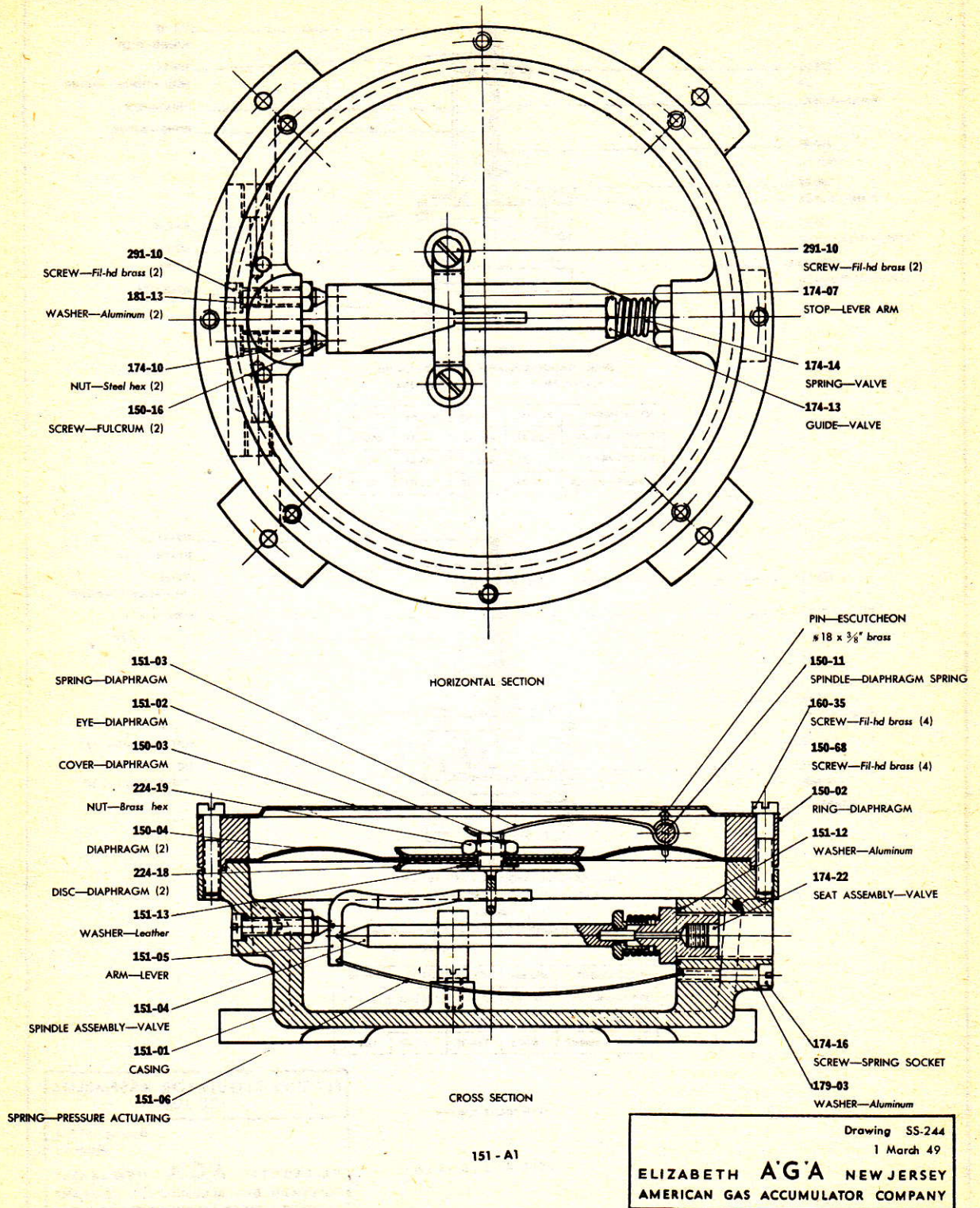
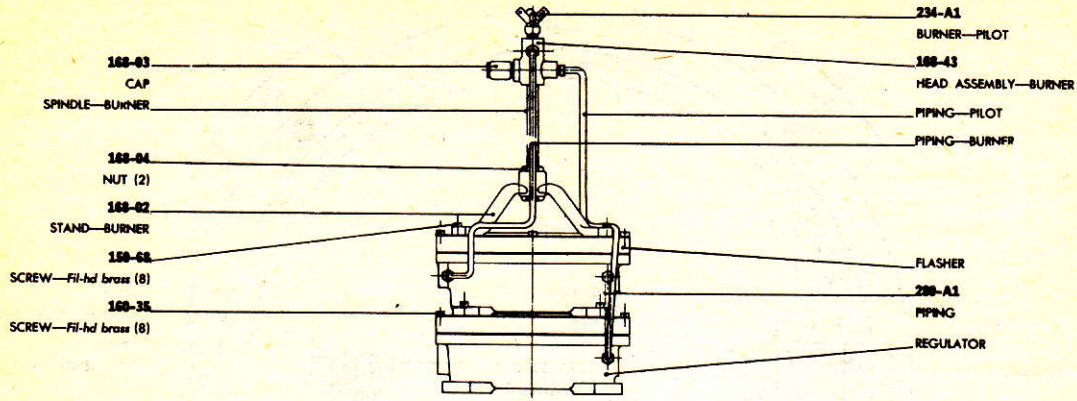
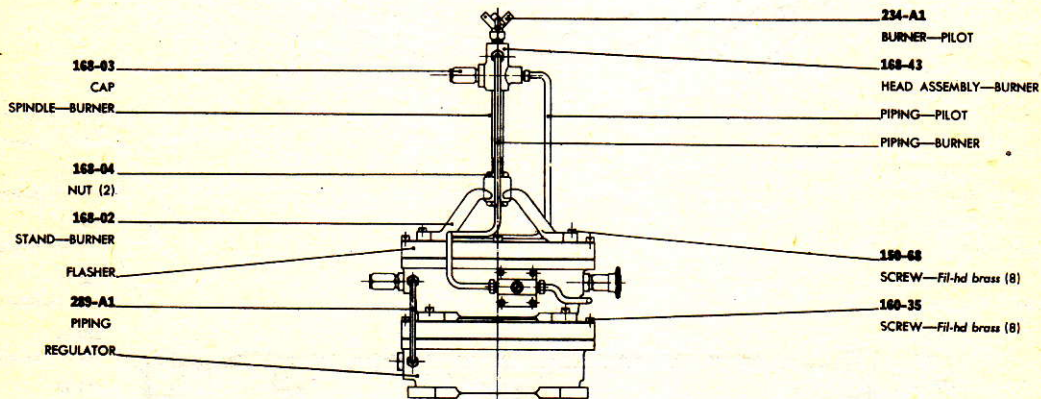


FIGURE 20-31.—130-mm. pressure regulator.



1297-A1
SINGLE FLASHER-REGULATOR ASSEMBLY—130 mm
FLASHER 150-A2 REGULATOR 151-A1

FOCAL HEIGHT	325 mm	370 mm	400 mm	435 mm
PIPING—BURNER	436-A1	454-A1	437-A1	455-A1
PIPING—PILOT	432-A1	456-A1	433-A1	457-A1
SPINDLE—BURNER	168-05	168-29	168-07	168-28



1302-A1
MULTIPLE FLASHER-REGULATOR ASSEMBLY—130 mm
FLASHER 419-A2 REGULATOR 151-A1

1304-A1
COMPLEX FLASHER-REGULATOR ASSEMBLY—130 mm
FLASHER 204-A2 REGULATOR 151-A1

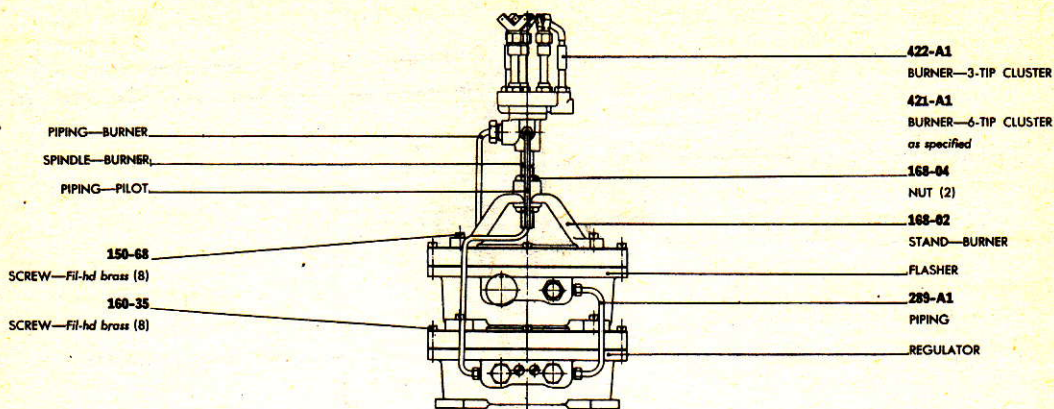
FOCAL HEIGHT	325 mm	370 mm	400 mm	435 mm
PIPING—BURNER	1321-A1	1324-A1	1322-A1	1323-A1
PIPING—PILOT *	1325-A1	1328-A1	1326-A1	1327-A1
SPINDLE—BURNER	168-05	168-29	168-07	168-28

WITH SINGLE BURNERS

WEIGHT LBS.—18

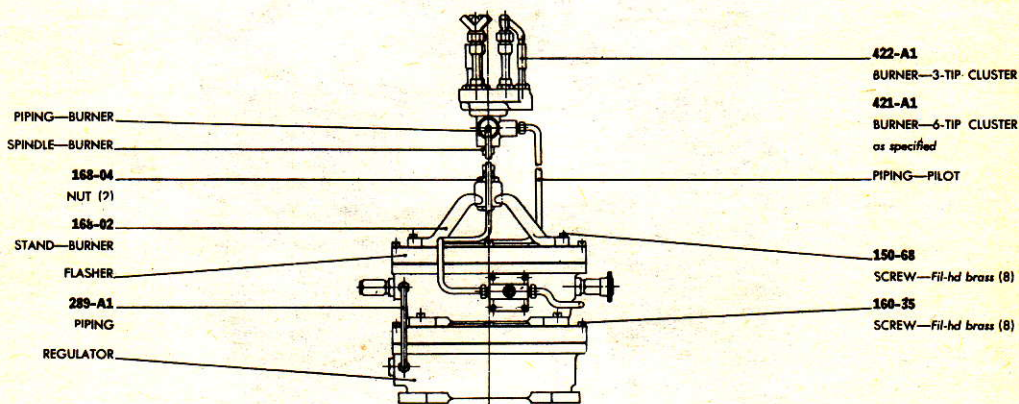
FLASHER-REGULATOR ASSEMBLIES 130 MM	
Drawing SS-234 1 March 49	
ELIZABETH A'G'A NEW JERSEY AMERICAN GAS ACCUMULATOR COMPANY	

FIGURE 20-32.—130-mm. flasher-regulator assemblies.



1299-A1
 SINGLE FLASHER-REGULATOR ASSEMBLY—130 mm
 FLASHER 150-A2 REGULATOR 151-A1

FOCAL HEIGHT	325 mm	400 mm
PIPING—BURNER	444-A1	445-A1
PIPING—PILOT	440-A1	441-A1
SPINDLE—BURNER	420-01	420-03



1303-A1
 MULTIPLE FLASHER-REGULATOR ASSEMBLY—130 mm
 FLASHER 419-A2 REGULATOR 151-A1

1305-A1
 COMPLEX FLASHER-REGULATOR ASSEMBLY—130 mm
 FLASHER 204-A2 REGULATOR 151-A1

FOCAL HEIGHT	325 mm	400 mm
PIPING—BURNER	1329-A1	1330-A1
PIPING—PILOT	1333-A1	1334-A1
SPINDLE—BURNER	420-01	420-03

WITH CLUSTER BURNERS

FIGURE 20-32A.—130-mm. flasher-regulator assemblies.

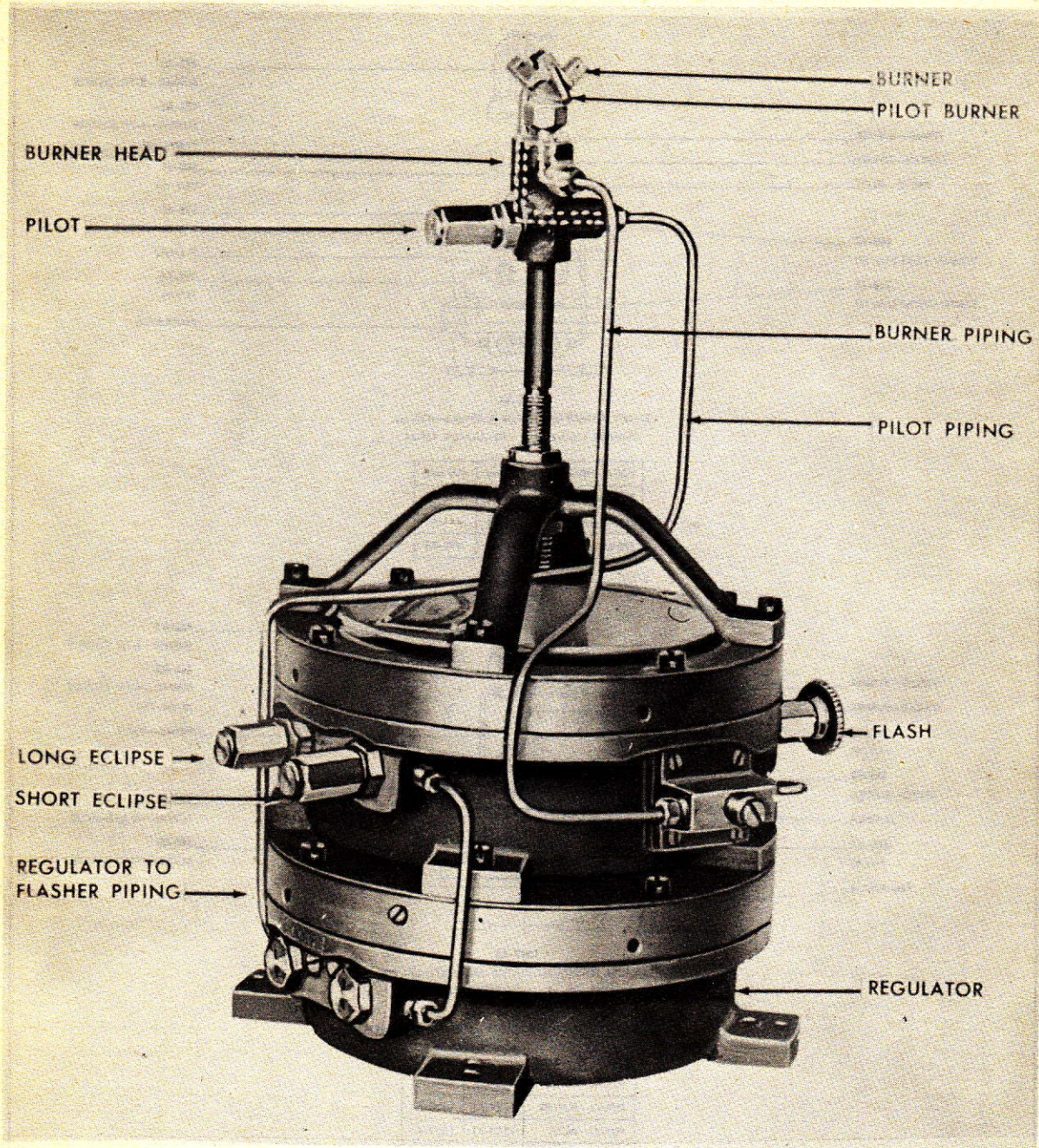


FIGURE 20-33.—130-mm. multiple flasher-regulator.

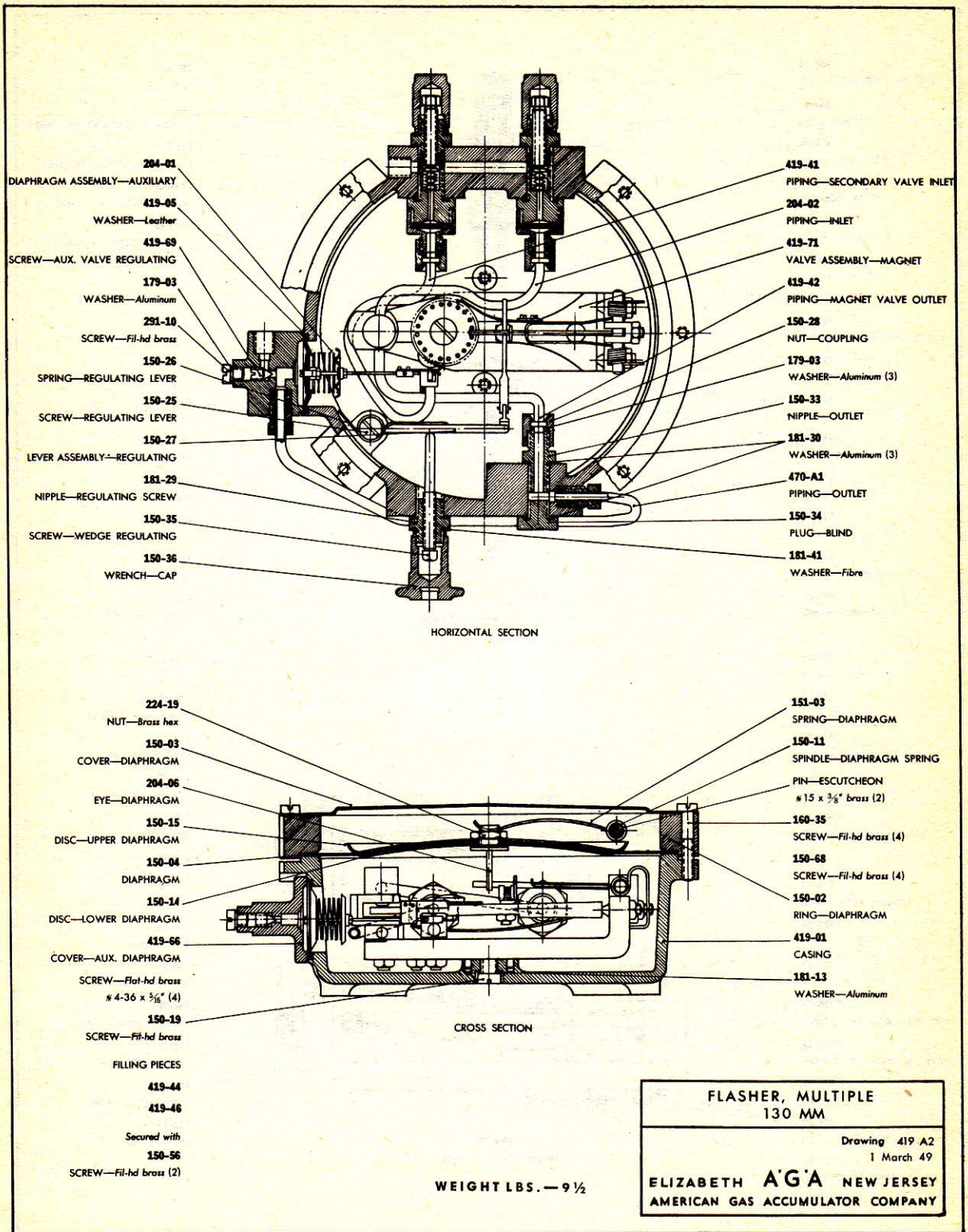


FIGURE 20-34.—130-mm. multiple flasher.

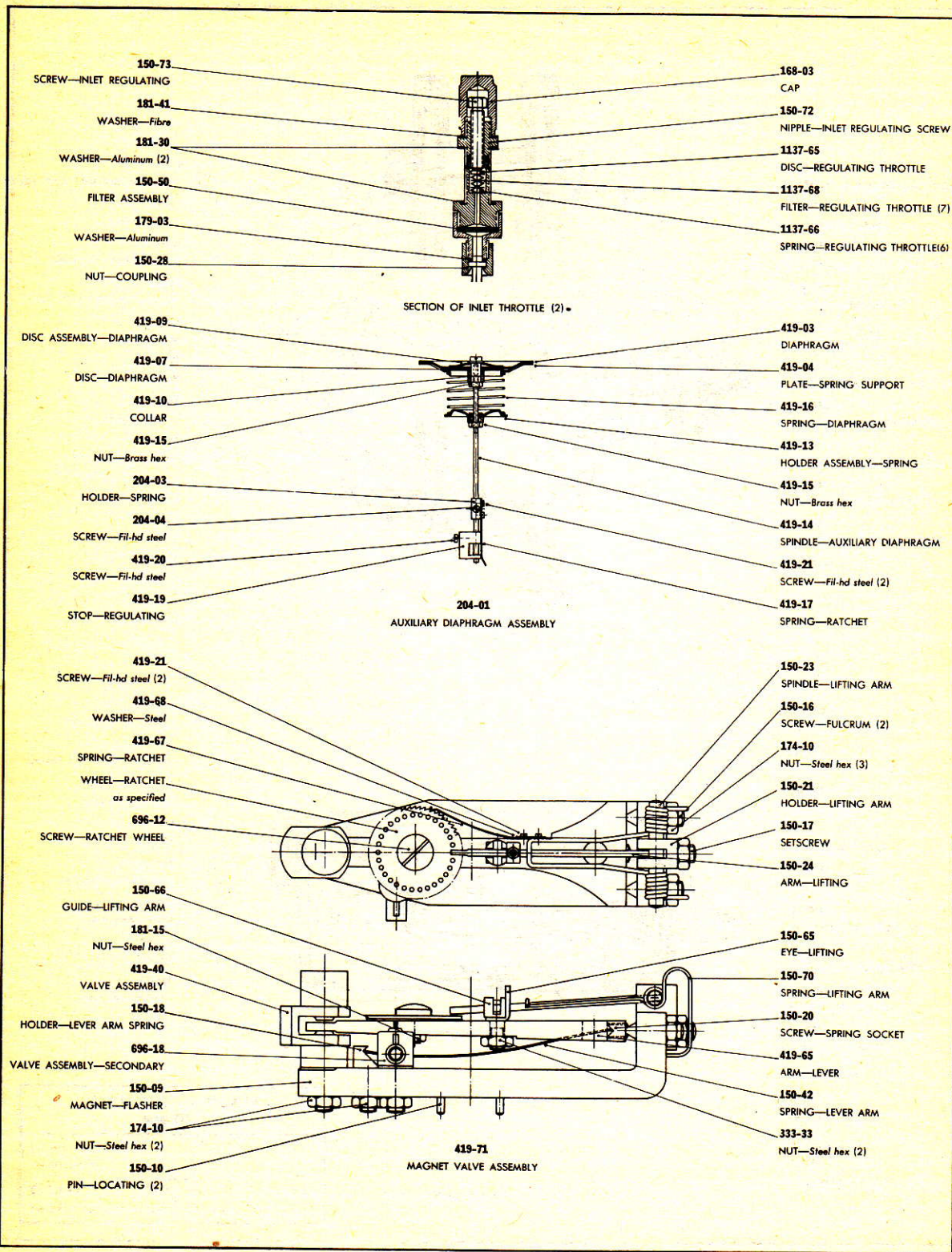


FIGURE 20-35.—130-mm. multiple flasher part assemblies.

E. 130-mm. complex short-long flasher-regulator.—This flasher is similar in all respects to the 130-mm. multiple flasher except for a factory-adjusted light period control within the flasher, and produces a group consisting of one short followed by one long flash, the flashes within the group being separated by an eclipse of equal duration to the short flash and the groups being separated by a long eclipse. The alternate long and short flash is produced by a ratchet wheel which is actuated by the alternate flow of gas to the burner, acting upon an auxiliary diaphragm attached to a ratchet and pawl which is arranged to rotate the ratchet wheel. When the short flash occurs, the valve lifting arm, which is linked to the diaphragm, comes to rest on top of one of the uprights of the ratchet wheel. When the flash takes place, the ratchet wheel is in such a position that the lifting arm falls in a slot in the ratchet wheel. The depth to which the lifting arm is allowed to fall in this slot is controlled by the tapered flash adjustable wedge. The alternate short and long eclipses are controlled exactly as in the multiple flasher. The 130-mm. complex flasher has four external adjustments. (See fig. 20-36). The long flash screw regulates the duration of the long flash and also affects, in direct proportion, the duration of the long eclipse. The long eclipse screw regulates the duration of the long eclipse independent of the adjustment of the long flash. The short eclipse screw regulates the duration of the short eclipse, and the pilot screw regulates the pilot. Assume the characteristic desired to be 0.3 second flash, 0.3 second eclipse, 1.2 seconds flash, 7.2 seconds eclipse, with a period of 9 seconds. Adjust as follows:

- (1) Adjust the pilot burner for proper flame.
- (2) Remove the cap and turn the long flash screw to the left until the duration of the long flash approaches the maximum and is a convenient multiple of that desired. For example, 3 seconds equals 2.5×1.2 .
- (3) Remove cap on long eclipse screw and adjust the screw until its ratio to that desired is as fixed by (6). For example, 18 seconds equals 2.5×7.2 .
- (4) Remove cap on short eclipse screw and adjust the screw so that its ratio to the desired eclipse is as fixed by (6). For example 3.0 equals 2.5×1.2 .
- (5) Turn long flash screw to the right until the long flash and the long eclipse have the desired duration. This will slightly decrease the short eclipse.
- (6) Check the three adjustments. In the example the characteristic should now be 0.3 second flash 0.3 second eclipse, 3 seconds flash, 18 seconds eclipse, or a period of 21.6 seconds.
- (7) Turn the long flash screw to the right until the flash rate is 10 double flashes in 90 seconds.
- (8) Replace caps.

Note.—An additional adjustment, that for the short flash, is located inside the flasher. This is a factory adjustment and *must not be attempted in the field*. The general grouping of the characteristic, that is, the number of short and long flashes per period, is fixed as part of the flashing mechanism and can only be altered at the factory.

F. 130-mm. interrupted quick or compound flasher-regulator.—This flasher produces an interrupted quick flash characteristic consisting of groups of rapidly recurring flashes and the groups separated by eclipses of equal duration. It differs from other flashers both in appearance and operational sequence in that it consists of three chambers stacked one on the other, the lower being a standard regulator and the other two being standard 130-mm. flashers. See also paragraph 20-7-15 (G) below. The normal characteristic is a series of 6 flashes of 0.2 second duration separated by an eclipse of 4.2 seconds duration. The middle chamber furnishes gas to operate 6 times at the prescribed characteristic at regular intervals to the upper chamber. The upper flasher receives this supply of gas and continues to operate until it is exhausted, then ceases to function until the new supply is received. There are four adjusting screws (see fig. 20-39). The lower flash screw controls the amount of gas fed to the upper flasher and ultimately the number of flashes per group. The lower eclipse screw controls the rate of flow of gas into the lower flasher and determines the long eclipse between groups. The upper flash screw controls the duration of the flash. The upper eclipse screw controls the duration of the eclipse between each flash. Assume the desired characteristic to be 0.2 second flash, 0.6 second eclipse six times, and 4.2 seconds eclipse, a period of 8.4 seconds. Adjust as follows:

- (1) Adjust the pilot burner for proper flame.
- (2) Remove the caps and turn the flash and eclipse screws on the lower flasher at least two full turns so as to provide a maximum flow of gas to the upper flasher.
- (3) Treat the upper flasher as an ordinary 130-mm. single flasher. Calculate the number of flashes per minute, i. e., $0.2 \text{ plus } 0.6 \text{ equals } 0.8 \text{ divided into } 60 \text{ equals } 75 \text{ flashes per minute}$. Set a preliminary characteristic of 1 second flash, 3 seconds eclipse. In making this adjustment listen for the click of the lower flasher which indicates the beginning of the flow of gas to the upper chamber. Time only the first two or three flashes since the amount of gas is rapidly depleted and there will be a lag in the rate of flash.
- (4) Now speed up the flash of the upper flasher to give 75 flashes per minute or 5 flashes in 4 seconds. At this point there will be a group of 10 to 12 flashes in a row. To reduce this to 6 as required, turn the lower flasher flash screw to the right until a group of 6 flashes is obtained.
- (5) Now adjust the lower flasher eclipse screw until the long eclipse is 4.2 seconds and the period is 8.4 seconds. A convenient check is 5 groups of 6 flashes every 42 seconds.

G. Substitute for compound flasher.—By installing a suitably designed ratched wheel in the multiple flasher (KK-130) the A. G. A. Co. has adapted this flasher so as to produce an interrupted quick flash characteristic. In this manner a more reliable characteristic of an unvarying number of flashes per group is attained than was possible with the compound flasher. The necessity of stacking three units, i. e., one regulator and two flasher assemblies, has been eliminated.

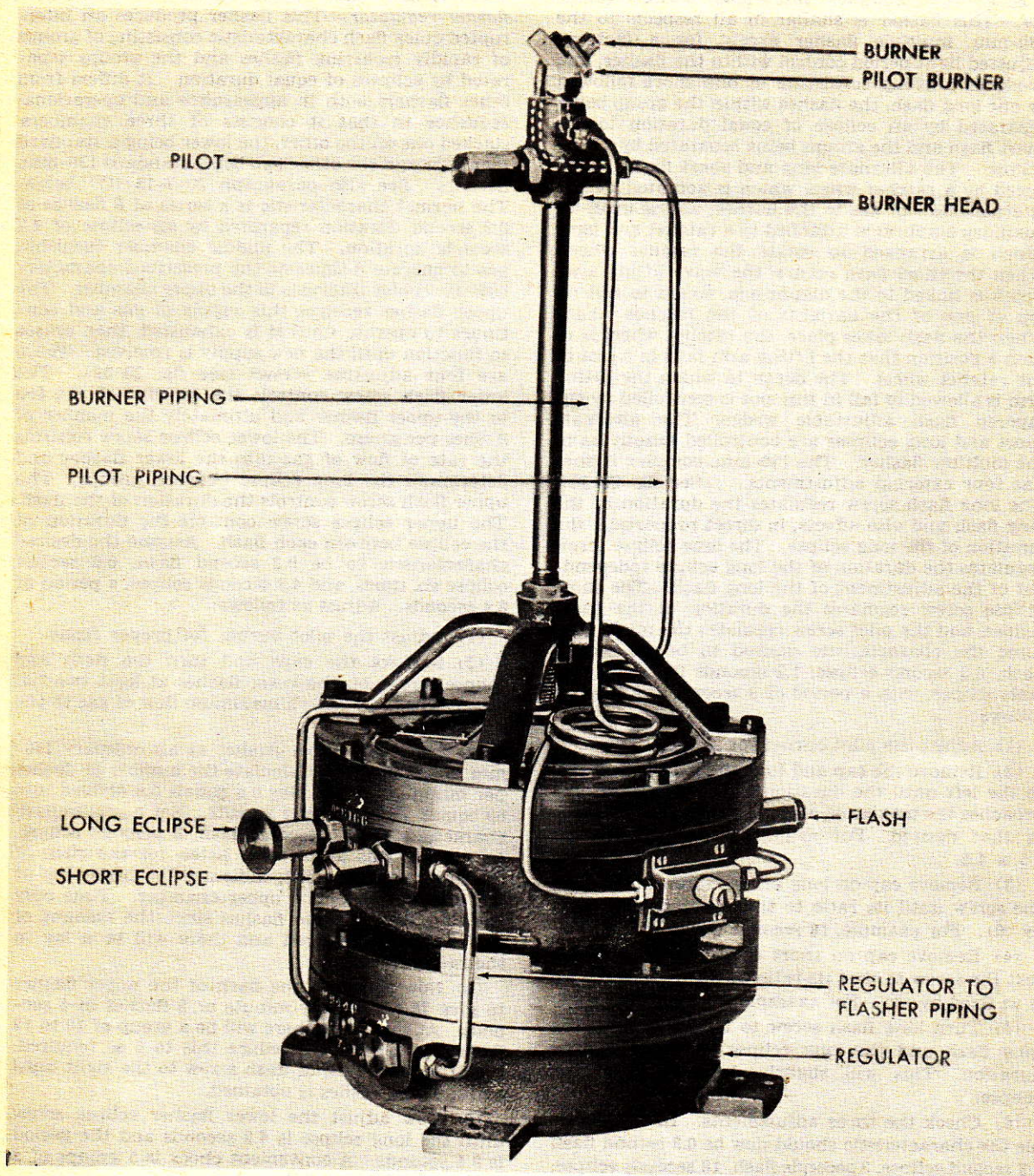


FIGURE 20-36.—130-mm. complex flasher-regulator.

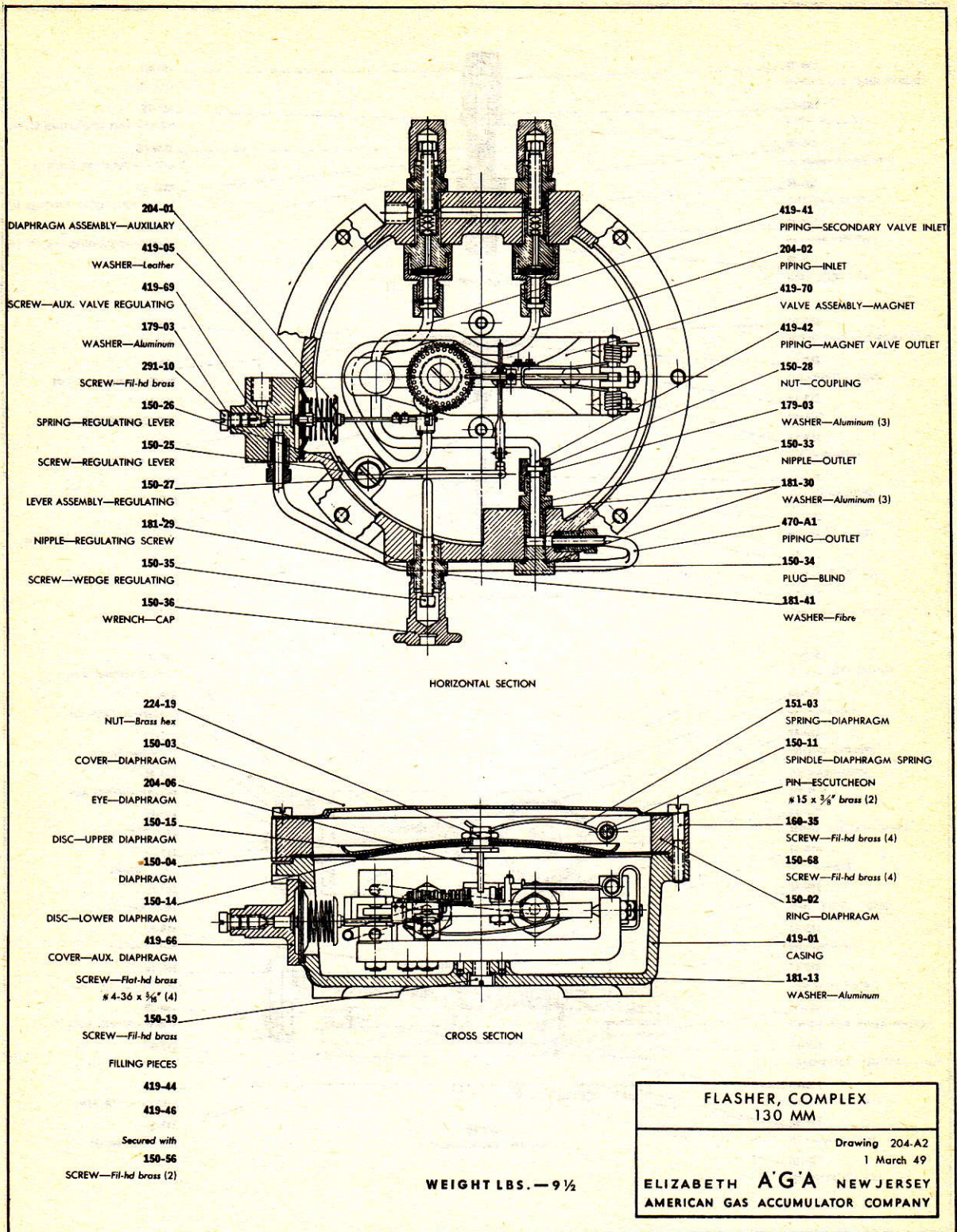


FIGURE 20-37.—130-mm. complex flasher.

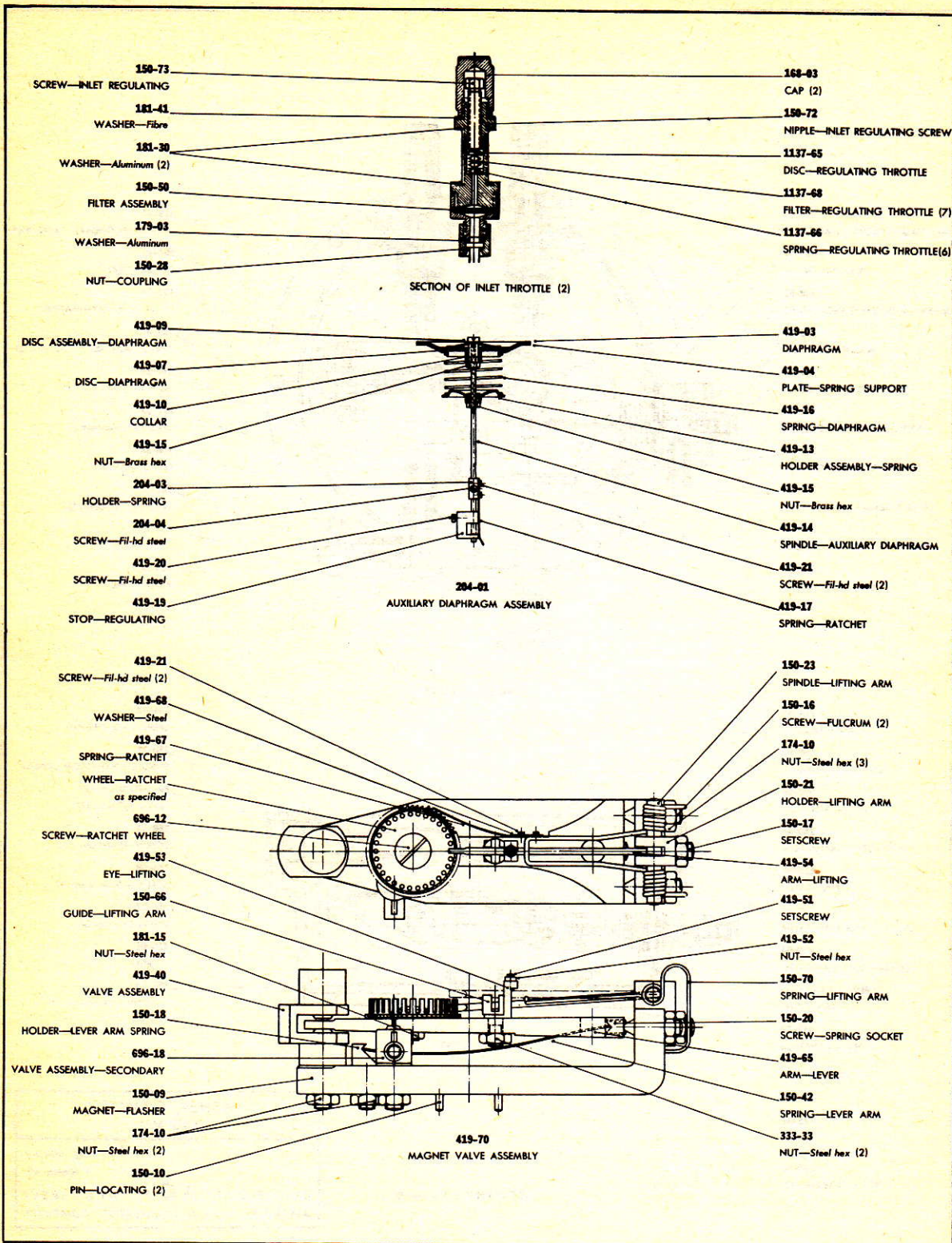


FIGURE 20-38.—130-mm. complex flasher parts assemblies.

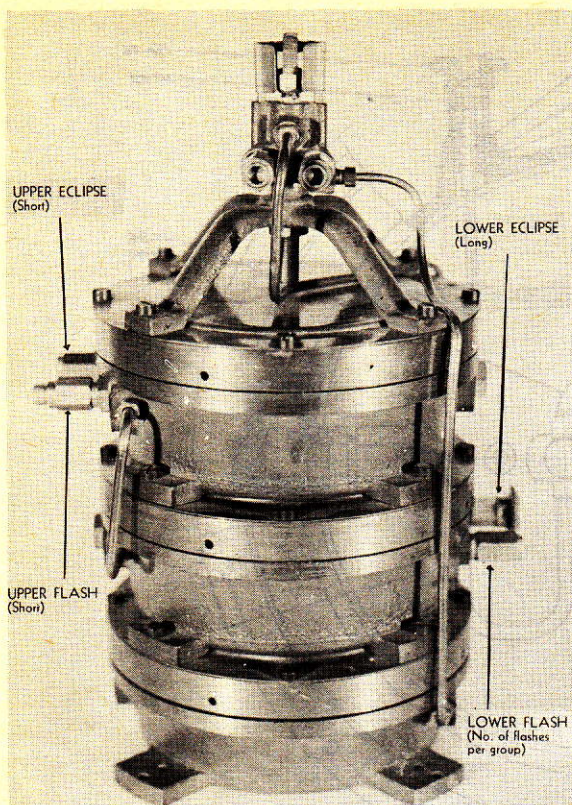


FIGURE 20-39.—130-mm. compound (interrupted quick) flasher-regulator.

(1) The interrupted quick flashing characteristic set by the manufacturer for a 1-cubic foot burner is:

0.3 second flash, 0.5 second eclipse; 0.3 second flash, 0.5 second eclipse; 0.3 second flash, 0.5 second eclipse; 0.3 second flash, 0.5 second eclipse; 0.3 second flash, 0.5 second eclipse; 0.3 second flash, 3.8 second eclipse; 8.1 second period.

(When using the $\frac{3}{4}$ -foot burner, a group of 0.4 second flashes and 0.4 second short eclipses with a 4.0 seconds long eclipse will be obtained.)

(2) If necessary to adjust this flasher, using a 1-foot burner, proceed as follows:

(a) Open up both eclipse screws two full turns (turn counterclockwise).

(b) Set flash 3 seconds long.

(c) Set long eclipse 38 seconds long.

(d) Set short eclipse 5 seconds long.

(e) Screw in (clockwise) flash screw until a total period of 8.1 seconds is attained. (Period equals 1 group of 6 flashes, 5 short eclipses and 1 long eclipse.) For a $\frac{3}{4}$ -foot burner, use valves for (b) of 4 seconds, (c) 40 seconds, and (d) 4 seconds; (e) will equal total period of 8.4 seconds.

(3) If properly adjusted, flashes will occur at

the rate of approximately 75 flashes per minute or 7 groups of 6 quick flashes per minute.

H. 240-mm. single flasher-regulator.—This is a large flasher-regulator serving a cluster of burners when the gas capacity is greater than 3 cubic feet and is used in shore lights where high candlepower is required. The principle of operation and adjustment is the same as the 130-mm. single flasher.

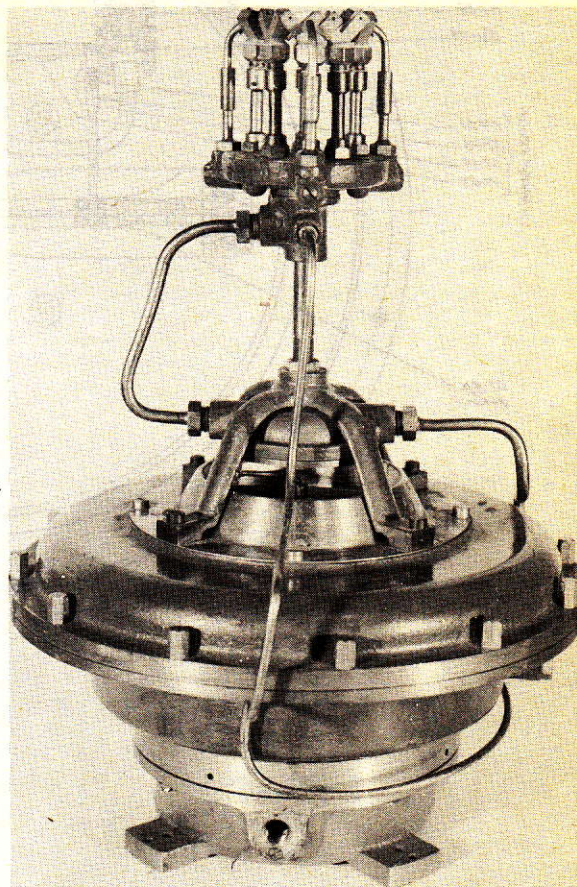


FIGURE 20-40.—240-mm. cluster burner-type flasher-regulator.

20-7-20 Focal Height—

A. Adjustment of focal height of flasher.—When acetylene lights are reported extinguished or burning dimly, maladjustment of the focal height of the flasher is frequently the cause. The center of the flame area as indicated on figure 20-42 must be adjusted to a line through the horizontal center of the lens (focal plane). For further details on focussing see Chapter 21.

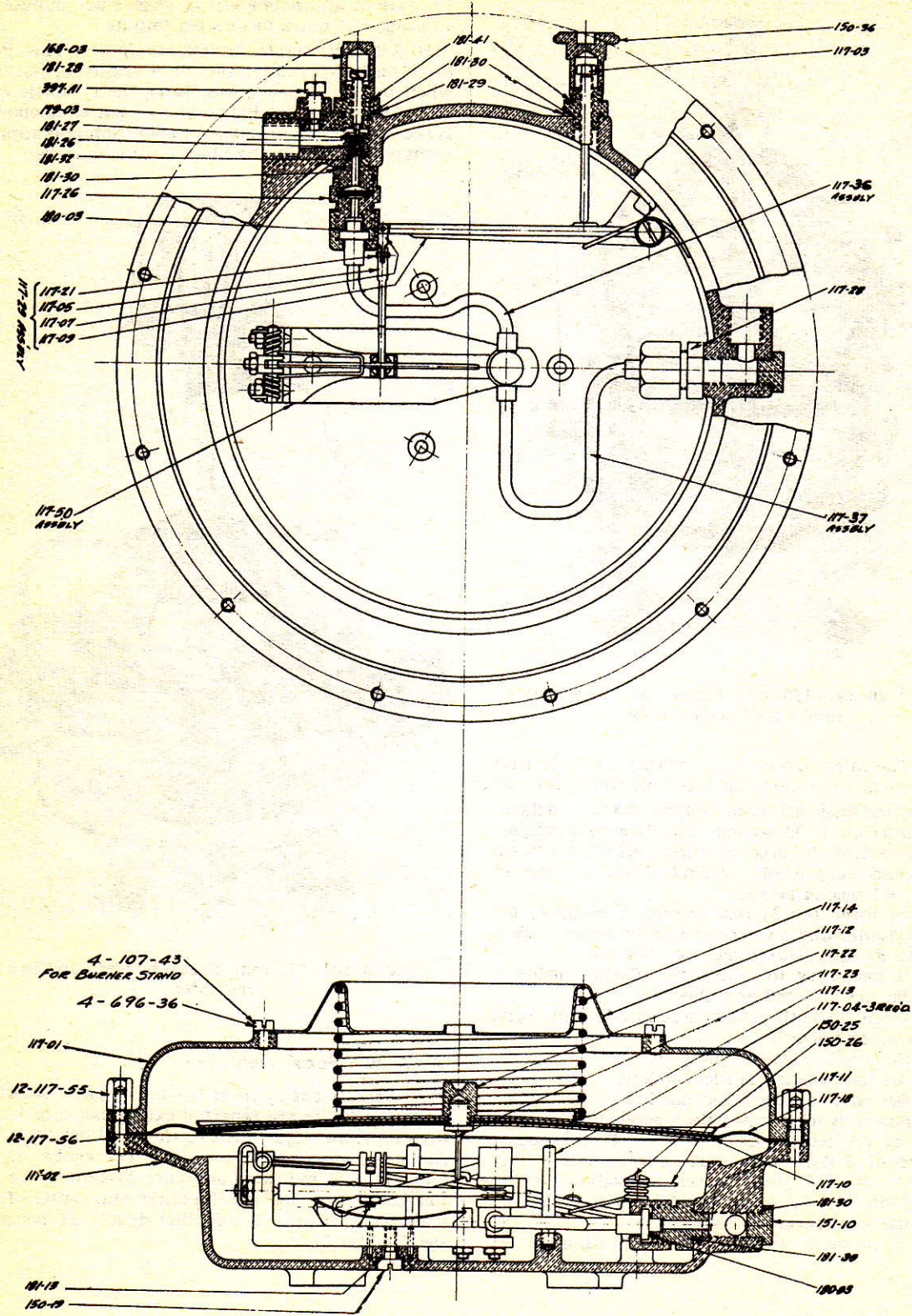


FIGURE 20-41.—240-mm. A. G. A. flasher.

B. In making the adjustment, the center point of the flame is considerably higher than the tip of the burner and allowance for this distance must be made. The following table shows the correct height to adjust over-all height of acetylene flashers equipped with burners normally used in the various sizes of lanterns.

Flasher (mm)	Lantern (mm.)	Burner (cubic foot)	Over-all height (inches)
50	150	$\frac{5}{16}$	$5\frac{2}{32}$
130	200	$\frac{1}{2}$	$12\frac{1}{16}$
130	300	$\frac{3}{4}$	$13\frac{3}{16}$
130	375	1	$14\frac{1}{8}$

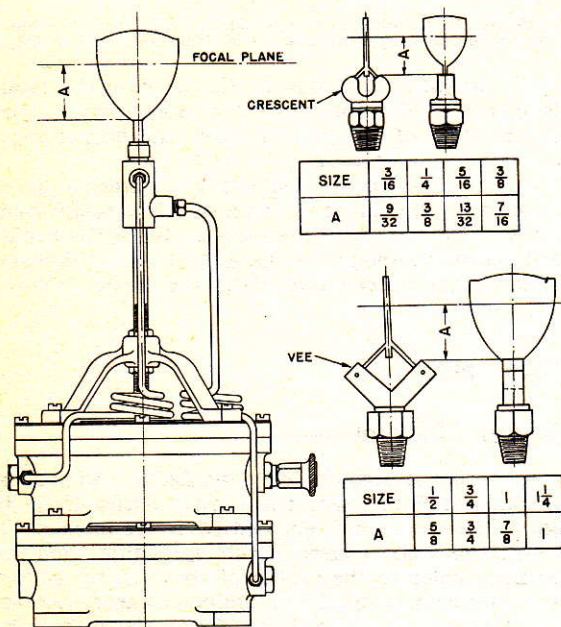


FIGURE 20-42.—Focal height of acetylene burners.

20-8 BURNERS

20-8-1 Description—

A. There are two standard types of burners, the *crescent* and the *vee*, used in acetylene flashers which are rated in cubic feet per hour of gas consumption. The burners are molded from steatite and mounted in brass taper-threaded sockets which screw into burner holders. The *crescent* or "low type," used on the 50-mm. flasher, takes its name from its shape. (See fig. 20-43.) Twin jets of gas are discharged through holes in each arm, so directed as to form a fish-tail flame when ignited. The size of the flame is proportionate to the capacity of the burner. The *vee* or "high" type burner which also takes its name from its shape,

is used in the 130 and 240 mm. flashers. The flame is produced in the same manner as in the small crescent burner. (See fig. 20-43.) The lava tips of these burners are threaded into the socket and cemented. They are very brittle and should be handled carefully.

20-8-5 Standard Burner Sizes—

A. Crescent-type burners are used in $\frac{1}{4}$, $\frac{5}{16}$, and $\frac{3}{8}$ cubic foot per hour sizes. Vee-type burners are used in $\frac{1}{2}$, $\frac{3}{4}$, and 1 cubic foot per hour sizes. In some districts a general policy prevails wherein a given size burner is used in certain size lanterns. For example, on single flashers, burner sizes would be used as follows:

- $\frac{5}{16}$ cubic foot in 150-mm. lanterns.
- $\frac{1}{2}$ cubic foot in 200-mm. lanterns.
- $\frac{3}{4}$ cubic foot in 300-mm. lanterns.
- 1 cubic foot in 375-mm. lanterns.

For complex, compound and quick flash characteristics:

- $\frac{3}{4}$ cubic foot in 200-mm. lanterns.
- 1 cubic foot in 375-mm. lanterns.

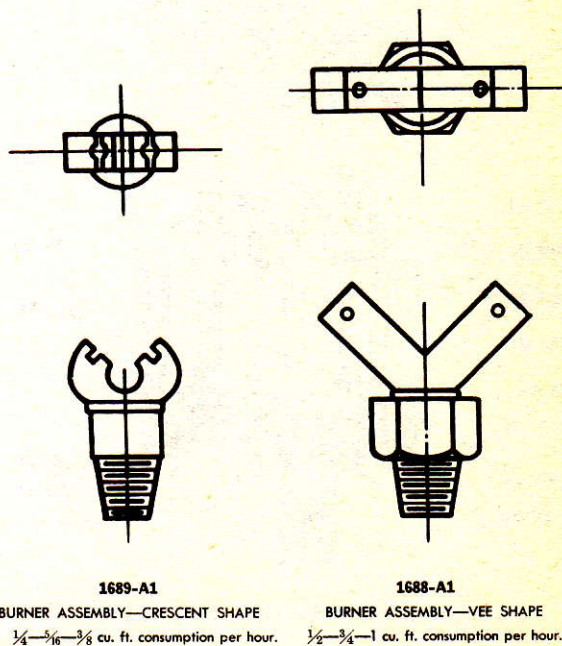


FIGURE 20-43.—Burner assemblies.

B. The following table furnishes information as to type of flasher-regulator to use with each type of burner, burner consumption, and the shortest and longest flash in seconds, of each type. The shortest eclipse shall be not less than the corresponding flash.

Burner size and consumption		Shortest light period in seconds				Longest light period in seconds			
Cubic feet per hour	Liters per hour	K-50	K-130 KG-130	KK-130 KKL-130	K-240 KK-240 KKL-240	K-50	K-130 KG-130	KK-130 KKL-130	K-240 KK-240 KKL-240
Crescent:									
3/4	7	0.1	-----	-----	-----	1.2	-----	-----	-----
5/16	9	.1	-----	-----	-----	1.0	-----	-----	-----
3/8	11	.1	-----	-----	-----	1.0	-----	-----	-----
Vee:									
1/2	14	-----	0.4	0.7	-----	-----	6.5	6.5	-----
5/8	18	-----	.3	.7	-----	-----	5.5	5.5	-----
3/4	21	-----	.3	.7	-----	-----	4.5	4.5	-----
1	28	-----	.2	.5	-----	-----	3.0	3.0	-----
Clusters:									
3x 3/4=2 1/4	64	-----	.3	.3	0.7	-----	1.6	1.6	15
3x 1 = 3	85	-----	.3	.3	.6	-----	1.4	1.4	12
6x 3/4=4 1/2	127	-----	.5	-----	.5	-----	.8	-----	5.5

NOTE.—K=single flasher; KG=interrupted quick flasher (consists of two single flashers); KK= multiple flasher; KKL=complex flasher. Newer designations of flashers are by characteristic, as single, multiple, complex, etc. Number following letter indicates size of diaphragm in millimeters.

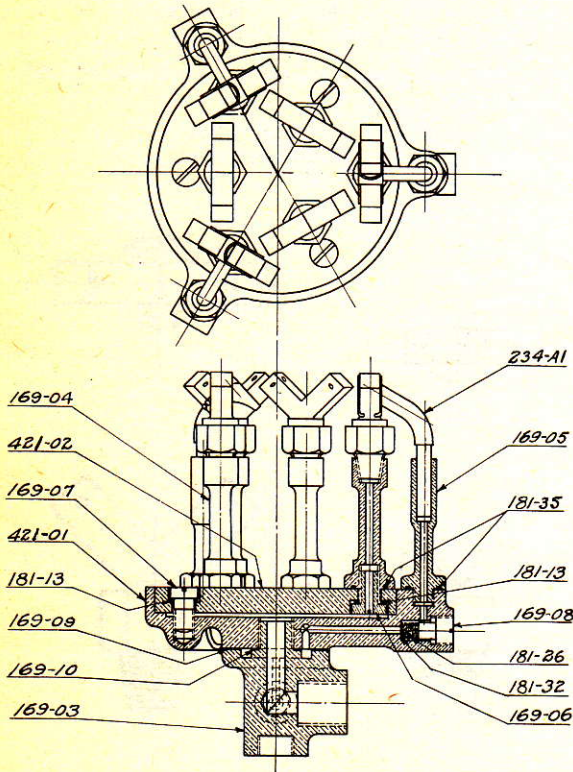


FIGURE 20-44.—Six-tip cluster burner.

20-8-10 Installation Hints—

A. *Burner holes.*—Never attempt to ream out the burner holes as it may deform the orifice and produce an irregular flame. The proper flame should be flat, bright, and somewhat in the shape of a fish tail.

B. *Position burner correctly.*—Burners must be screwed into the burner holders in such a position

as to permit installation of the pilot whose flame is to be located in the "crotch" of the burner. Since the position of the pilot is fixed, the burner must be installed accordingly.

C. *Excessive force.*—Do not use excessive force in screwing the burner into place. It is easily fractured at the joint with the socket. Using the standard sealing compound (A. G. A. Co.) on the threads, screwing the burner hand tight will suffice. Do not use white lead.

20-9 PILOTS

20-9-1 Description—

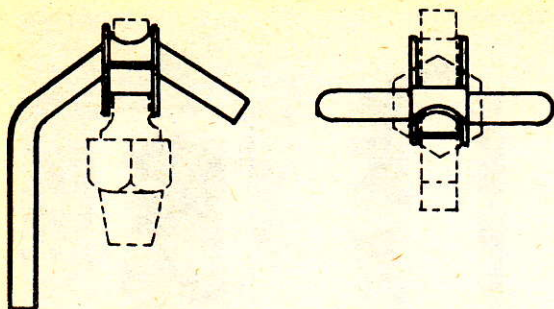
A. A pilot is used on acetylene flashers to provide a constant flame near the burner outlet so as to ignite the gas as it is emitted from the burner. It consists of a short piece of tubing leading from the burner holder to the crotch of the lava tip burner and produces a small nonluminous flame. Acetylene from the regulator is piped directly to the pilot valve which is located in the burner head.

20-9-5 Specific Types—

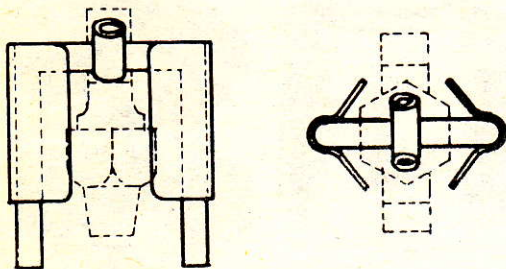
A. The following pilots may be found in general use:

Type	Construction	Used with burner
AGA 233-A1	Single	3/8 cubic feet per hour and less.
AGA 234-A1	do	1/2 cubic feet per hour and larger.
AGA 1230-A1	Double	1/2 cubic feet per hour and larger (non-standard).
IFS F-11-S2	Single	3/8 cubic feet per hour and less (non-standard).

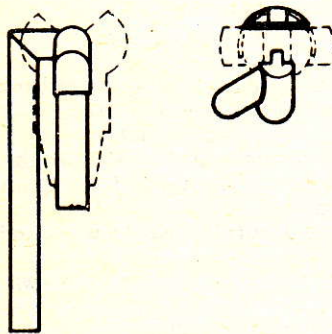
B. *Preferable types.*—The first two above types have demonstrated a marked superiority in resistance to puffing and resistance to, and the effects of, crusting.



234-A1—A. G. A. single pilot burner for Vee-type burners.



1230-A1—A. G. A. double pilot burner for Vee-type burners.



233-A1—A. G. A. single pilot burner for crescent-type burners.

FIGURE 20-45.—Acetylene pilots.

C. *Standardization.*—Although some double pilots may still be found in use, single pilots are now the only standard type. Replacements shall be made as necessary with single pilots and corresponding burner heads. See paragraph 20-16-10 (C) for instructions for conversion of existing double pilots to single pilots.

D. *Gas consumption.*—Single pilots consume approximately $\frac{1}{3}$ cubic foot/day when properly adjusted.

20-9-10 Burner Heads—

A. These are required for mounting the burner and pilot, and for housing the pilot adjustment for

all 130- and 240-mm. flashers, and for installation on the 50-mm. flasher when the focal height is in excess of 155-mm.

B. Burner heads are available in the following sizes:

Burner head type	Pilot construction	Pilot type	Burner type
168-22 single.....	Small single.....	233-A1.....	Crescent.
168-43 single.....	Large single.....	234-A1.....	Vee.
Various (3, 6, 9, 12 cluster)	Large cluster.....	234-A1.....	Vee.

20-9-15 Valves—

A. These are simple devices which control the amount of gas flow and once adjusted need very little attention.

B. *Construction.*—The valve (throttling device) has 6 thin crimped disks (also known as throttle springs, A. G. A. 1137-66) interposed with 7 paper disks (also known as throttle filters, A. G. A. 1137-68). The flow of gas is controlled by a screw which compresses the disks.

20-9-20 Adjustment—

A. Never make the final adjustment of a pilot until about one-half hour after first lighting it. Pilot flames have a tendency to increase during this period. Sometimes several minutes will elapse before any flame at all will be supported due to air in the piping system. The pilot flame, after final adjustment, should be as large as possible, *without being luminous*. There should be no yellow showing—just a firm blue glow. Too high a pilot flame will cause carbon and soot to form at a rapid rate, which may smoke up the lantern and eventually extinguish the light itself.

20-9-25 Installation—

A. Pilots are installed in burner head assemblies by inserting the stems into holes drilled for that purpose. These holes are a fairly tight fit; however, a thin film of special sealing compound should be applied to the stems as a seal before inserting. This sealing compound is a special preparation of white lead and castor oil and is also used on the burner threads. It is procurable from the A. G. A. Co. Do not use ordinary white lead.

B. *Tight fit.*—The pilot should fit snugly into the crotch of the burner. Sometimes it is necessary to give a slight kink to the pilot in order to effect a proper fit. Always try the pilot stem in the drilled hole with the pilot head away from the burner before installing. Stems which are a tight fit should be replaced. (In an emergency they may be dressed down with emery cloth or file.)

C. *Clamping lugs.*—On the single pilot, thin clamping lugs will be noted. The ends are to be bent carefully around the arms of the burners. The solid round piece protruding from the pilot head on the opposite side from the stem is for the purpose of dissipating the heat of the pilot.

20-9-30 Conversion of Double to Single Pilot—

A. Since the double pilot is no longer standard, it is necessary to convert all flashers so equipped to single pilots. Procedure for this conversion will be found under paragraph 20-16-10 (C) (1).

20-10 SUNVALVE

20-10-1 General Description—

A. The A. G. A. sunvalve is a device which automatically discontinues the operation of the flasher during daylight hours. The light is turned off in daylight and is turned on again at the approach of darkness.

The action of sunlight on the device controls the flow of gas to the burner. However, the pilot is not affected since it is supplied with gas direct from the regulator. Mechanical movement of the sunvalve element is obtained by the difference in expansion of certain of the structural members which absorb light. The minute difference in length resulting from difference in temperature is multiplied by mechanical linkage to provide the necessary valve opening. The sunvalve reduces the gas consumption approximately 20 to 40 percent.

B. The A. G. A. sunvalve consists of a system of metal rods protected by a strong glass cylinder. One rod is a thin walled cylinder coated with lampblack and is exposed to the light. Three rods are enclosed within this rod or cylinder to protect them from the light. All four rods are made from the same material and expand and contract equally under temperature variations. The black rod or cylinder is light absorbing and is connected to a valve in the acetylene line. In daylight the black cylinder expands and closes the valve; when darkness approaches it contracts and opens the valve.

The black cylinder is retained at the top of a rigid framework, as are the other rods. The bottom of the black rod is capped by a disc-like casting containing in its center a pointed screw which is fixed to a metal diaphragm and set into the top of the chamber. The pointed screw is carried through the diaphragm and rests on a balanced lever which operates a gas valve. The degree of expansion may be controlled by adjusting the tension of the diaphragm by means of an adjusting screw at the top of the framework.

20-10-5 Adjustment Procedure—

A. The adjustment of a sunvalve is highly critical and must be carefully done.

(1) Cover the sunvalve completely for 2 hours prior to and during the adjustment. The reason for this is, that if the apparatus has been exposed, the amount of expansion is unknown and an accurate adjustment cannot be made if the tube is partially expanded. After being covered for 2 hours, the tube will be fully shrunk.

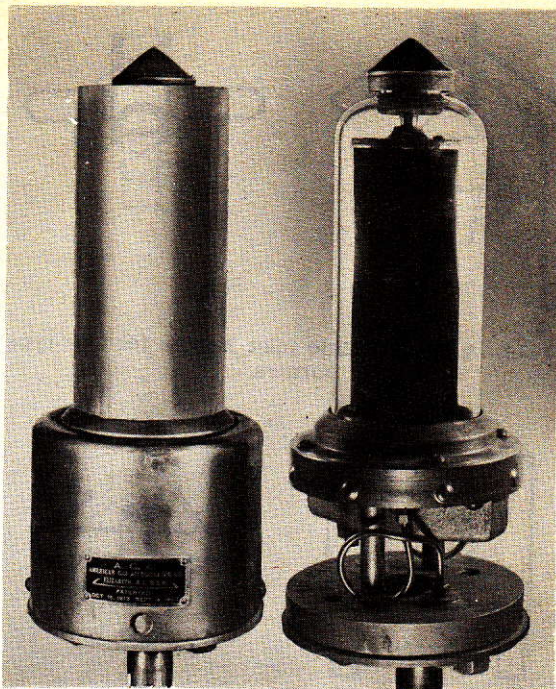


FIGURE 20-46.—Sunvalve.

(2) Be sure the light is operating properly before turning on the sunvalve.

(3) Turn on the sunvalve and the light should continue to operate.

(4) Remove the cap at the top of the glass.

(5) Insert the socket adjusting wrench. *Keep weight of hand off the wrench.*

(6) Turn wrench clockwise until the light goes out. Observe the position of the pointer on the graduated disc.

(7) Continue turning *clockwise* an additional 45 degrees.

(8) Turn back in a counterclockwise direction until the light comes back on. Note the exact point at which this occurs. This is the critical position.

(9) Continue to turn counterclockwise an additional 15°. *This will be the correct point of adjustment.*

(10) Remove wrench and replace cap. Remove the covering over the sunvalve.

B. There will be a certain time lag between the removing of the covering and the shutting off of the light.

C. Sunvalves may be adjusted in the shop or on board tenders and need not be permanently installed at the time of adjustment. Once adjusted, they may be stored as spares. Handle sunvalves carefully and do not jar, particularly when making the adjustment.

D. See paragraph 21-9-5 (H) for instructions for replacing a broken glass cylinder or renewing the black coating on the metal cylinder.

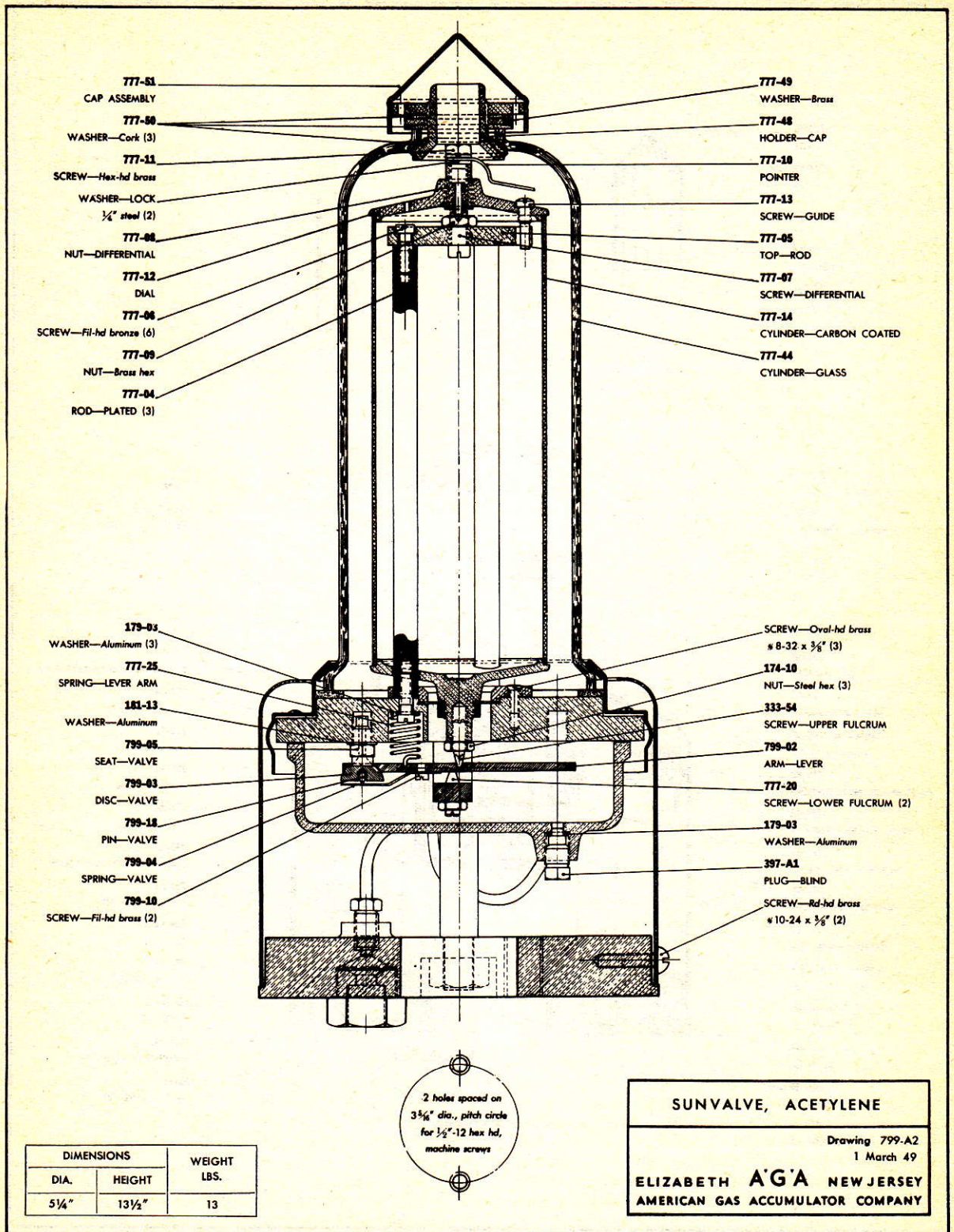


FIGURE 20-47.—Sunvalve.

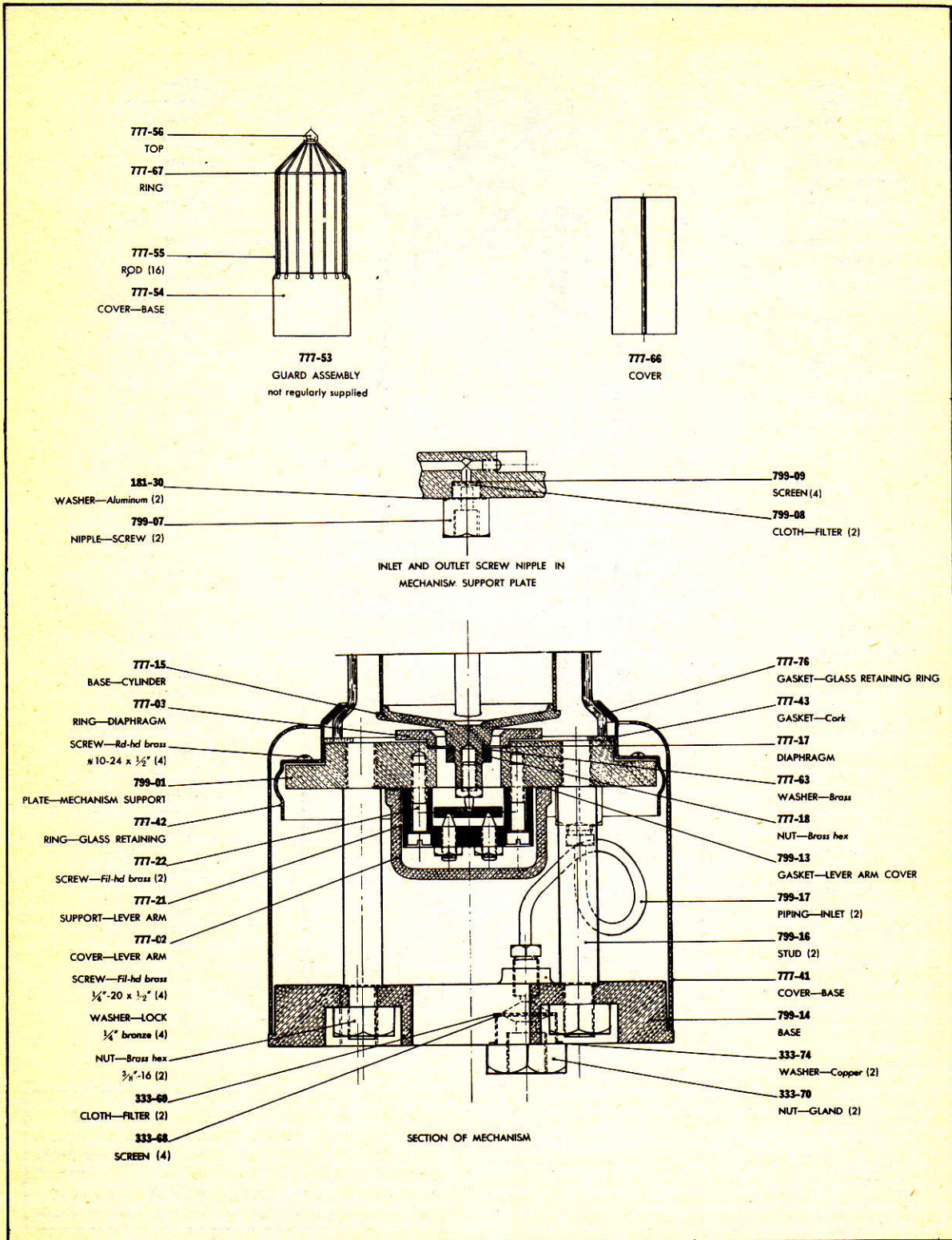


FIGURE 20-48.—Sunvalve mechanism.

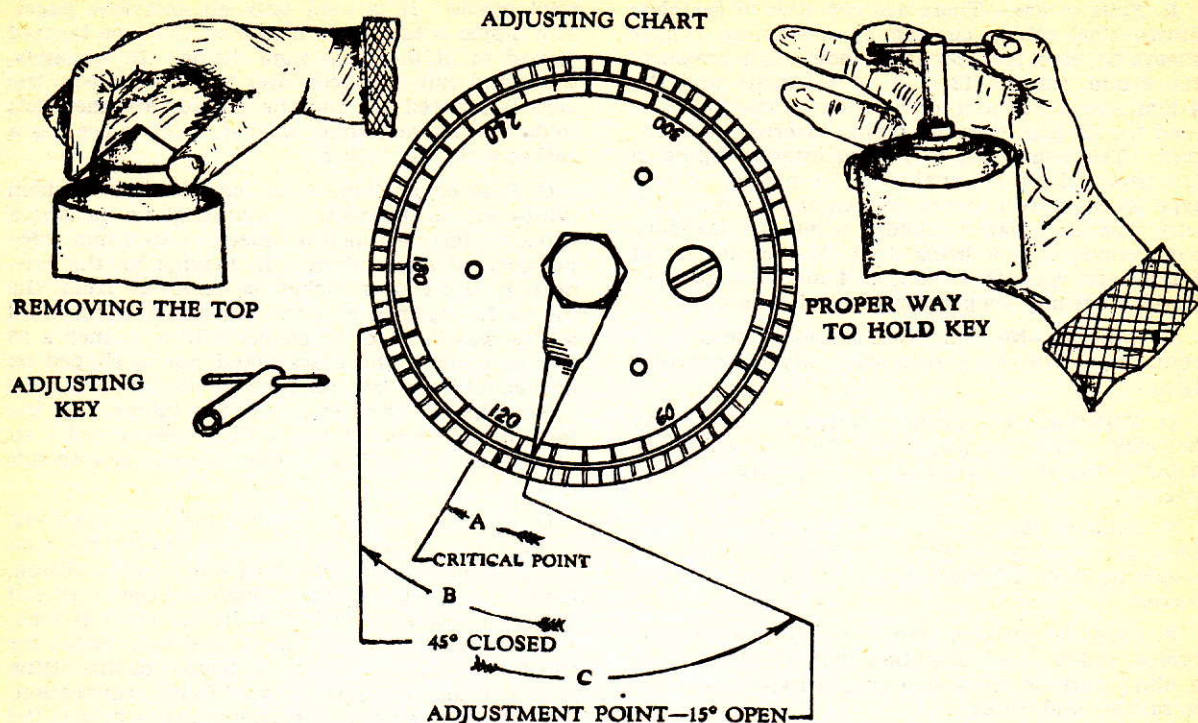


FIGURE 20-49.—Sunvalve and sunrelay adjustment.

20-11 PIPING AND FITTINGS

20-11-1 General Description—

A. All acetylene fittings (connections) and piping (tubing) valves, manifolds, and gages are of special design and construction. The screw fittings used in connection with acetylene apparatus were originally of Swedish design and conformed to the metric system of measurement. This system has since been converted to the British standard pipe thread (B. S. P.) or Whitworth thread system. The difference between the Whitworth pipe thread and the National pipe thread used in the United States is that the angle of the Whitworth thread (not the taper) is 55 degrees while the angle of the National pipe thread is 60 degrees.

B. *Component parts of an acetylene buoy piping system.*—A typical acetylene buoy piping system includes the following:

(1) A length of high-pressure piping inside each buoy pocket leading from the cylinder valve to the hollow threaded staybolt located in the side of the pocket.

(a) Steel tubing, copper-covered to prevent corrosion, has been used in the past. A new stainless steel tubing is now the only type authorized for use in buoy pockets. All connections are $\frac{3}{4}$ -inch Whitworth straight pipe thread. Screw connections have flat, machined contact surfaces and are made tight by using aluminum washers.

(2) A length of high-pressure copper-covered or stainless steel piping from each pocket staybolt outlet to the manifold which should be located inside the daymark of the tower.

(3) A diaphragm-type shut-off valve, or combination shut-off valve and manifold. (See fig. 20-58.)

(4) A length of high-pressure copper-covered or stainless steel piping from the shut-off valve to the lantern.

C. A piping system for a minor light is similar to the foregoing except that the length of high pressure tubing leads directly from the cylinders to the manifold. Stainless steel tubing is not mandatory as in the case of buoy pockets.

20-11-5 High Pressure Piping—

A. *Steel tubing.*—High pressure stainless or copper-covered steel tubing must be used to conduct acetylene at pressures in excess of one atmosphere between lantern, valves, manifold, and cylinders. Fittings are permanently brazed on the tubing and a special technique is required for this operation. (See sec. 20-11-55.) Fittings are so attached to the copper-covered steel tubing that the copper *never* comes in contact with the acetylene. All acetylene connections must be gasketed with aluminum washers.

B. Sizes in use.—There are two sizes of seamless drawn steel tubing covered by a seamless copper sheathing used for acetylene under high pressure; the 8-mm. size (0.312 o. d. or $\frac{5}{16}$ -inch) and the 4-mm. size (0.156 o. d. or $\frac{5}{32}$ -inch). The 8-mm. is used for all high pressure piping external to a lantern. The 4-mm. size is used as interior piping in lanterns and for external sunvalve piping. A new type stainless steel tubing $\frac{1}{4}$ -inch and $\frac{5}{32}$ -inch o. d. with 0.35-inch wall thickness, using the standard connections, is now being used ($\frac{1}{4}$ -inch in lieu of 8 mm. and $\frac{5}{32}$ -inch in lieu of 4 mm.) in place of standard 8-mm. copper-coated steel tubing.

C. Caution.—No other tubing should be used in connection with high pressure acetylene installations.

D. Shipping.—For shipping purposes, tubing may be coiled to a 3-foot diameter. Close the ends with a bottle cap or by wrapping with burlap or cellophane.

E. Bending radius.—Tubing should preferably be bent to a radius of not less than 4 inches and under no circumstances to a radius of less than 2 inches.

F. Care of disconnected tubing.—Disconnected tubing which is left installed shall be closed with a blind plug or screw cap or otherwise sealed off to salt air and water.

G. Carbon deposit.—Tubing should be blown out before making final connections. Carbon deposits will build up inside during disuse.

20-11-10 Low Pressure Piping—

A. This tubing comes in one size only, 4 mm., and is of brass composition known as tombac. It is used where the pressure does not exceed that of the regulator (20 inches of water column pressure), such as on flashers or internal sunvalve piping.

20-11-15 Connections—

A. F-10 connection.—This connection ($\frac{3}{4}$ -inch Whitworth size) consists of a brass gland nut and steel nipple. The steel nipple is threaded and brazed to 8-mm. steel tubing. In making up the F-10 connection, the copper jacket on the 8-mm. tubing is removed for $1\frac{3}{16}$ inch and threaded back about $\frac{3}{16}$ inch with a special $\frac{5}{16}$ inch x 26 straight special V thread die. The brass gland nut is slipped on hexagonal head first, and the steel nipple screwed on far enough so that the threaded end is $\frac{1}{16}$ inch below the edge of the copper covering. The steel nipple is then brazed to the tubing, care being taken that the spelter runs down into the threads. See section 20-11-55 for detailed brazing procedure. An aluminum washer known as F-13 is used as a gasket with this fitting. The F-12 nipple is the steel part of an F-10 connection.

Note.—The stainless steel tubing requires a different size nipple.

B. F-20 connection.—This connection ($\frac{1}{2}$ inch Whitworth size) consists of a brass gland nut and

steel nipple. It is used only on acetylene gages. The nipple is tapped $\frac{1}{8}$ inch National pipe tapered thread to fit the male gage fitting. In assembly, the gland nut is placed over the steel piece, the gage is screwed on, and the threads are then soft soldered. An aluminum washer, F-23, is used as a gasket with this fitting.

C. F-40 connection.—This connection ($\frac{1}{4}$ inch Whitworth size) consists of a brass gland nut and a threaded ferrule which is brazed to an 8-mm. copper-covered steel tubing. In making up the connection, the copper jacket is removed from the tubing for $\frac{3}{8}$ inch and the bared end is threaded all the way back to the copper with a $\frac{5}{16}$ inch x 26 special V die. The brass gland nut is slipped on hexagonal head first, followed by the threaded steel collar which is then brazed to the tubing, and the face of the ferrule faced with a special tool. An aluminum washer, F-43, is used as a gasket with this fitting.

D. F-40A connection.—This is similar to the F-40, except that it is used on 4-mm. ($\frac{5}{32}$ inch o. d.) copper-covered steel tubing. In making up this fitting, the copper is removed for $\frac{3}{16}$ inch and the bared end threaded with a $\frac{5}{32}$ inch x 36 die for about $\frac{1}{4}$ inch. An aluminum washer, F-43, is used as a gasket for this fitting. The A. G. A. counterpart of this fitting differs from the Service-type F-40A connection. The thread size on the hexagonal gland nuts is the same, ($\frac{1}{4}$ -inch straight Whitworth), but they differ in the following respects: A. G. A.-bore of nut 0.344 inch, nipple body diameter 0.333 inch and thread in nipple 4 mm. x 0.5 mm.; Service-type bore of nut 0.328 inch, nipple body diameter 0.315 inch, and thread in nipple $\frac{5}{32}$ inch x 36. Thus the parts are not interchangeable. The F-40A is extensively used in the Service. The same F-43 aluminum washer may be used for both.

E. F-60 connection.—This connection is $\frac{5}{16}$ inch x 26 thread size and consists of a brass gland nut and brass collar or ferrule, which is silver soldered to 4-mm. brass (tombac) tubing. This fitting may also be used on 4-mm. copper-covered steel tubing. An aluminum washer, F-63, is used as a gasket with this connection.

F. F-40 coupling.—This is a hexagonal coupling similar to the F-190 described below, except for size. It is counterbored and threaded in each end with $\frac{1}{4}$ -inch straight Whitworth pipe thread to take a standard F-40 or F-40A connection, and may be used for joining lengths of 8-mm. or 4-mm. copper covered steel tubing together.

G. F-60 coupling.—This coupling is seldom used. It is counterbored and threaded with a $\frac{5}{16}$ inch x 26 special thread or a standard 8-mm. x 1-mm. thread F-60 connection in each end and can be made up as needed. It is used for low pressure and can be made of brass of suitable hexagonal stock.

H. F-150 coupling.—This coupling is of steel, about $\frac{5}{8}$ inch hexagonal and $1\frac{3}{4}$ inches long. It is threaded on both ends with $\frac{5}{16}$ inch x 26 special thread to take the threaded ends of 8-mm. copper-covered steel tubing, both ends of which are then brazed. It is used in long runs of tubing where brazing is feasible in the field.

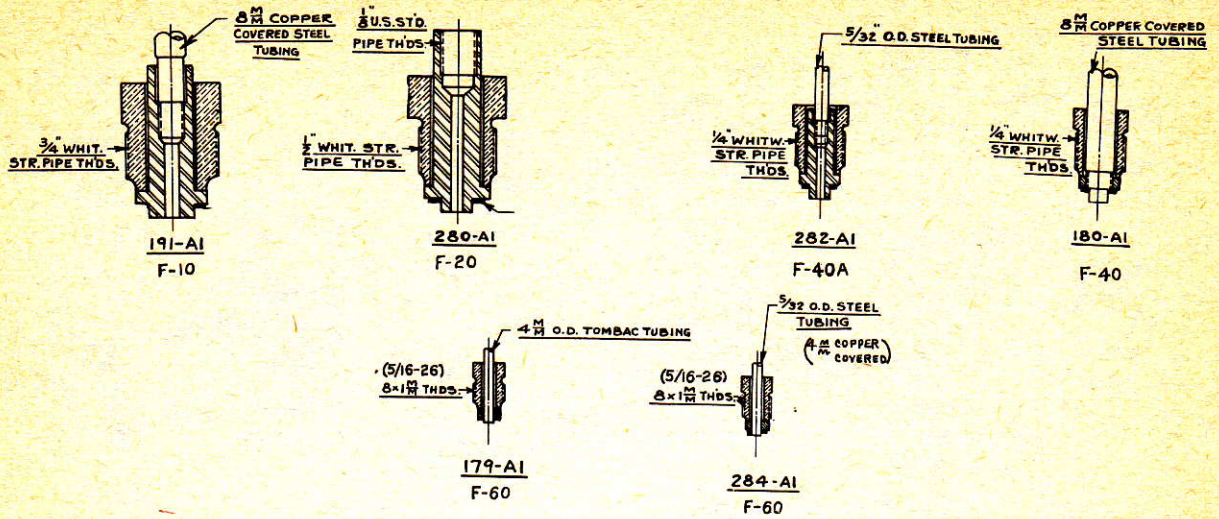


FIGURE 20-50.—Pipe connections, nuts, and bushings.

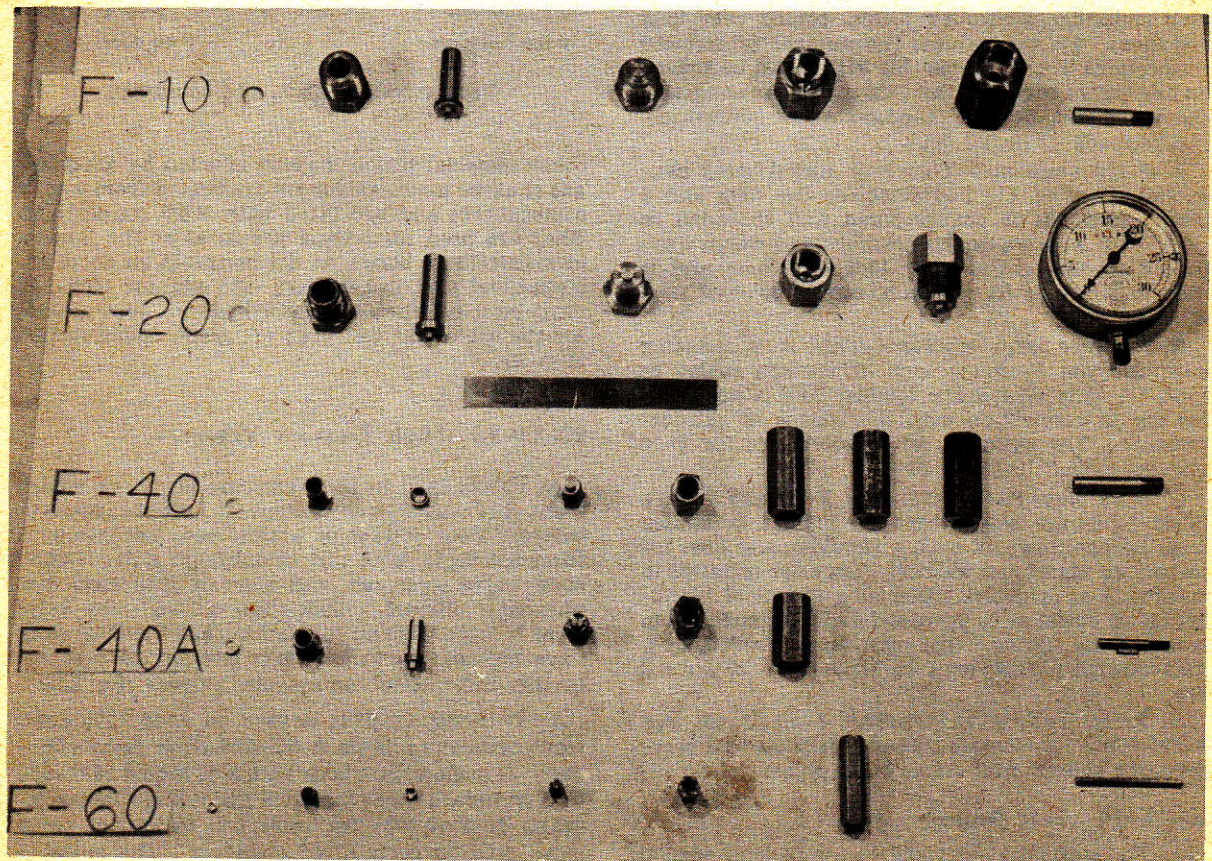


FIGURE 20-51.—Standard acetylene pipe connections and associated fittings.

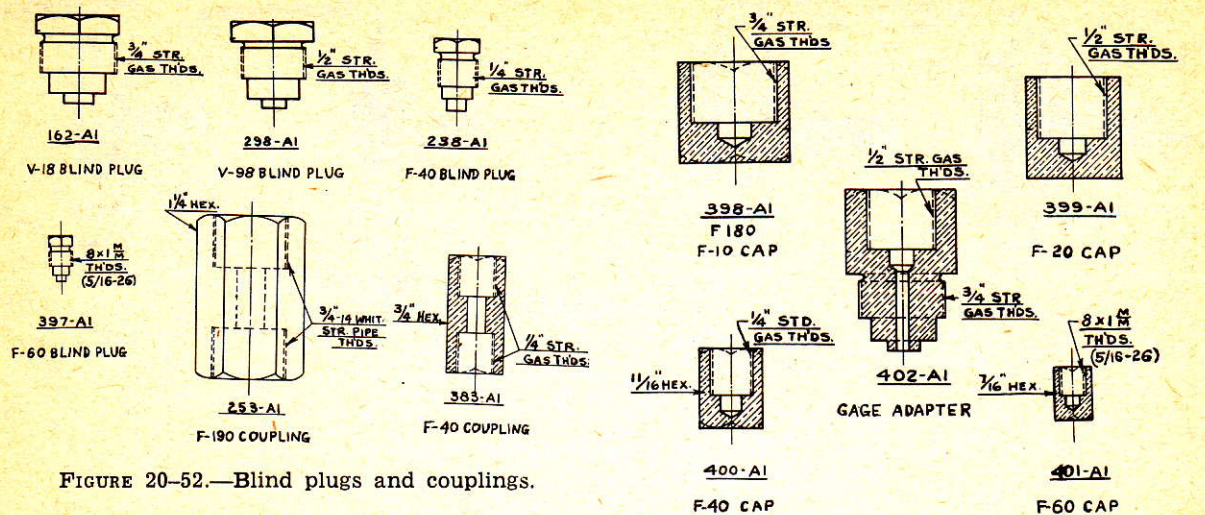


FIGURE 20-52.—Blind plugs and couplings.

I. *F-160 coupling*.—This is a steel hexagonal fitting about 1 $\frac{3}{4}$ inches long and $\frac{3}{4}$ inch hexagonal. It is threaded in one end with $\frac{5}{16}$ inch x 26 thread to take the end of a threaded piece of 8-mm. copper-covered steel tubing to which it is then brazed. The opposite end is counterbored and threaded $\frac{1}{4}$ inch straight Whitworth to take a standard F-40 or F-40A connection. This connection is usually used as a coupling in running 8-mm. tubing over long distances. Its use reduces the number of screwed connections in the line as this fitting can be brazed on one end of each length of tubing at the shop, and the other end, being a standard screw connection, can be made up in the field.

J. *F-190 coupling*.—This is a nickel steel hexagonal coupling 1 $\frac{1}{4}$ inches across the flats and 2 inches long. It is counterbored and threaded in each end with $\frac{3}{4}$ -inch straight Whitworth pipe thread to take standard F-10 connections and is used to join lengths of 8-mm. copper-covered steel tubing.

K. *Pressure gage adapter*.—This is a reducing bushing from F-10 ($\frac{3}{4}$ inch Whitworth male) to F-20 ($\frac{1}{2}$ inch Whitworth female) and is necessary for use in connection with the testing of cylinder pressure. The cylinder valve outlets are for F-10 and the gage fittings for F-20.

L. *Blind plugs V-18, V-98, F-20, F-40, and F-60*.—Blind plugs are solid, threaded fittings machined from hexagonal stock with a shoulder and boss for seating an aluminum washer. They are installed in manifolds or cylinders either as a means of blanking off an outlet or to prevent foreign particles from entering the tubing. The sizes range from the $\frac{3}{4}$ inch straight Whitworth to $\frac{5}{16}$ inch x 26 thread size.

M. *Screw caps F-10 (F-180), F-20, F-40, and F-60*.—Caps are female threaded fittings and serve the same general purpose as blind plugs.

20-11-20 Test Gage—

A. The standard acetylene test gage is of special design with the stipulation that no copper alloy or

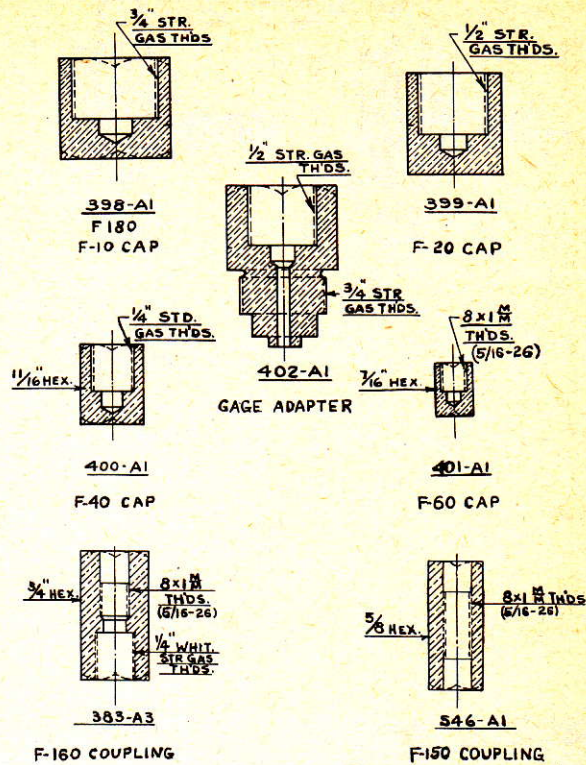


FIGURE 20-53.—Caps and couplings.

other material which may be affected by acetylene gas shall be used. Gages are graduated from 0 to 30 atmospheres and are fitted with F-20 connections. They are used for testing pressures at the lantern or manifold on buoys, at the manifold on shore installations, and on cylinders. An adaptor (402-A1) must be used when testing cylinders. Instructions for the use of the test gage are given under section 20-5-30.

20-11-25 High Pressure Valves—

A. Valves used in high-pressure acetylene equipment are, with one exception, diaphragm-type valves. They consist of a steel body containing a threaded brass valve nut (diaphragm nut), a valve stem, valve stem cup, and a set of thin steel diaphragms. Should a leak show through the valve stem threads, it is an indication that the steel discs have become fractured. (See section 20-5-20 for further information on cylinder valves) (fig. 20-5).

B. *V-10 valve*.—This is used on A-50 (200 cubic feet) cylinders and on A-25 (100 cubic feet) cylinders. It has a square body with a $\frac{3}{4}$ inch x 14 thread U. S. Standard taper threaded male spud. See paragraph 20-5-20 (C) for reference to special taper valve used on certain old cylinders. The outlet is threaded for F-10 connections.

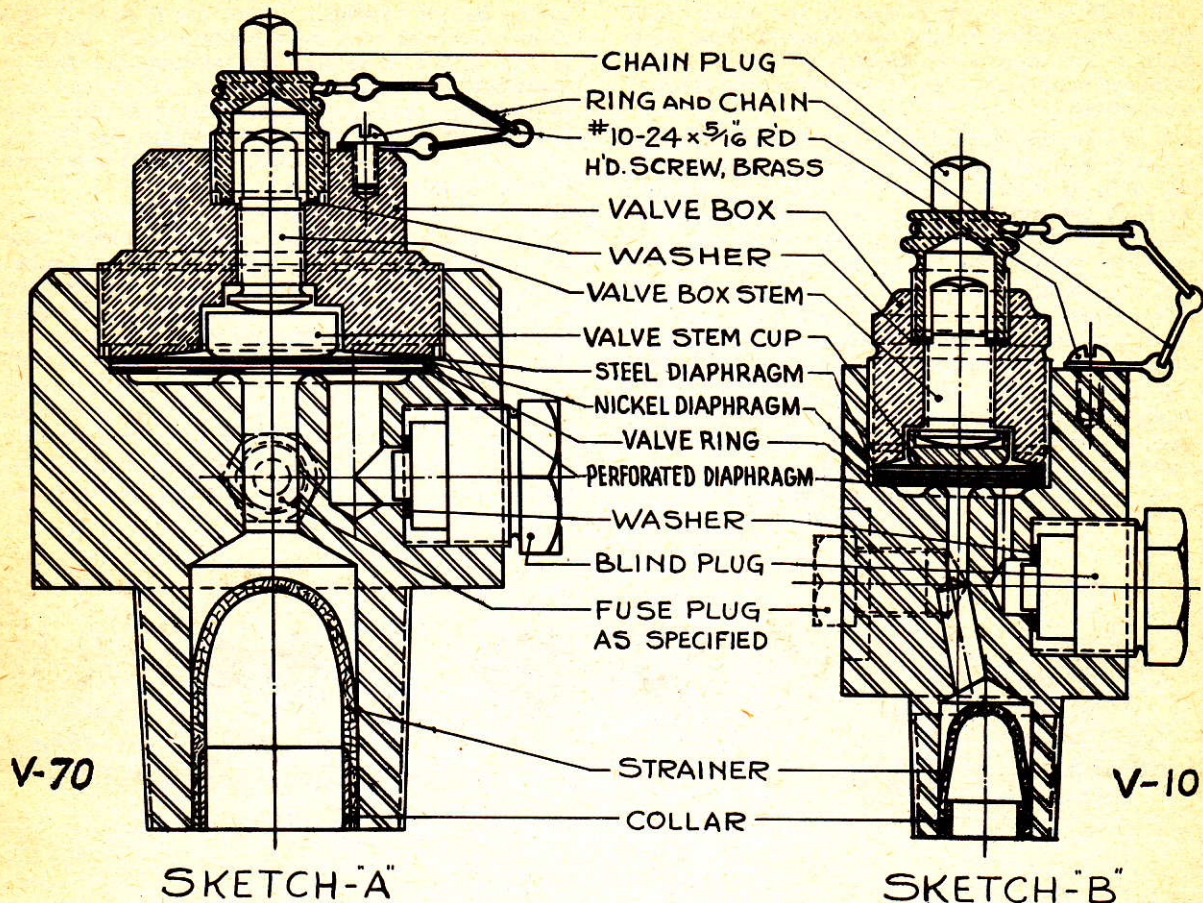


FIGURE 20-54.—V-10 and V-70 cylinder valves

ASSEMBLY NUMBERS, BODY NUMBERS AND STUD THREAD CHARACTERISTICS OF A. G. A. CYLINDER VALVE

Sketch symbol	Assembly No.	Valve body	Stud threading					
			Pipe size	Form	Taper per foot	Fuse plug		
A	296-A1	296-01	1½ inch-11.....	Whitworth.....	Inches ¾	175-A1	} Used in A-300 cylinders.	
A	296-A2	296-10	1½ inch-11.....	do.....		¾		None
A	296-B1	296-11	1½ inch-11½.....	Briggs.....		¾		None
B	161-A1	161-01	¾ inch-14.....	Whitworth.....	Inches 1½	175-A1	} Used in A-25 and A-50 cylinders.	
B	161-A2	161-15	¾ inch-14.....	do.....		1½		None
B	458-A1	458-01	¾ inch-14.....	Briggs.....		¾		None
B	458-A2	458-02	¾ inch-14.....	do.....		¾		175-A1
B	720-A1	720-01	1 inch-11½.....	do.....		¾		None
B	1391-A1	1391-01	¾ inch-14.....	Whitworth.....		¾		175-A1

Other parts used in the above valve assemblies

Name	Part numbers on sketch	
	A	B
Valve box.....	296-02	161-02
Valve box stem.....	161-03	161-03
Valve stem cup.....	296-03	161-04
Chain plug.....	161-05	161-05
Perforated diaphragm.....	296-04	161-06
Valve ring.....	296-05	161-07
Nickel diaphragm.....	296-06	161-08
Steel diaphragm.....	296-07	161-09
Washer.....	161-10	161-10
Strainer.....	296-08	161-11
Collar.....	296-09	161-12
Ring and chain.....	161-13	161-13
Blind plug.....	162-A1	162-A1
Washer.....	191-03	191-03

NOTES

Diaphragms are usually sold in complete sets as follows:
 For acetylene valves shown on Sketch "A":
 1 each of 296-04, 296-05 and 296-06.
 5 of 296-07.
 For acetylene valves shown on Sketch "B":
 1 each of 161-06, 161-07 and 161-08.
 2 of 161-09.
 For CO₂ valve shown on Sketch "B":
 1 each of 161-24, 161-25 and 161-26. (These are all bronze diaphragms.)
 5 of 161-09.
 In each valve the diaphragms are assembled in the order shown, i. e., the perforated diaphragm nearest the seat, then the spacer ring, etc.

C. *V-70 valve*.—This is used on the A-300 (1,060 cubic feet) cylinders and has a round steel body with a 1½ inch x 11 thread Whitworth taper threaded male spud. The outlet is threaded for F-10 connections.

D. *V-270 line shut-off valve*.—This has a 2 inch x 2 inch x 4½ inch square steel body, tapped at each end with ¾ inch straight Whitworth pipe thread for F-10 connections. The end having the deepest hole is the inlet. This valve may also be had with an added tapped hole for the pressure gage.

E. *Combination line shut-off valve and manifold*.—These valves are similar to the line shut-off valve, are most commonly used on buoys, and are available with and without test gage connections.

F. *Pressure gage valve for lantern mounting*.—There are two types in use; the A. G. A. diaphragm type, used on all A. G. A. lanterns, and the conical seat type used on Service-type lanterns.

(1) The A. G. A. diaphragm type valve has the inlet tapped for an F-10 connection, and the outlet

to the flasher assembly tapped for F-40 or F-40A connection, and contains a built-in filter. The operation of the valve does not interrupt the flow of acetylene to the flasher assembly, but serves as a by-pass to a pressure gage outlet near the valve body tapped ½ inch straight Whitworth pipe thread. This valve is normally *closed*, being open only when testing cylinder pressures.

(2) The Service-type pressure gage valve has a conical seat which is forced against a tapered valve seat in the same manner as an ordinary valve. When the valve is open, the pressure is on the stem. However, behind the conical seat there is a shoulder carrying an aluminum washer which seats against the bottom of the valve box when the valve is fully open, sealing off the valve threads. Only a quarter turn is required to go from closed to fully open position. It is important that the valve stem be quickly and fully opened against the aluminum gasket so that minimum leakage occurs between the closed and fully open position.

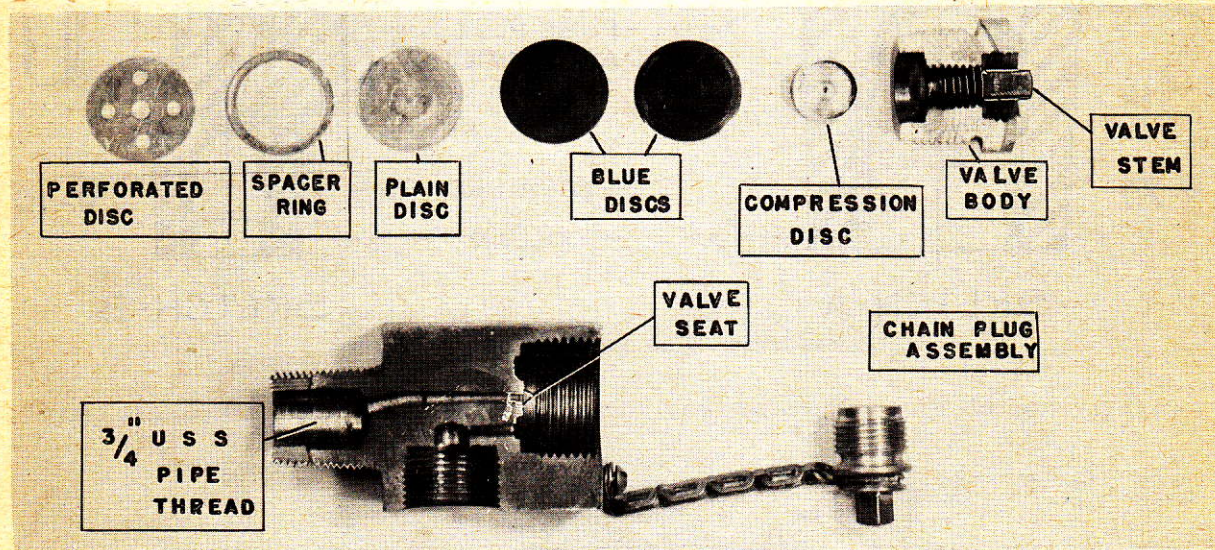


FIGURE 20-55.—Valve assembly for A-25 and A-50 cylinders.

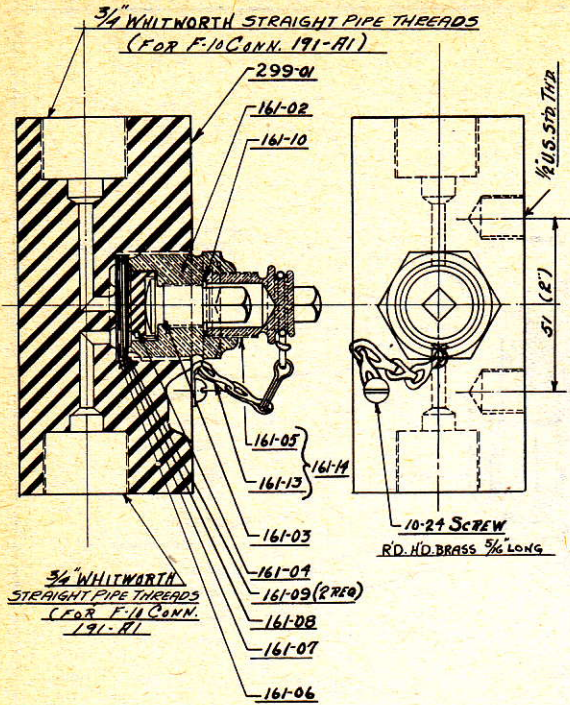


FIGURE 20-56.—V-270 line shut-off valve.

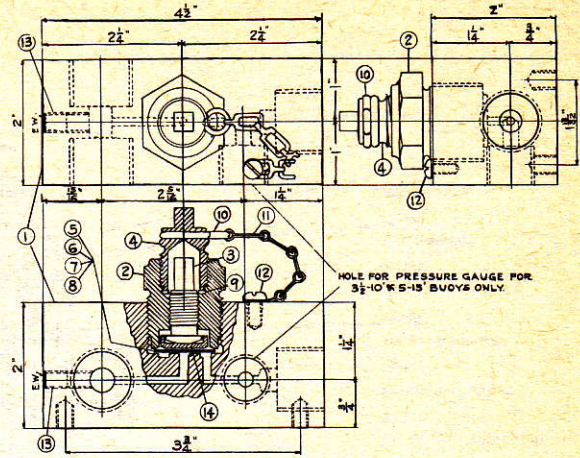


FIGURE 20-57.—Assembly for two-hole combination shut-off valve and manifold.

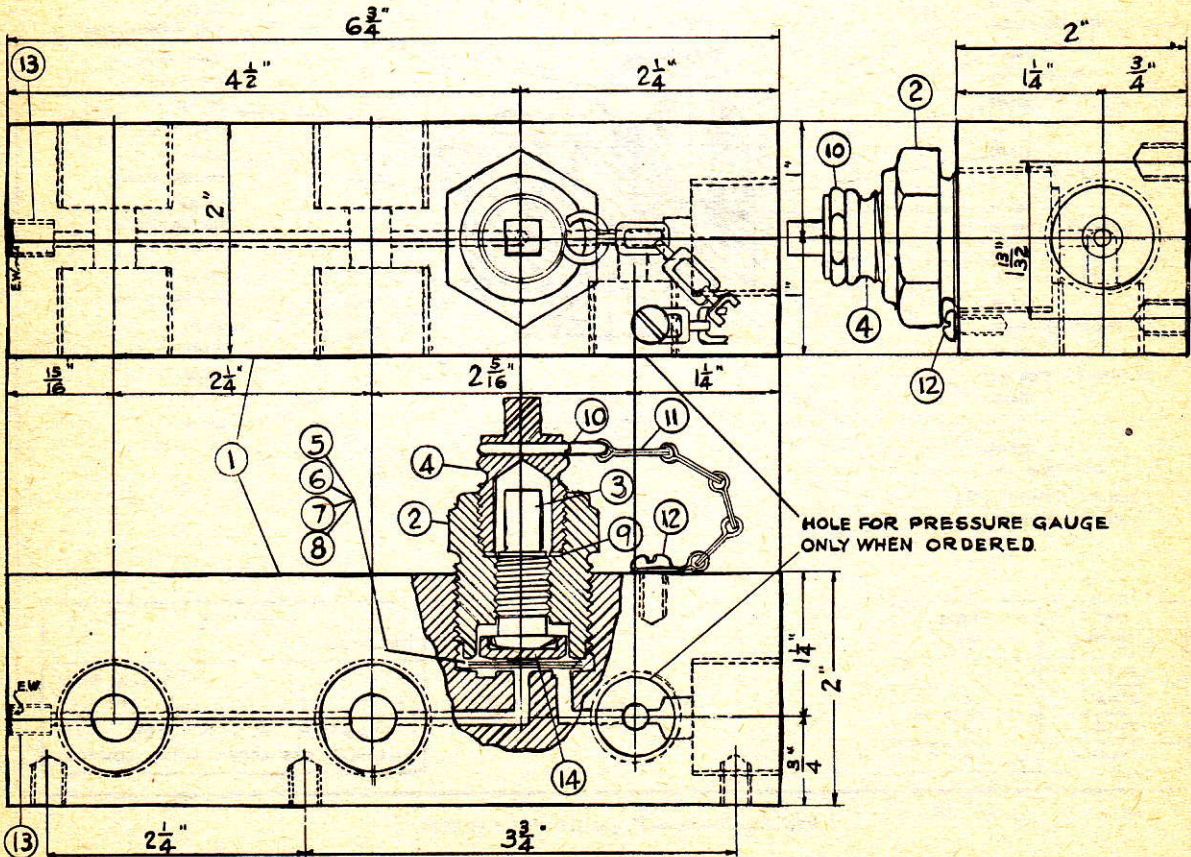
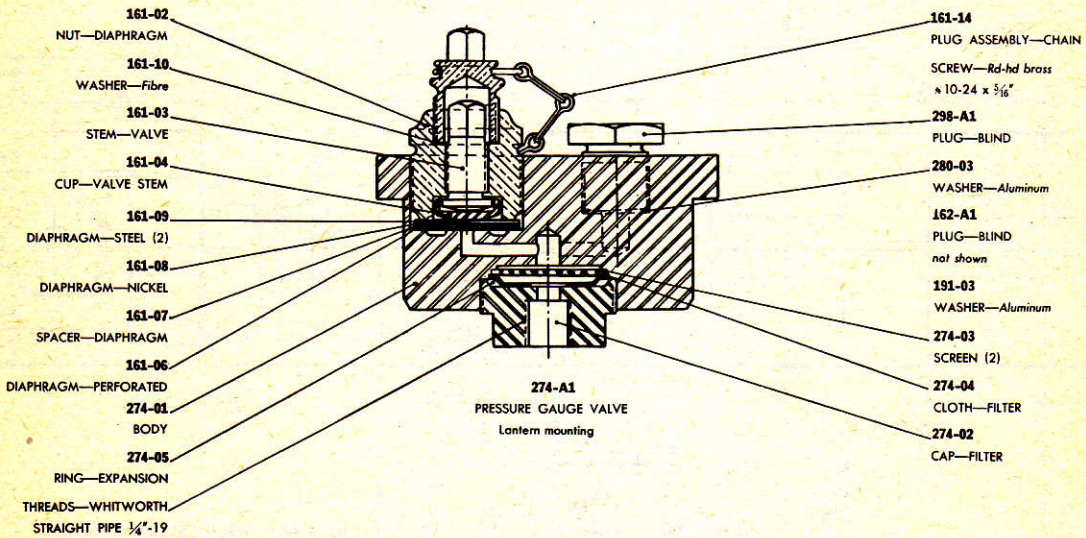
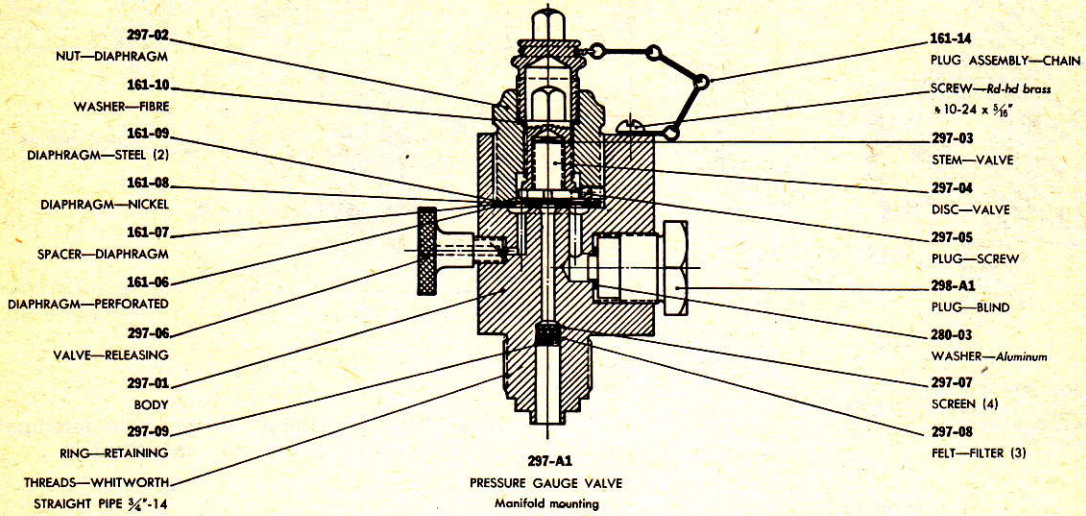


FIGURE 20-58.—Assembly for four-hole combination shut-off valve and manifold.



PART NUMBER	WEIGHT LBS.
260-A1	6
274-A1	6
297-A1	3
384-A1	6

VALVES	
PRESSURE GAUGE	
Drawing SS-231 1 March 49	
ELIZABETH A'G'A NEW JERSEY AMERICAN GAS ACCUMULATOR COMPANY	

FIGURE 20-59.—Pressure gage valves.

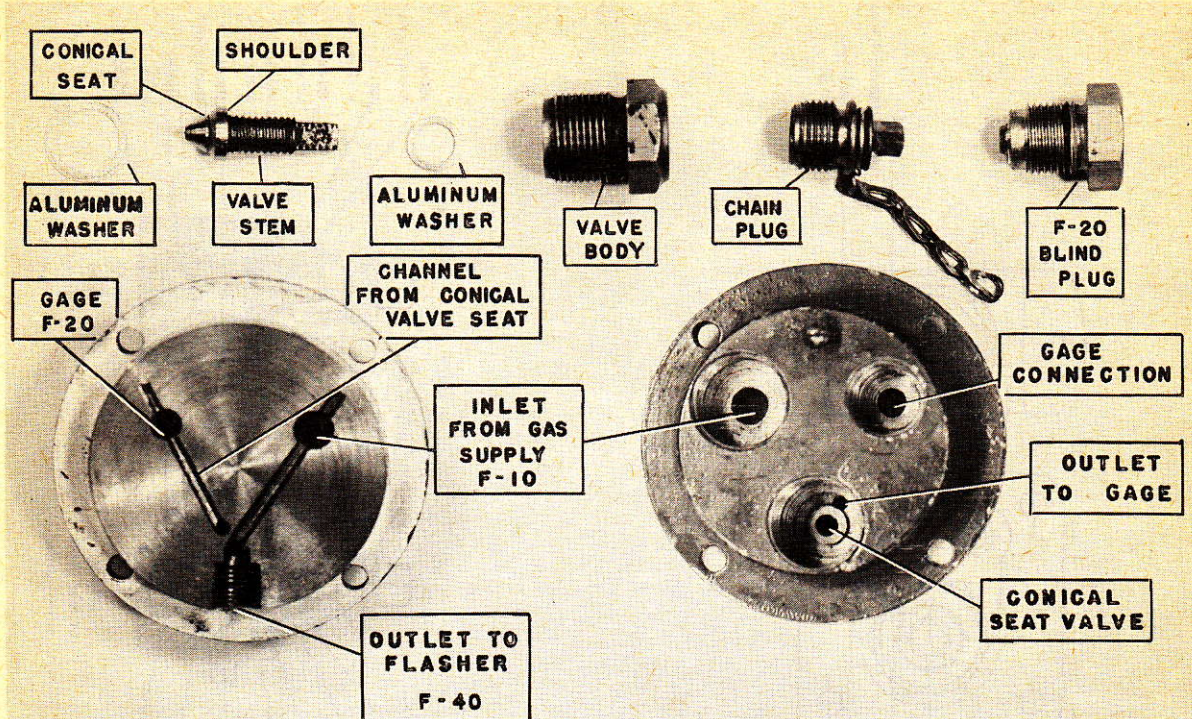


FIGURE 20-60.—Third District-type 200- and 375-mm. lantern test manifold.

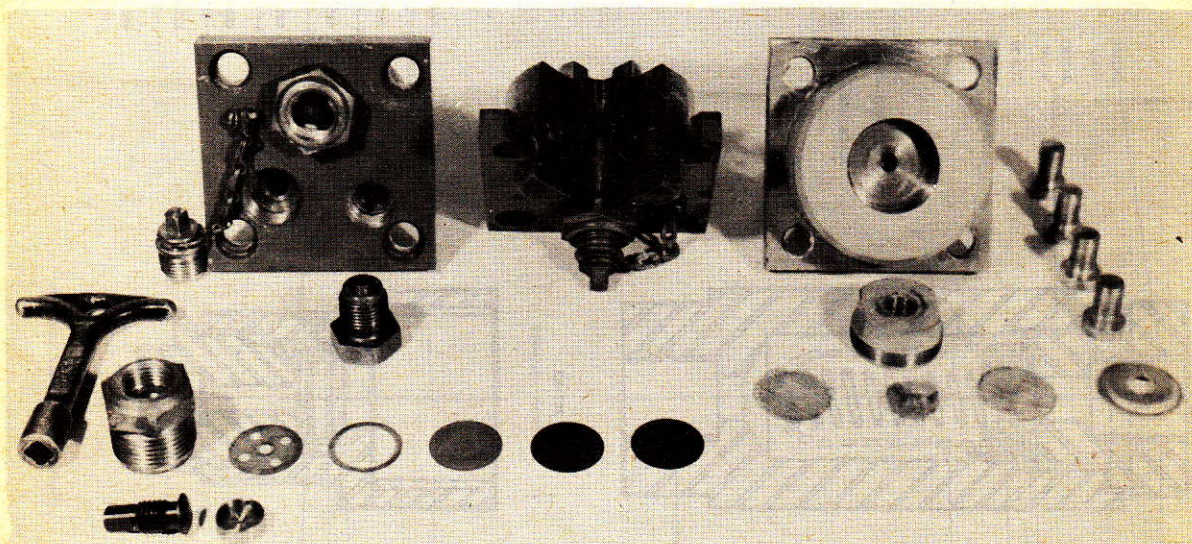


FIGURE 20-61.—A. G. A. pressure gage valve for lantern mounting.

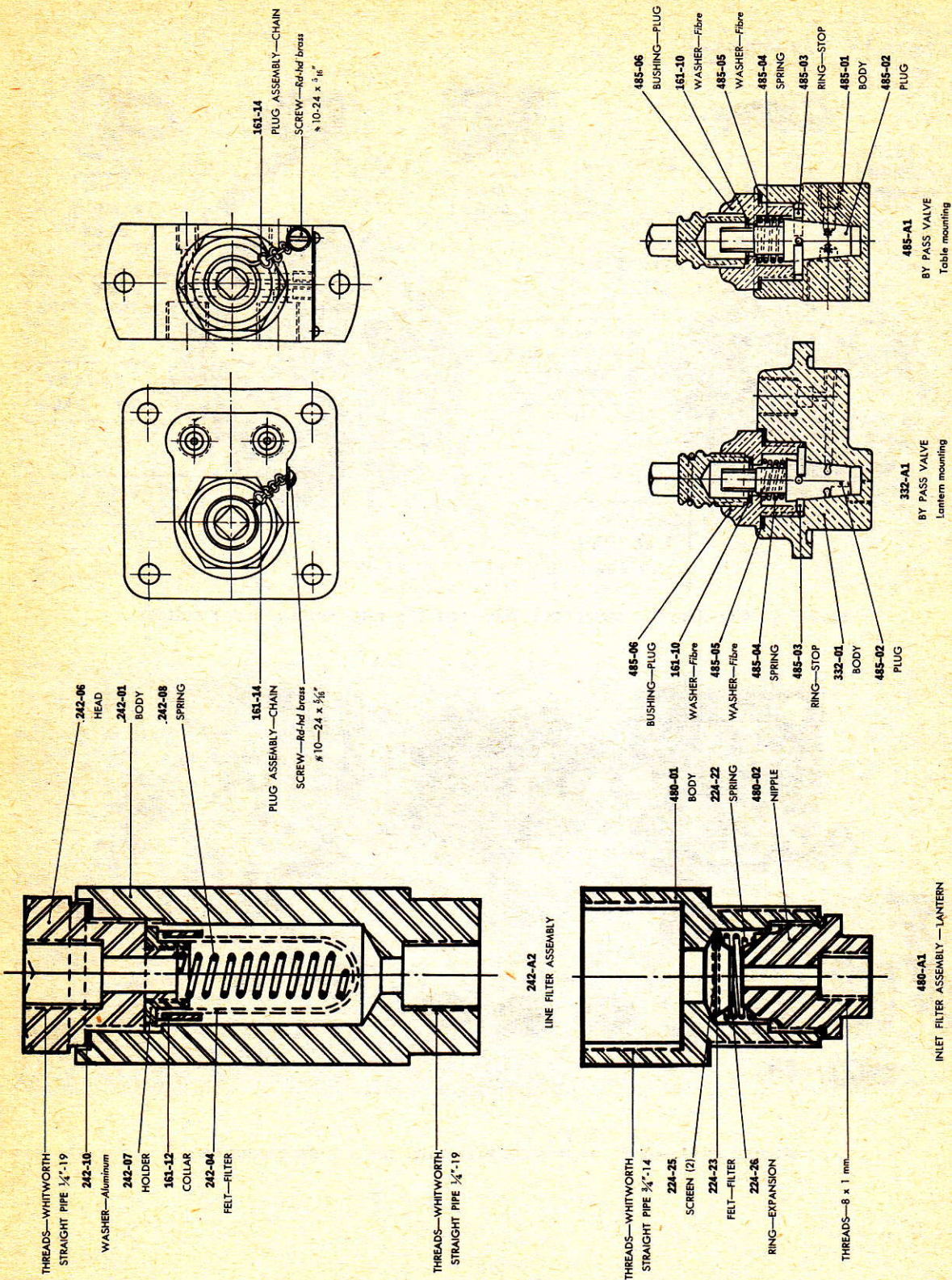


FIGURE 20-62.—Filters and by-pass valves.

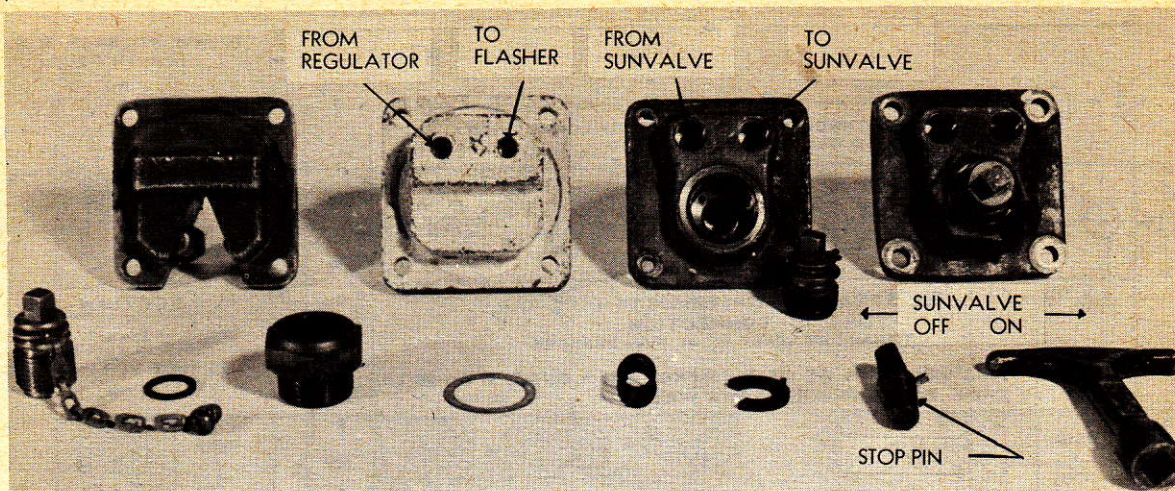


FIGURE 20-63.—A. G. A. by-pass valve (sunvalve) lantern mounting.

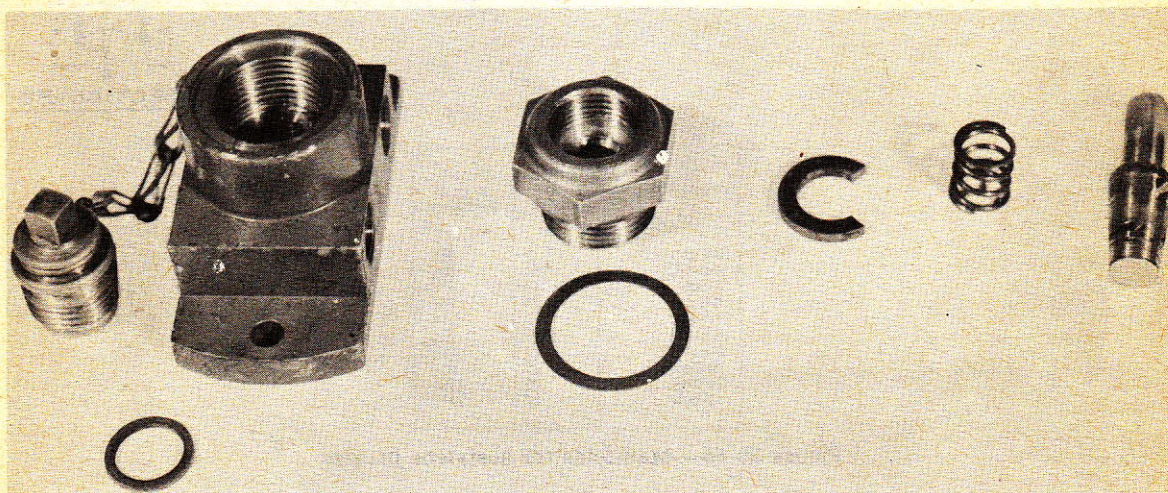


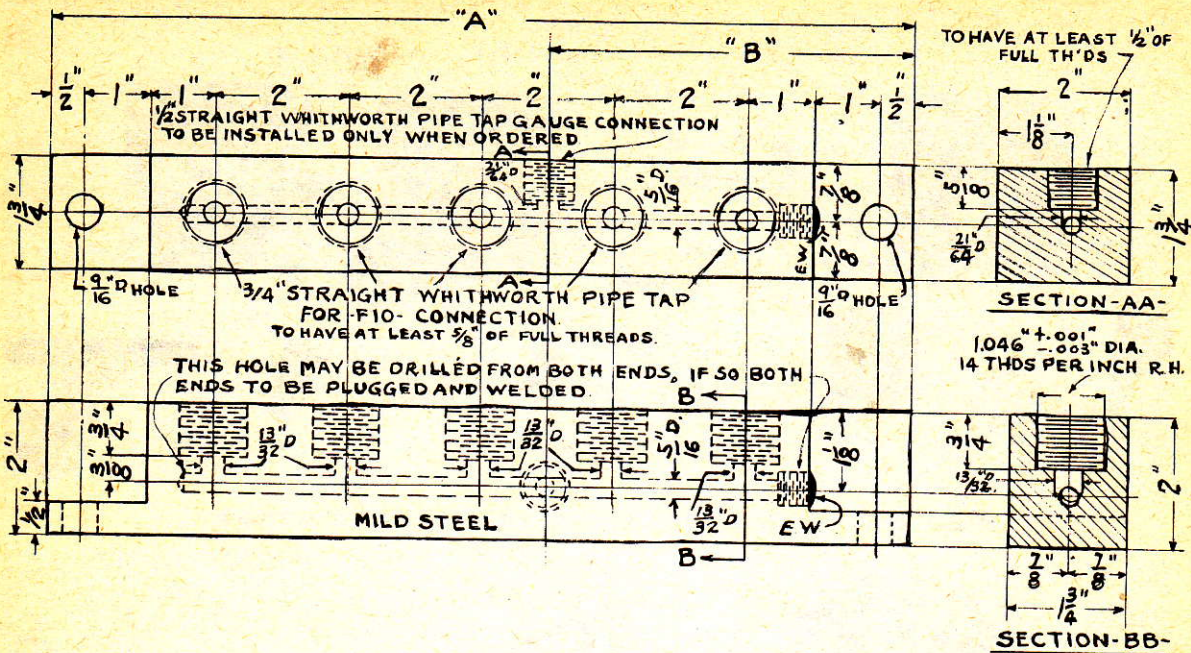
FIGURE 20-64.—A. G. A. by-pass (sunvalve) table mounting.

20-11-30 Low Pressure Valves—

A. Only one type is in use; the by-pass sunvalve cock. It is a plug cock type. There are two models of this type of valve, the K-440 for use in a lantern, and the K-460 for wall mounting and use in tank houses and on structures. In operation, they are placed in the line so that the gas may be either bypassed through a sunvalve or used direct from regulator to flasher. The stem of this valve should not be twisted hard, as the stop is only a small pin which is easily broken off, thereby losing the on and off positions.

B. A summary of the various types of commonly used valves is given below:

Types of valves	A. G. A. part No.	C. G. sketch	Uses
HIGH PRESSURE			
V-10.....	458-A1.....	512-D.....	In A-25 and A-50 cylinders.
V-70.....	296-A2.....	512-B.....	In A-300 cylinders.
V-270.....	299-A1.....	486.....	Straight line shut-off.
V-280, not shown.....	125-A1.....		As above with gage connection.
Gage valve.....	297-A1.....		In tank house manifolds.
Manifold and valve.....	2 hole, plain.....	488.....	On buoys with 200- and 375-mm. lanterns.
Manifold and valve.....	2 hole, with gage connection.....	488.....	On buoys with 150-mm. lanterns.
Manifold and valve.....	4 hole, with gage connection.....	488A.....	On buoys with 4 pockets.
Test valve.....	274-A1.....		On A. G. A. lanterns.
Test valve.....			In Service-type lanterns.
LOW PRESSURE			
K-440 sunvalve cock.....	332-A1.....		Installed in lanterns.
K-460 sunvalve cock.....	485-A1.....		Wall mounting, shore structures.



Connection No.	Dimension A (inches)	Dimension B (inches)
3-hole	9	3 1/2
4-hole	11	3 1/2
5-hole	13	5 1/2
6-hole	15	5 1/2
7-hole	17	7 1/2
8-hole	19	7 1/2
9-hole	21	9 1/2
10-hole	23	9 1/2
11-hole	25	11 1/2
12-hole	27	11 1/2

FIGURE 20-65.—Manifolds for acetylene fittings.

20-11-35 Manifolds—

A. There are 2 types of manifolds in general use, the plain multihole type ranging from 2 to 10 holes, and the combination manifold and shut-off valve. All holes are tapped to take the F-10 connection.

20-11-40 Filters—

A. The F-500 is a line filter made of steel. It contains a felt sleeve fitted over an open coil spring and is tapped at each end to take an F-40 or F-40A connection.

20-11-45 Washers—

A. These are aluminum washers which *must be renewed each time an acetylene connection is made.* The F-13 washer fits 3/4 inch Whitworth connections such as F-10. F-23 washers fit 1/2 inch Whitworth connections such as F-20. The F-43 washer is used for F-40 fitting, F-63 washer for F-60 fitting, V-23 washer for V-14 fitting, and F-503 washer for F-500 filter.

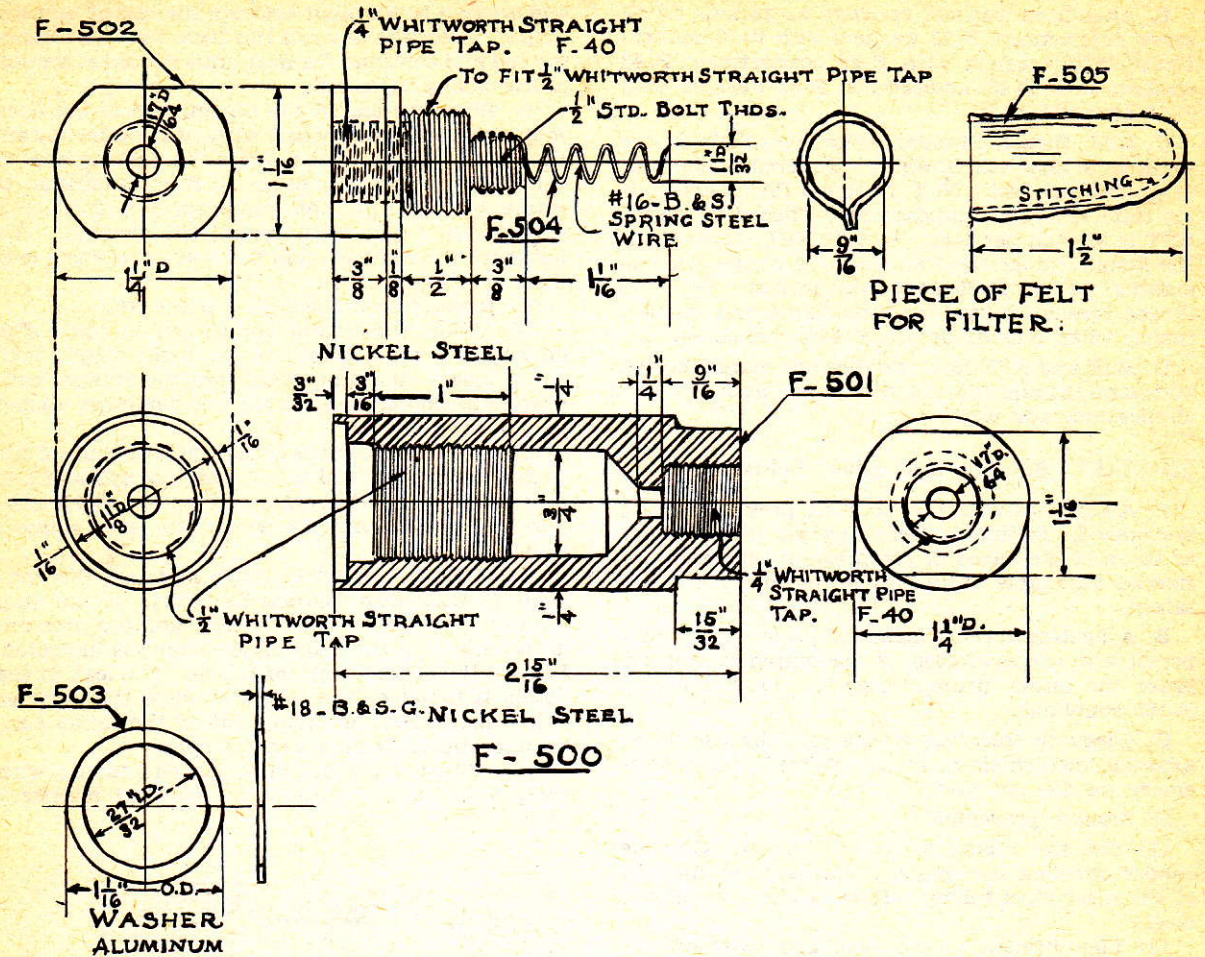


FIGURE 20-66.—Acetylene gas filter.

20-11-50 Summary of Acetylene Connections—

A. Following is a summary of commonly used acetylene connections:

Designation	Thread Size	CG Sketch	A. G. A. Part	Application
F-10 (Nut and nipple)	3/4 Straight Whitworth	256	191-A1	Connection, 8 mm. cc steel tubing.
F-12 (Nipple only)	5/16 x 26 Tap, Special	256	191-02	Used on 8 mm. cc steel tubing.
F-20 (Nut and nipple)	1/2 Straight Whitworth	256	280-A1	Acetylene gages, only.
F-40 (Nut and ferrule)	1/4 Straight Whitworth	256	180-A1	Connection, 8 mm. cc steel tubing.
F-40A (Nut and nipple)	1/4 Straight Whitworth	256A		Connection, 4 mm. on steel tubing.
F-60 (Nut and ferrule)*	5/16 x 26 Special	256	179-A1	Connection, 4 mm. brass tubing.
V-18 Blind plug	3/4 Straight Whitworth	234	162-A1	Plugging F-10 (3/4) tapped holes.
V-98 Blind plug	1/2 Straight Whitworth	234	298-A1	Plugging F-20 (1/2) tapped holes.
F-40 Blind plug	1/4 Straight Whitworth	234	238-A1	Plugging F-40 (1/4) tapped holes.
F-60 Blind plug*	5/16 x 26 Special	234	397-A1	Plugging F-60 (5/16) tapped holes.
F-190 Coupling	3/4 x 3/4 Straight Whitworth	234A	253-A1	Between two F-10 (3/4) connections.
F-40 Coupling	1/4 x 1/4 Straight Whitworth	234A	383-A1	Between two F-40 (1/4) connections.
F-60 Coupling*	5/16 x 5/16 Special (seldom used)			Between two F-60 (5/16) connections.
F-150 Coupling	5/16 x 5/16 Special	356	546-A1	Brazing to 8 mm. cc steel tubing.
F-160 Coupling	5/16 x 1/4 Special and Straight Whitworth.	356	383-A1	Brazing to 8 mm. cc steel tubing.
F-180 Screw cap	3/4 Straight Whitworth	234	398-A1	Capping F-10 (3/4) connections.
Gage adaptor	3/4 to 1/2 Straight Whitworth	234	402-A1	Gaging cylinders.
F-500 filter	1/4 Straight Whitworth, each end	231	242-A1	Installed, high pressure lines.

*NOTE.—Metric size 8 mm. x 1 mm. thread is interchangeable with 5/16 x 26 special thread.

B. Aluminum washers are used as gaskets on all screw connections, F-13 washers with F-10 connections; F-23 washers with F-20 connections; F-43 washers with F-40 connections; F-63 washers with F-60 connections.

C. BSP, British Standard Pipe (parallel) is the same as Whitworth Straight. Tapered Whitworth is $\frac{3}{4}$ inch per foot. NPT, National Pipe Thread, is the same as Briggs Standard Pipe Thread. Tapered NPT is $\frac{3}{4}$ inch per foot. $\frac{1}{8}$ x 27 NPT (tapered) is the female thread used on the F-20 nipple, used in making up the F-20 gage connections. $\frac{5}{32}$ x 36 thread, special, is used for threading 4 mm. cc steel tubing when making up the F-40A connection.

D. BSP and NPT taps and dies are manufactured both straight and tapered, each type having various applications and uses.

20-11-55 Brazing and Silver Soldering—

A. All fittings attached to high pressure tubing are brazed. Fittings attached by use of soft solder or those of the flared or compression type are considered unreliable or unsuitable in the interest of safety.

B. A heating torch capable of producing a temperature in excess of 1600° F. is required to properly braze the larger fittings, such as the F-150 and F-160 couplings.

C. Adequate shielding of the joint by use of an asbestos lined shield or by use of fire bricks is necessary for the operation.

D. Brazing procedure:

(1) Cut the tubing to proper length. Cut the copper covering the proper distance from the end of the inner steel tubing. Take care not to cut the steel.

(2) File through to the steel and twist off the copper covering. Clean the exposed steel tubing with emery cloth and apply cutting oil. Thread for a distance of $\frac{1}{2}$ -inch.

(3) Prepare the flux by mixing brazing compound with water. Chase Brazing Compound, Oxweld Braze Flux, or equal is recommended. Apply the flux to the threaded portion of the tubing.

(4) Wash the nipple in clean naphtha to remove the oil. Blow out to clean and dry.

(5) Slip the gland nut over the tubing with the threads out. Screw the nipple on the threaded end of the tubing. When tight, there should be a distance of $\frac{3}{32}$ inch between the end of the nipple and the edge of the copper covering.

(6) Set the fitting in an upright position within the brazing shield and apply the acetylene torch with a soft, neutral flame to about the center of the nipple or coupling. As the fitting shows a red heat, work the flame up near the top. Regulate the torch so that the tubing and the nipple reach the same temperature as indicated by the same red color.

(7) Preheat the end of the brazing rod (Airco No. 27 low-fuming braze $\frac{1}{8}$ -inch diameter or equal) by holding it momentarily in the flame. Dip the rod in brazing compound to a depth of about $\frac{3}{8}$ inch

and apply it to the joint between the tubing and the nipple. After the flux has run from the rod, remove the rod and continue the heat until the bared section of the tubing turns red.

(8) Place the end of the brazing rod at the open joint and rotate slowly and without pressure toward the joint. As the joint reaches the melting heat of the rod, the end will begin to flow. Continue to rotate the rod until the entire space is filled plus enough for a full fillet around the opening. (Do not move the rod back and forth as air pockets may form.)

(9) Remove both the heat and the rod.

(10) Allow the brazed connection to cool. File off excess brazing alloy and clean the nipple with emery cloth. It is important that the finished connection be smooth in order for the aluminum washer to seat properly.

(11) With connections brazed on both ends of the tubing, attach one end to an acetylene cylinder and a pressure gage to the other end using a F-190 coupling. Use an aluminum washer for each connection.

(12) Open the cylinder valve and test the connections with soap solution for leaks. If the soap solution does not indicate a leak but the pressure drops, a leak in the body of the tubing is indicated. Discard the entire length of tubing. If a leak in the fitting is found by the soap test, close the cylinder valve, disconnect the tubing, cut off the faulty connection and braze on another nipple.

(13) When made up, blow out the tubing with compressed air or acetylene, taking all necessary precaution.

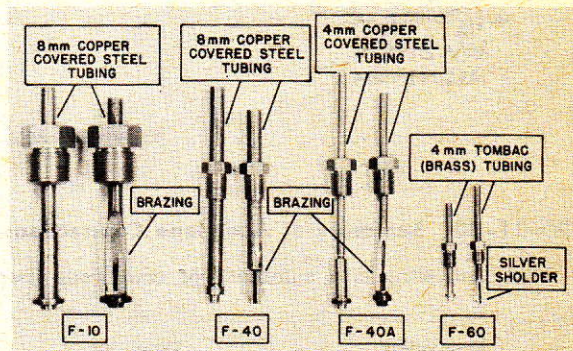


FIGURE 20-67.—Standard fittings for acetylene tubing (before and after brazing).

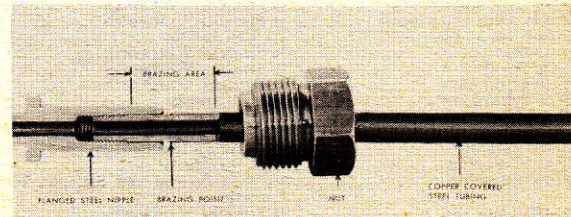


FIGURE 20-67A.—Close up of brazed fitting.

E. Precautions in brazing:

(1) Do not apply heat directly to the rod.
 (2) Avoid contact of the brazing rod to the side of the fitting below the opening. This will cause spelter (melted rod) to spill down the side and makes an unsightly job and unnecessary filing to remove the same.

(3) Try to avoid too much heat at the lower end of the fitting. This causes the fitting to over-expand; the threads become loose and occasionally allow spelter to run through and plug the nipple hole.

(4) Do not cool the fittings in water since the chilling action tends to harden the steel tubing.

F. Silver soldering.—Connections on low pressure acetylene piping are silver soldered. Since these lines and fittings are entirely of brass, a brazing alloy requiring less heat than that for steel fittings is used. A silver brazing alloy equal to grade IV,

Navy Specifications N-47-S-13, $\frac{1}{16}$ inch in diameter, has been found satisfactory. A low temperature flux such as "Handy Flux" (Navy Spec. 51-4a) or equal should be used.

G. Silver soldering procedure (F-60 connections).

(1) Slip the brass nut over the tubing and then place the brass ferrule over the end of the tubing, allowing about one-sixteenth inch of the tubing to stick through. It will be noted that one side of the ferrule has been beveled at the hole. This provides space for the silver solder to flow, therefore this side should be entered in placing on the tubing.

(2) Place just a drop of flux at the beveled edge of the ferrule and bring the fitting to the outer end of torch flame.

(3) Move the fitting in and out of the flame until a red heat is nearly attained. When this occurs, touch the end of the wire silver solder to the proper spot. The slightest drop of silver is all that is necessary.

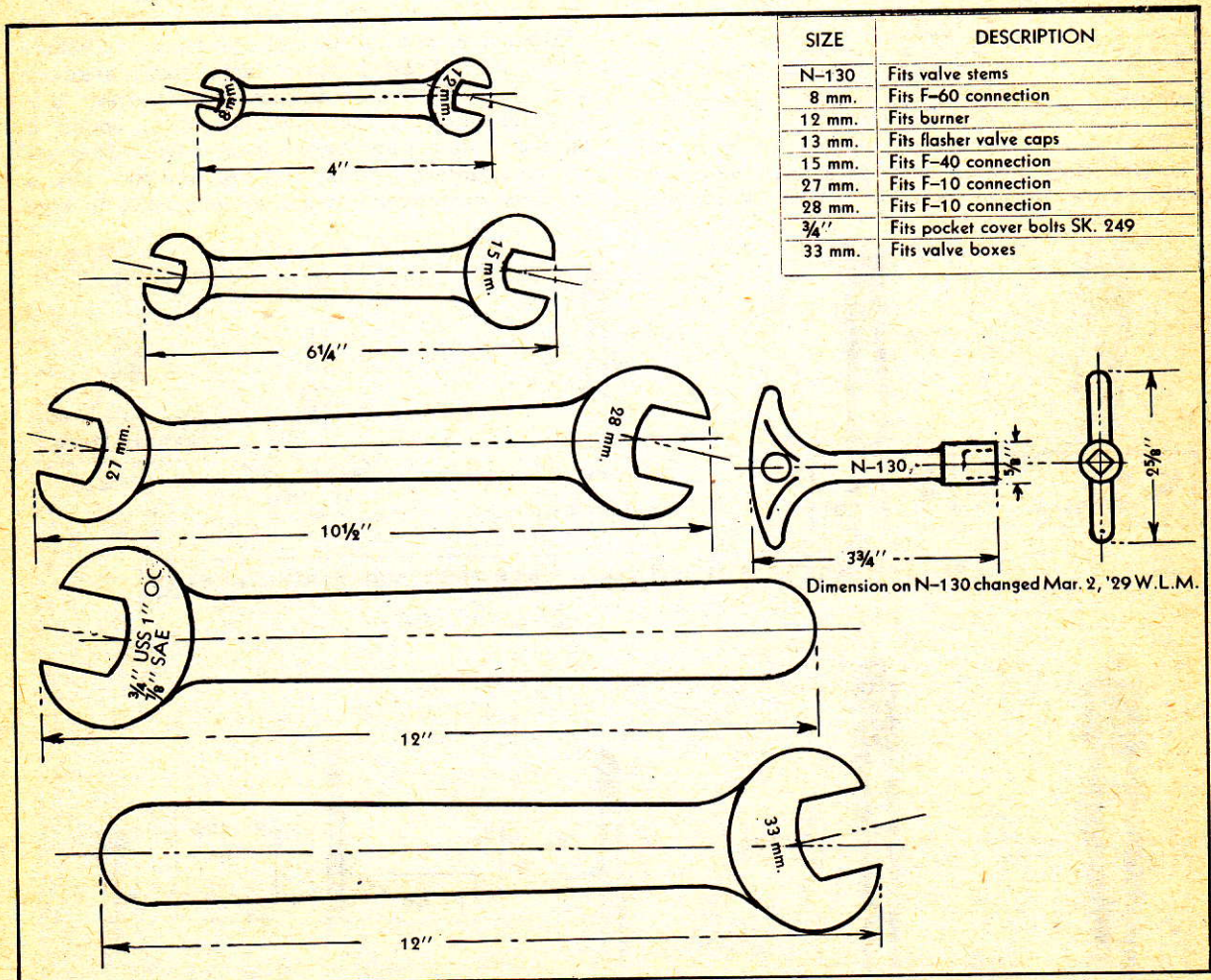


FIGURE 20-68.—Special wrenches for acetylene apparatus.

(4) Considerable practice will be required as the melting point of the ferrule is not much higher than that of the solder.

20-12 SPECIAL TOOLS

20-12-1 General Description—

A. *Special tools required.*—Since all fittings used with acetylene equipment are of special size and thread, special wrenches, taps, dies, and counterbores are used in connection with their manufacture and maintenance.

20-12-5 Wrenches—

A. All of the following listed wrenches are double-ended except for the Tee wrench used on shut-off valves, and the three-fourths inch U. S. S. size, used on pocket cover bolts, and the 33 mm. size. (See fig. 20-68.)

Wrench size	Use
3/4" U. S. S.	Pocket cover bolts.
33 mm.	Diaphragm nut or valve box.
27-28 mm.	F-10 and F-20 connections.
13-15 mm.	13 mm. fits flasher valve caps; 15 mm. fits F-40 connections.
8-12 mm.	8 mm. fits F-60 connections, shut-off valve; 12 mm. fits burners.

B. Wrenches used in buoy pockets or wherever cylinders are handled should be non-sparking type.

20-12-10 Shop Tools—

A. Following is a list of taps, dies and counterbores used in the manufacture of acetylene fittings. (See fig. 20-69.)

Tap/Die size	Counterbore dimensions	Uses
3/4 x 14 Straight Whitworth	0.968 body—0.403 pilot	F-10 fittings.
1/2 x 14 Straight Whitworth	0.745 body—0.340 pilot	F-20 fittings.
1/4 x 19 Straight Whitworth	0.400 body—0.262 pilot	F-40 and F-40A.
5/16 x 26V Special	0.270 body—0.153 pilot	F-60 fittings.
3/32 x 36 National Special	No. 30 drill	4 mm. steel tube.

It is preferable to use counterbores for all tapped holes so as to provide a flat, even seat. In tapping, care should be taken to prevent scoring the seat with chips. A flat copper disc placed in the bottom of the hole before tapping will protect the seat.

B. Special facing tools are used for facing the F-40 and F-60 connections after brazing or silver soldering. They are fitted with pilots which enter the end of the tubing, and cutting edges for facing the collars or ferrules. Another type of facing tool is available from the A. G. A. Co. and comes in two sizes. It is used for reseating the valve seats in the bodies of both the cylinder and line shut-off valves. They are of the counterbore type and are provided with a threaded bushing which is used as a guide to keep

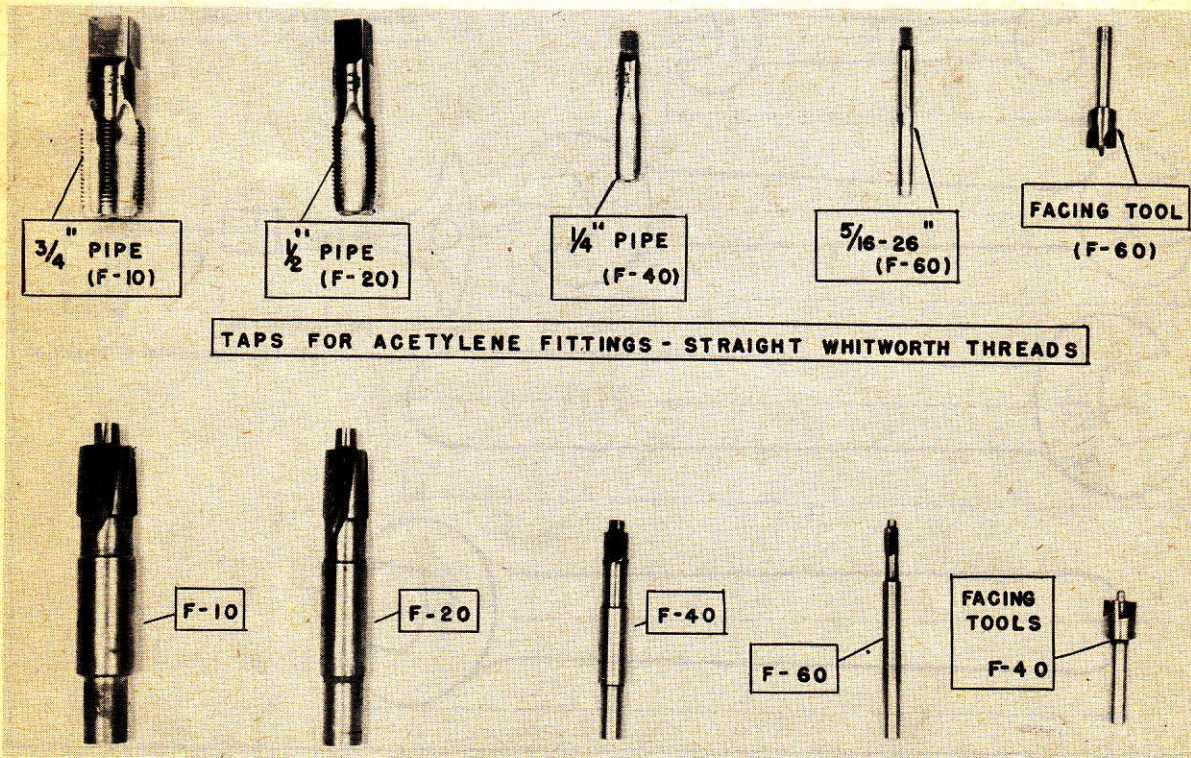


FIGURE 20-69.—Counterbores and taps for acetylene fittings.

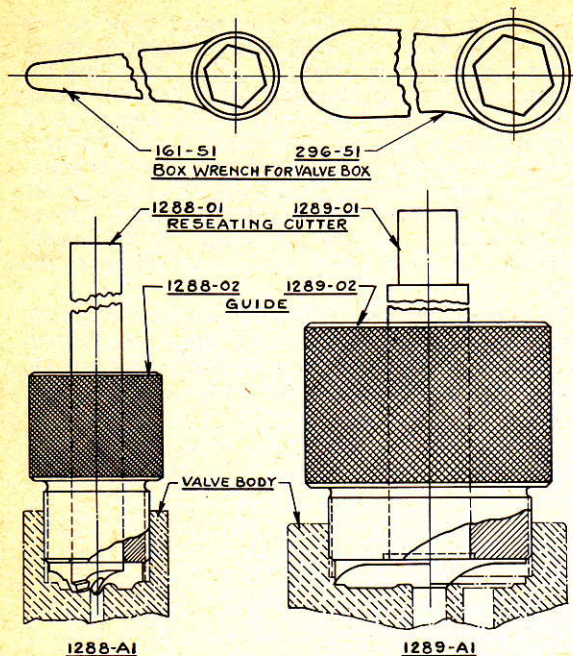


FIGURE 20-70.—A. G. A. reseating tools and wrenches for $\frac{3}{4}$ - and $1\frac{1}{2}$ -inch stud valves.

the tool in exact alignment. The small size is used for the V-10 and line shut-off valves, and the larger size is used for the V-90 valve. Great care must be used with these tools in avoiding too great a cutting pressure which will quickly ruin the cutting edge of the tool.

20-12-15 Bending Hickeys—

A. *Bending steel pipe.*—Bending hickeys (fig. 20-71) are tools for use in connection with the bending of steel tubing. The long handles and the rounded slots in the head (which should be made of brass) serve to facilitate neat and accurate bending.

B. *Caution.*—Do not use a monkey wrench, or place tubing in a vise with a rough face. To do so may fracture or puncture the copper sheathing and entirely destroy its purpose.

C. *The minimum bending radius* for 8-mm. steel tubing is 2 inches; shorter bends tend to crack the copper covering.

20-12-20 Field Servicing—

A. A complete list of tools necessary for servicing acetylene apparatus is given under paragraph 20-16-30.

20-13 NEW INSTALLATION, BUOYS

20-13-1 General—

A. No new acetylene lighted buoys are now being purchased by the Coast Guard, however, the description contained in the following paragraphs is retained herein as useful information.

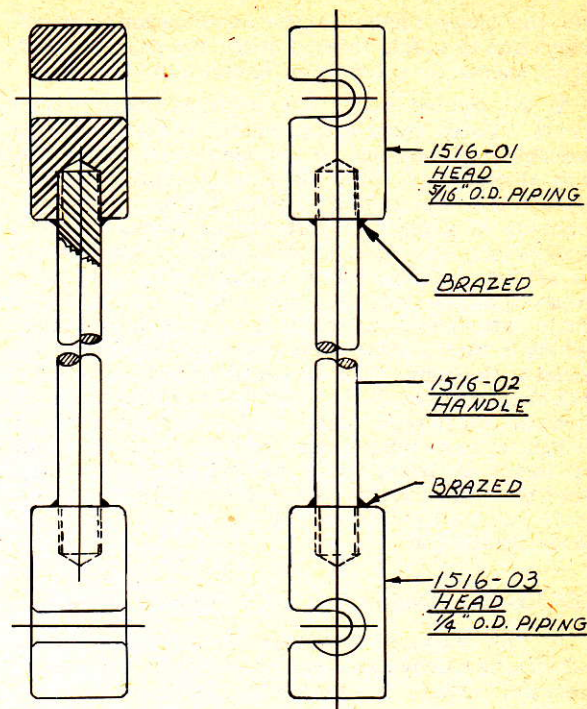


FIGURE 20-71.—Double-headed "bending hickey" for acetylene tubing.

B. Since a buoy received from the manufacturer will not be equipped with the necessary acetylene fittings, the procedure listed under section 20-13-10 should be followed. The necessary special tools are described under part 20-12. Stillson or monkey wrenches and pliers must *not* be used in connection with acetylene equipment.

20-13-5 Component Apparatus—

A. *Piping and fittings.*—Special 8-mm. copper-covered or one-fourth inch stainless steel tubing cut to proper lengths with threaded connections brazed on each end, a combination shut-off valve and manifold, pipe clips, aluminum washers, gas cylinders and wooden wedges, and an acetylene lantern with flasher-regulator mechanism are the necessary component apparatus for all acetylene lighted buoys.

B. *The cylinders* (A-300's in large lighted buoys, A-50's and A-25's in the smaller type buoys), are placed in the buoy pockets and the gas is conveyed to the lantern through lengths of one-fourth inch stainless steel and 8-mm. copper-covered steel tubing leading from the valve of the cylinder. (Only stainless steel tubing may be used inside the pocket.)

C. *A threaded staybolt* is fitted in the wall of the buoy pocket. This staybolt fitting leads from the side of the pocket within the buoy body, up through the buoy head inside the foot bracket angle and protrudes about $2\frac{1}{2}$ inches above the head of the buoy.

D. *A length of 8-mm. copper-covered or 1/4-inch stainless steel tubing* from the staybolt fitting leads

up the tower angles to the combination shut-off valve and manifold located inside the daymark and from thence up a tower leg to the lantern.

E. *All lighted buoys are provided with pocket vents.* These vents are intended to bleed off any possible accumulation of acetylene gas. They are not threaded in order to obviate confusion with the regular gas tubing staybolt fitting. The vent consists of a piece of soft rubber tubing about 2 inches long and $\frac{3}{16}$ -inch in diameter. This tubing is slit on one side for a distance of $\frac{3}{8}$ -inch and plugged at one end; the other end is connected to a fitting attached to a length of $\frac{1}{4}$ -inch brass tubing which in turn is attached to a vent connection in the head of the buoy. The slit permits the gas to escape but closes against the entry of water should the buoy become submerged. The rubber vent is encased within a brass tube for protection. Vent pipes run up inside the tower leg to the underside of the lantern platform with the vent end bent downward in a half loop. (See Chapter 24 for further details on buoy ventilation.)

20-13-10 Preparation of a New Buoy—

A. The following procedure should be followed when a new buoy has been received from the manufacturer. Note: See paragraph 20-13-1 (A). For example: An 8 x 26A lighted buoy.

(1) *Covers.*—Remove the covers from the buoy pockets, being careful not to damage the gasket, which may frequently be stuck to the cover.

(2) *Plugs.*—Remove the plugs from the staybolt fittings.

(3) *Mounting manifold.*—Make a template of the four tapped holes in the bottom of the combination shut-off valve and manifold and drill four $\frac{9}{32}$ -inch holes so as to mount the valve vertically on the inside of the daymark on the side directly over the buoy head gas staybolt connections and on a vertical center line. Mount the manifold such that the single hole outlet is uppermost. Imbed the valve in a thin layer of putty or thick red lead to prevent rust.

(4) *Bending tubing.*—When the gas tubing is furnished in straight lengths, it may be bent to the desired angle using a "bending hickey." (See fig. 20-71.) Care must be taken not to fracture the copper covering of the steel tubing.

(5) *Piping system arrangement.*—This consists of five lengths of tubing, one stainless steel length to connect the cylinder in each of the two buoy pockets to the threaded staybolt, one copper-covered or stainless steel length from each of the staybolts to the manifold, and one from the manifold to the lantern. When installing tubing, bend the lower end of each tower leg tubing to lead fair for about 3 inches from the staybolt in the buoy head, thence close into the crotch of the angle, up the leg of the tower and across the inside of the daymark in line with the holes in each side of the manifold. The lantern tubing should lead out of the top hole of the manifold, bend over to the tower leg (to the right, looking from inside) thence up under the lantern plate, across to the center, down, and out under the lower edge of the lantern plate, and then up to the lantern inlet. (See fig. 20-72.)

(6) *Blow out pipes.*—After bending the tubing

and before final installation, always blow it out since fine particles are broken loose from the inside of the tubing during bending. When installing the tubing, fit each connection with an aluminum washer. *These must never be used a second time.* Replace with a new one, each time a connection is broken and remade. The steel part of the connection is given a thin coat of graphite grease or oil. Take care, however, not to get any on the face of the connection. Secure the tubing to the superstructure by clips which are furnished with the buoy.

B. *Tubing lengths.*—Following is a table of standard lengths for buoy tubing, including the fittings. In cutting tubing for these lengths, subtract $1\frac{1}{2}$ inches since each fitting adds $\frac{3}{4}$ inch.

Buoy Type	Number of cylinders	† Buoy pocket	Tower leg 1	Tower leg 2	Lantern pipe
5x15	2 A 50	*2' 3"	6' 6"	6' 6"	3' 2 $\frac{1}{2}$ "
6x20	2 A 50	*2' 3"	4' 8"	4' 8"	5' 10"
7x18	4 A 50	**2' 3"	*8' 3 $\frac{1}{2}$ "	*6' 3 $\frac{1}{2}$ "	5' 8"
8x20	2 A 300	*4' 8"	6' 10 $\frac{1}{2}$ "	6' 10 $\frac{1}{2}$ "	5' 10"
8x23	2 A 300	*2' 6"	6' 2"	6' 2"	6' 11"
8x26	2 A 300	*5' 0"	6' 8 $\frac{1}{2}$ "	6' 8 $\frac{1}{2}$ "	6' 0"
9x32	2 A 300	*3' 4 $\frac{1}{2}$ "	8' 6 $\frac{1}{2}$ "	8' 6 $\frac{1}{2}$ "	7' 7"
9x38	2 A 300	*3' 4 $\frac{1}{2}$ "	7' 4 $\frac{1}{2}$ "	7' 4 $\frac{1}{2}$ "	9' 5"

*2 each of these.

**4 each of these.

†Tubing used in buoy pockets must be stainless steel.

NOTE. A. G. A. Co. now manufactures stainless steel tubing, part 553-32, approx. 3 feet in length for pockets using A-50 cylinders and part 1177-11, approximately by 7 feet in length for pockets using A-300 cylinders.

C. *Installing cylinders.*—The A-300 cylinders used in this buoy (8 x 26) are placed in the pockets so that the valve outlet connection is at right angles with the pocket connection and the pocket tubing is bent into a three-quarter circle, the end bent to enter the valve and the staybolt. See Chapter 27 for additional details on installing cylinders, etc.

(1) When installing the cylinder in the buoy pocket, have the buoy lying on its side with the pockets horizontal. Inspect the pockets and remove all foreign matter. The wooden cylinder cushion is to remain directly on the bottom of the pocket. The A-300 cylinder may be handled with a rope sling around the body of the cylinder so that it can be lifted in a horizontal position. Secure another line to the lifting bail so that the cylinder will not be permitted to slide into the pocket too rapidly.

(2) *Wedges.*—Drive three oak wooden wedges about 2 by 2 by 14 inches equally spaced around the cylinder after it is in place.

(3) *Loose washer.* Make up the pocket connections and be sure that they are not cross-threaded and that the aluminum washers are firmly held on the end of the nickel steel connections. If the washer slides loosely on the fitting, crimp or bend it slightly across the center until force is required to slide it on the end of the fitting. *Gas tubing is stiff and difficult to bend into place and unless care is observed, cross-threading and leaks may easily result.*

(4) *Pocket cover.*—The gasket should be inspected for proper fit. The tank cover swing bolts should be free and the nuts turned easily by hand. The nuts should be tightened alternately and evenly.

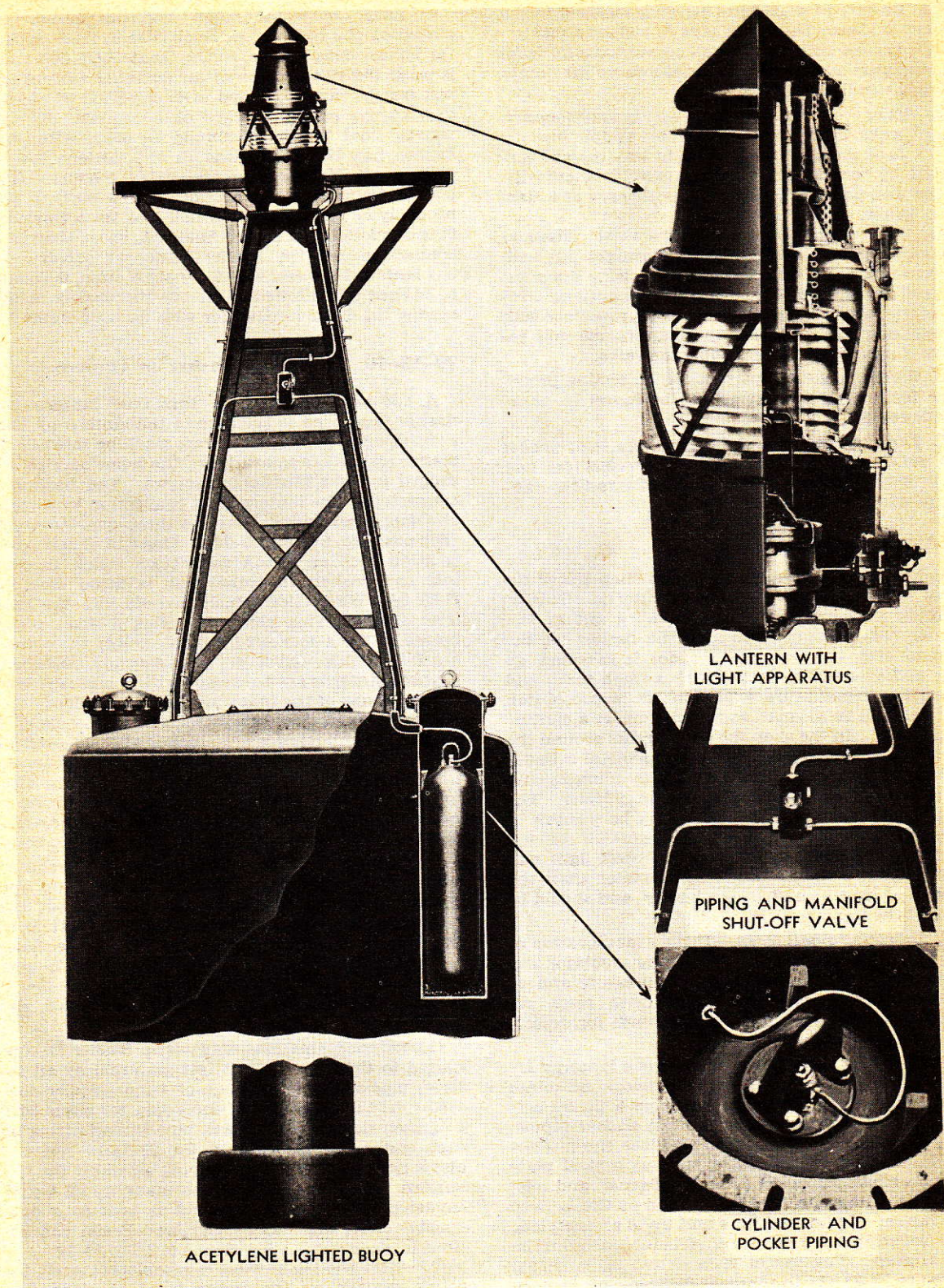


FIGURE 20-72.—Piping arrangement of acetylene lighted buoy.

(5) Be sure to wedge the cylinder *securely* in the pocket or it may fracture a pipe in a short time.

(6) *Testing valves.*—Test all connections for leaks by applying a liquid soap solution to all joints. (Bubbles indicate a leak.)

D. *Leaks.*—Valves require very little maintenance. Slight leaks, if any, can be corrected as follows:

(1) *Leak at the outlet.*—A slight leak may be corrected by “cracking” open the valve momentarily. If the leak persists, proceed as in the case of a stem leak, below.

(2) *Stem leak.*—Disassemble the valve. Remove the chain plug. Unscrew the diaphragm nut with a box wrench. Clean the valve box, using dry compressed air or acetylene, using all precautions. Inspect the valve seat and if not smooth, resurface with a reseating tool. Inspect the diaphragms and replace if necessary. Reassemble the valve.

E. Further detailed instructions on testing procedure for acetylene systems will be found in paragraph 20-15-5.

F. *The presence of acetylene gas in a buoy pocket will not occur except as a result of carelessness, and by properly testing connections and handling tubing carefully, can be avoided.*

20-13-15 Testing Flashers—

A. *Shop test.*—Flashers should be shop-tested for leaks before installing in new lanterns. This is done by allowing all the air to work out of the flasher and smelling all around the flasher for the odor of acetylene gas. If no odor is detected, go over and around the flasher with a small torch and listen for a miniature explosion or “pop.” Often the leak will be so small as to not support a continuous flame. In the shop the air currents around the flasher may be overcome by placing a metal cylinder around the flasher. Allow 10 or 15 minutes and then pass the torch around inside the cylinder. The leak will be more audible and it may be possible to determine whether it is at the regulator or the flasher. The metal cylinder should be of light material, about 3 inches larger in diameter than the flasher, at least as high as the burner, and should be open at the top.

B. *Detecting small leaks.*—If the exact location of the leak is not detected, separate the regulator and flasher, plug up the outlets, apply pressure and go over all joints and screw heads with clock oil. Clock oil is more effective than soapsuds for detecting very small leaks.

C. *Shop-test jig.*—In the shop, where lanterns are overhauled and made ready for buoys or minor lights, it is advantageous to construct a jig for setting up and testing interior lantern flasher piping. The jig should be made up to simulate the interior conditions in a lantern base, such as a steel plate with four pins on which to set the flasher, and inlet fittings in the same relative position as the lantern test valves. By hooking this unit up to an acetylene line, the entire assembly is tested before installing in the lantern. The use of such a test jig is shown by figure 20-73 (1) to simulate Service-type lantern piping. In figure 20-73 (2) the flasher is equipped with the regular A. G. A. interior piping for use in the A. G. A. lantern.

D. *Final test.*—Too much emphasis cannot be placed on the need for extreme care in final testing for leaks. Small leaks, so tiny that their detection is made difficult because of air currents around the test bench, can be located after a period of operation in the confined space of a lantern. Therefore, a final torch test should be made after the flasher has been operating in the lantern for at least one-half hour, and preferably 2 hours. If a leak is found in a connection, a new washer will probably be the answer. If not, look for a fracture. If the leak is found on the final test, other than at a connection, set the flasher aside for repairs. If the lantern has been closed for some time, it should be opened and allowed to air out thoroughly before testing the flasher-regulator with an open flame.

20-13-20 Installing Flasher in Lantern—

A. *150-mm. lantern.*—In this type lantern the flasher is secured to the base of the lantern by four 5- by 75-mm. flister head brass machine screws. If metric screws are unavailable, the holes may be retapped for 10 x 32 machine screws. The flasher is connected to the lantern inlet connection by a piece of 4-mm. steel tubing, bent to a three-quarter circle. (See piece No. 5 of fig. 20-74.) One end of this piece is fitted with an F-40A connection which threads into the flasher, the other end is fitted with an F-60 type connection which threads into the base inlet fitting. This connection has a steel collar brazed to the 4-mm. steel tubing, unlike the standard F-60 fitting, which has a brass collar. Flashers in these lanterns are furnished with a crescent type burner of one of the following sizes as required: $\frac{1}{4}$ -, $\frac{3}{16}$ -, or $\frac{3}{8}$ -cubic-foot capacity. The focal height of the flasher unit itself is $5\frac{23}{32}$ inches with a $\frac{3}{16}$ -cubic-foot burner. Mounting holes for the installation of this lantern should be at least $1\frac{1}{32}$ inch in size, for $\frac{3}{8}$ -inch bolts. Always use brass lantern bolts, spaced equally on a pitch circle $9\frac{1}{8}$ inches in diameter for $\frac{3}{8}$ -inch bolts. Always use brass lantern bolts.

B. *200-mm. lantern.*—This lantern is purchased either with or without a 130-mm. flasher, lens, and shade. While the flasher is on test, tap out the flasher holding-down-screw holes in the bottom of the lantern base with a 10-32 tap. These holes are originally tapped for a metric thread 5 x 75 mm. Since metric screws are not generally available, it is best to retap for the national standard size mentioned.

(1) *Interior pipe assembly.*—The flasher is connected to the lantern inlet test manifold by an interior pipe assembly made up of 4-mm. copper-covered steel tubing bent to a three-quarter circle with a $\frac{1}{4}$ inch straight Whitworth pipe thread fitting on each end. (See piece No. 6, fig. 20-74.) There is also a Service-type interior piping assembly for this lantern. This assembly is also made up of 4-mm. copper-covered steel tubing but is bent to a one-quarter circle and has Service type F-40A connections on each end. (See piece No. 2, fig. 20-74.)

(2) After the flasher test is completed, screw the fitting located on the inside bend of either the A. G. A. or Service-type pipe assembly firmly into the flasher-regulator inlet hole; place a $\frac{5}{8}$ x 10-32 flister head brass machine screw in each of the

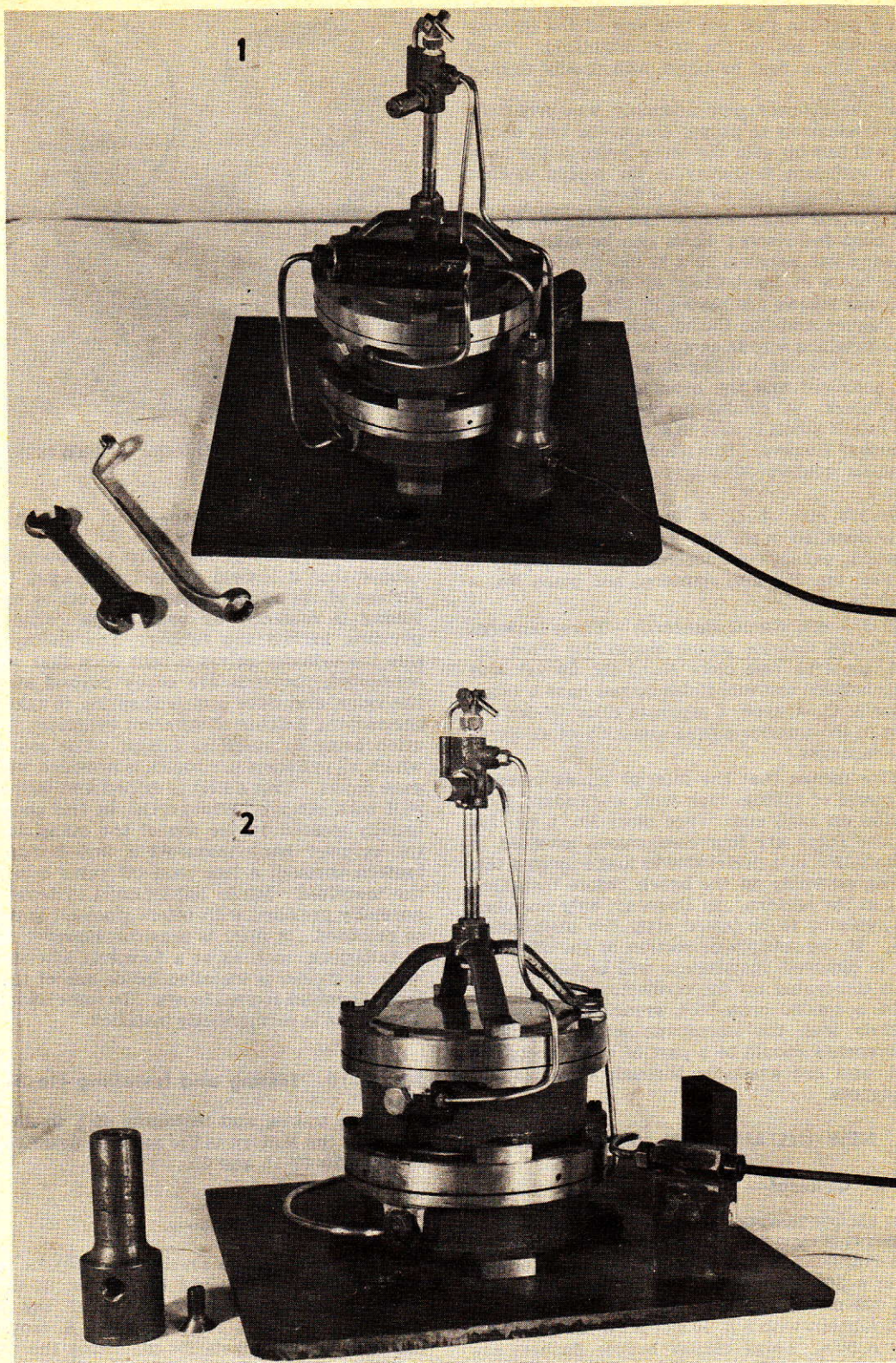


FIGURE 20-73.—Flasher test jig.

flasher lug holes and lower the unit into the lantern in such a position that the free end of the interior pipe assembly enters the inlet manifold. Then screw the fitting first by hand, and finally tighten with a wrench.

(3) If the interior pipe assembly was originally bent approximately to proper shape, the lugs of the flasher will line up with the screw holes in the base. There is sufficient flexibility in the piping so that installation should not be too difficult.

C. *Alignment made easier.*—The lining up of the flasher hold-down-screw holes can be made easier by screwing two headless 10 x 32 machine screws in opposite holes in the bottom of the lantern base. Two regular screws are placed in the adjacent lugs of the flasher and the flasher lowered so as to fit over the headless screws as guides for proper alignment. Two regular holding-down screws are considered sufficient and the headless screws may remain in place. A similar procedure of using one stud in lieu of a bolt is used in mounting the lantern on a buoy. However, this stud *must be replaced* by a regular holding-down bolt after the others are in place.

D. *300/375 mm. A. G. A. lantern.*—Flashers are similarly installed in the 300- and 375-mm. A. G. A.-type lantern, except that different interior piping is used. For the 375-mm. lantern, see piece No. 4 figure 20-74.

E. *200/375-mm. Service lanterns.*—These lanterns have different interior piping assemblies from the A. G. A. lanterns (see piece No. 3 fig. 20-74) and since the lantern test manifolds do not have a filter, as do the A. G. A. type, a separate filter (F-500) is installed in the interior piping assembly of all Service-type lanterns.

(1) This means that the interior piping consists of two pieces of tubing, each with a standard F-40 connection on each end. (See piece No. 1 fig. 20-74.) Since there are four connections involved in this installation it is preferable to make up and test the piping assembly on the bench before installing the unit in the lantern. In this way, only one connection remains to be tested after the installation is made. If the stormpane section of the 200-mm. lantern is removed, installation will be easier.

(2) In tightening up the connections in the test manifold, a special crow-foot wrench is necessary, particularly with the stormpane section in place. These wrenches should be a part of every acetylene tool kit, and are available through Coast Guard supply depots.

20-14 NEW INSTALLATION, MINOR LIGHTS

20-14-1 General—

A. An acetylene-operated minor light may contain apparatus ranging from a 150 mm. lantern and an A-25 cylinder to a fourth order lens or larger and a bank of A-300 cylinders. Typical installations include a 200-mm. lantern with 6 A-50 cylinders; a 300-mm. lantern with 8 A-50's or a 375-mm. lantern with 10 A-50's. Large cluster burner flashers are occasionally installed using a bank of A-300 cylinders. Figure 20-75 shows typical layouts for shore structures.

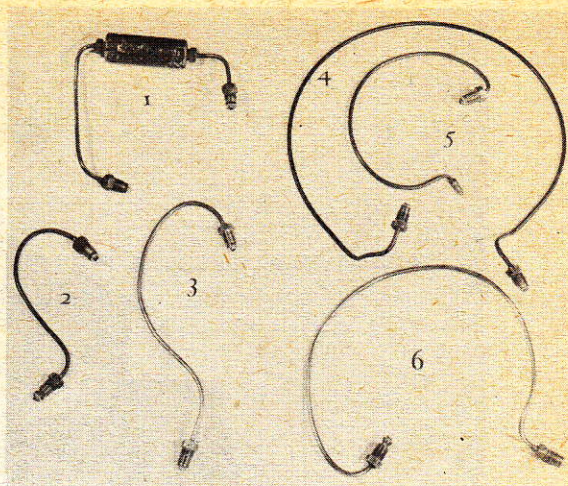


FIGURE 20-74.—Interior lantern tubing.

20-14-5 Piping System—

A. *Securing the piping.*—The gas tubing is so arranged that it is held about 1 inch away from the surface of the tower by steel brackets to which the tubing is fastened by brass clips. This permits painting behind the tubing. The tubing leading into the cylinder valves is bent such that when disconnected, the ends are easily pushed away from the valve, and have sufficient spring to take care of the varying heights of different cylinders, this variation being as much as 1 inch. The manifold, to which all cylinders are piped, is provided with a test gage outlet. This outlet is drilled and tapped (one-half inch straight Whitworth) in the shop and is usually located on the top of the manifold. From the cylinder bank manifold a line is run to the lantern through a line shut-off valve located near the manifold. Minor light piping systems are not normally provided with filters since all lanterns are so provided. A filter is provided however, in a few installations, such as at a formerly attended light, where a flasher is installed inside one of the order-type assembled fresnel lenses. In some installations, a test gage is permanently installed.

20-14-10 Testing and Installing Flasher—

A. The testing and installing of a flasher mechanism in the lantern is the same as described under sections 20-13-15 and 20.

20-14-15 Sunvalves—

A. The sunvalve is always installed in the low-pressure line and should be located in an unobstructed position conveniently near the lantern. The 200-, 300-, and 375-mm. A. G. A. lanterns are provided with brackets for mounting the sunvalve.

(1) *Mounting the sunvalve.*—Remove the plate from the boss of the lantern base located to the right of the test manifold.

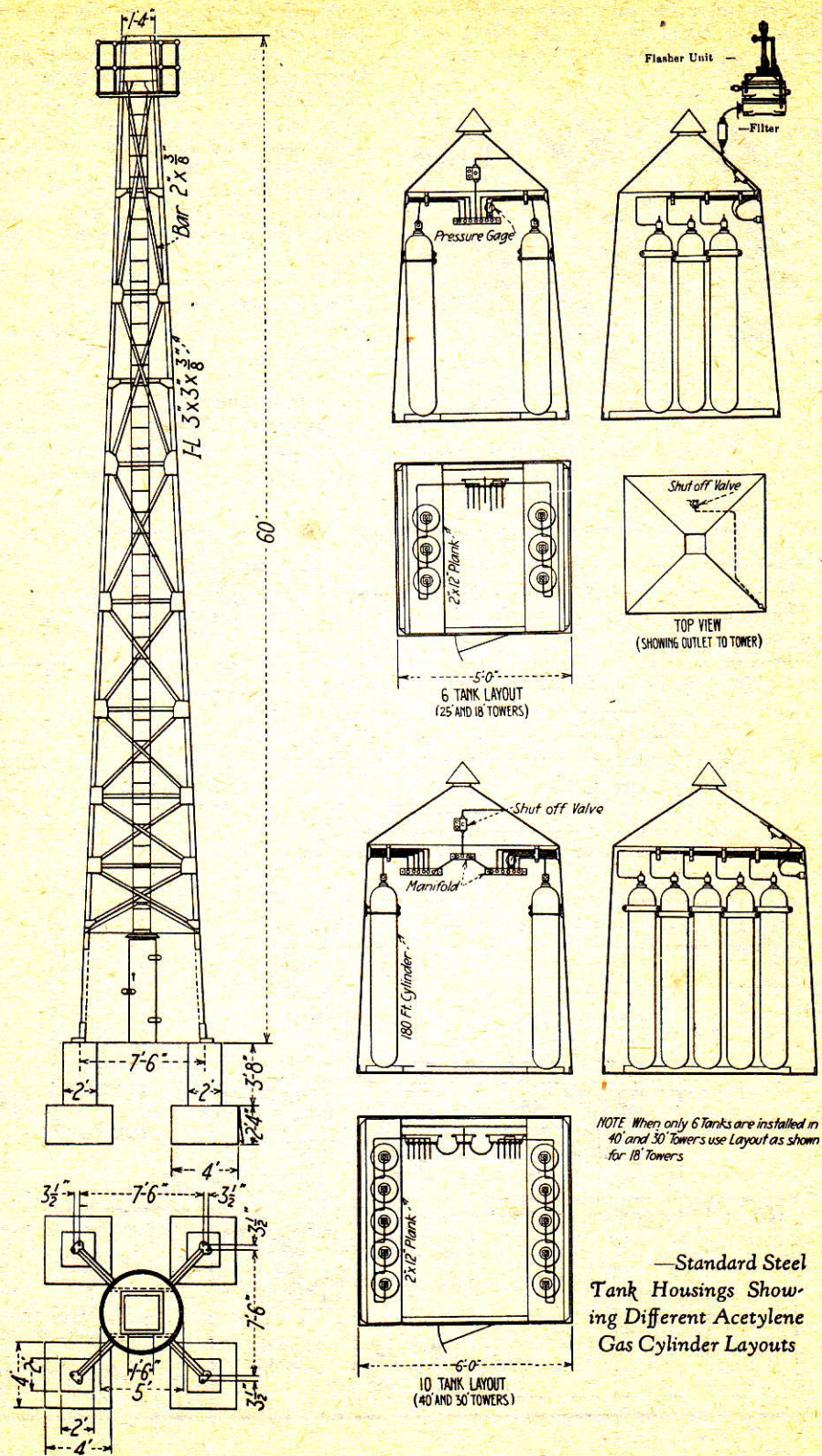


FIGURE 20-75.—Standard steel tank housings showing different cylinder layouts.

(2) Install a sunvalve by-pass valve (AGA part 332-A1). Put a little putty on the valve flange and be sure the large tapped (F-40) holes are uppermost.

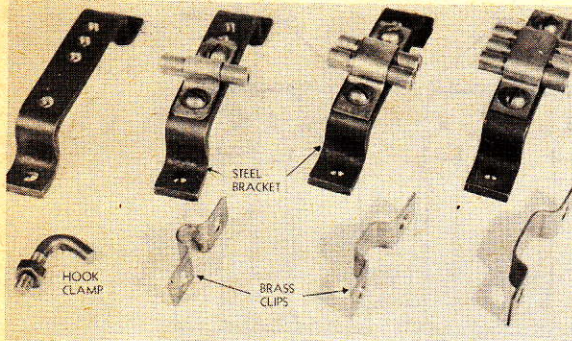


FIGURE 20-76.—Acetylene piping brackets, hook clamp and clips.

(3) Remove the short tubing between the regulator and the flasher.

(4) Make up a set of interior piping using 4-mm. brass tombac tubing and F-60 connections. One piece of tubing connects the regulator to the right hand threaded hole (F-60) in the sunvalve cock. The other leads from the remaining threaded hole in the valve to the flasher unit. See figure 20-79 for this interior piping. For the exterior piping use 4-mm. copper-covered steel tubing, not that it is needed for pressure reasons but because it can stand more abuse in handling.

(5) Two pieces of tubing, with F-40A connections, lead from the sunvalve cock in a small radius curve toward the base of the lantern and then spread right and left respectively up in such a manner as to follow the diagonal bars of the stormpane section. They then come together again and curve out as necessary to lead fair into the sunvalve. No provisions are made in the bases of Service-type lanterns for installing sunvalve cocks. When required,

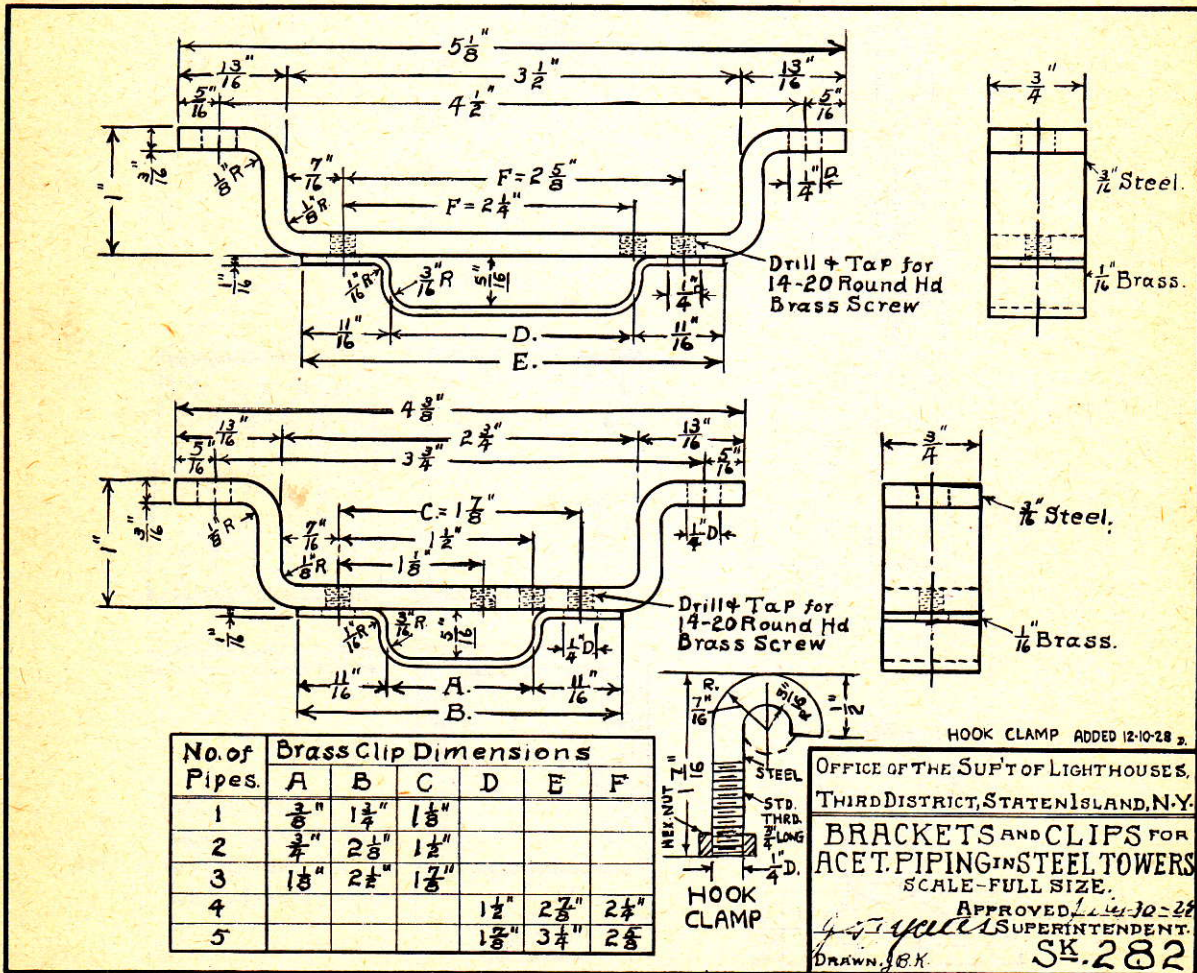


FIGURE 20-77.—Brackets and clips for acetylene piping in steel towers.

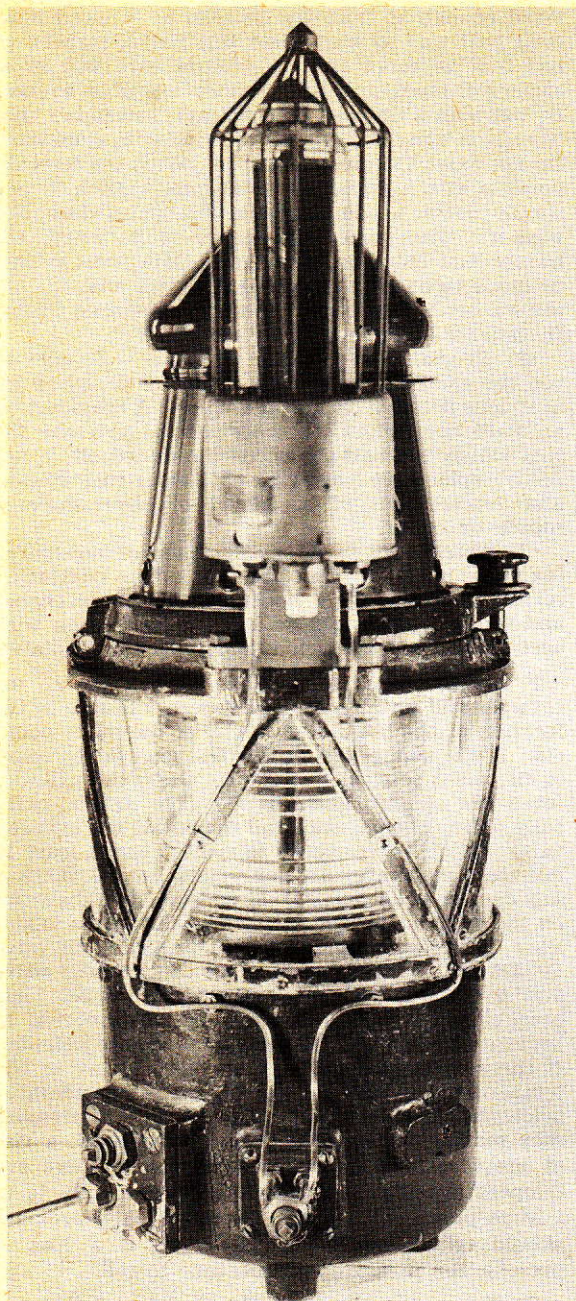


FIGURE 20-78.—Sunvalve installation.

an opening is drilled out in the same relative location as in the A. G. A. lantern. This is a shop job.

B. Sunvalve cock.—When the sunvalve cock stem is turned to the left, the gas is by-passed around the sunvalve. When it is turned to the right the gas passes on up to the sunvalve, which permits the gas to flow down and into the flasher if the sunvalve is open.

C. Note.—Caution must be exercised in the opera-

tion of a sunvalve cock. It is a plug-type valve and is prevented from being turned completely around only by the presence of a small brass pin which serves as a stop. *Do not use force* on this valve; to do so will shear the pin off, in which case the definite "off" and "on" positions of the valve are lost.

20-15 TESTING NEW INSTALLATIONS

20-15-1 General—

A. Although described specifically for lighted buoys, the following test procedure is applicable to all acetylene installations.

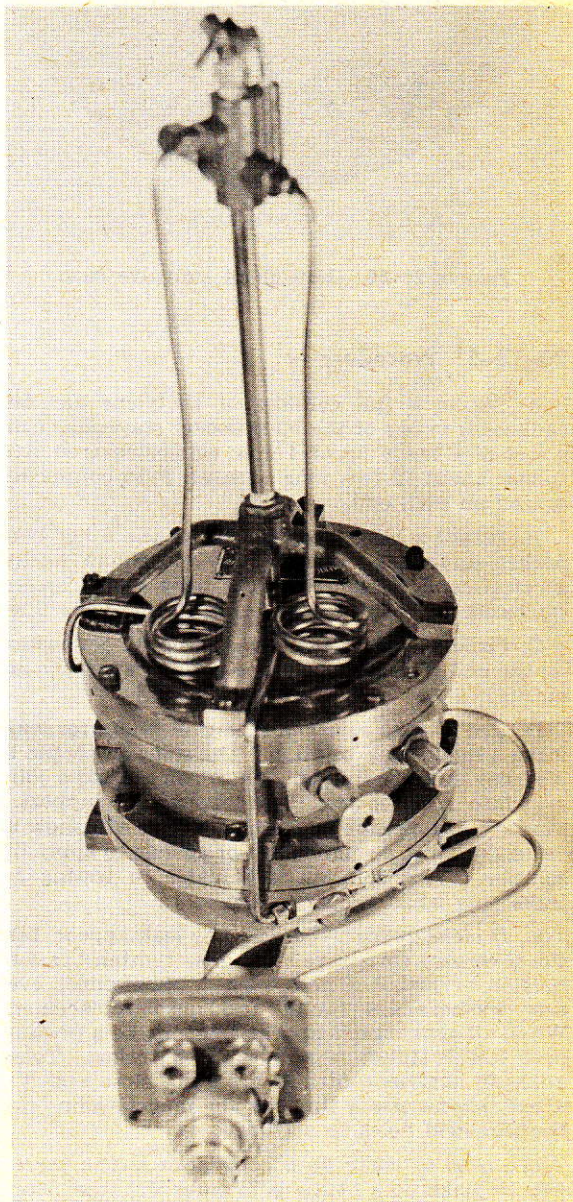


FIGURE 20-79.—Interior sunvalve tubing.

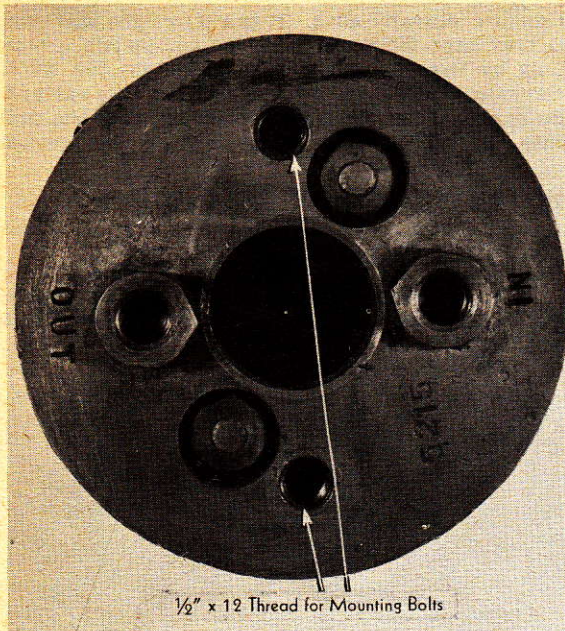


FIGURE 20-80.—Bottom of sunvalve base.

20-15-5 Procedure—

A. Obtain a full cylinder of acetylene gas and connect it to one of the buoy pocket staybolts, using a test pipe made up of 4 mm. copper covered steel tubing about 12 feet long with an F-10 connection brazed on each end.

B. Install a blind plug (V-18) in the other buoy pocket staybolt(s), using a new aluminum washer at each connection. With the buoy piping system disconnected at the lantern end, blow out the lines.

C. Place a cap (F-180) over the F-10 connection on the end of the lantern pipe outlet. Turn the gas on full.

D. *Use of soap solution.*—Test all joints for leaks using a liquid soap solution. The solution should be a syrupy mixture thin enough to run around a joint and into crevices but thick enough to support a bubble. The precise location of a leak will show up better by using a small brush or sponge to apply the solution. This solution is valuable in testing for leaks only when properly used.

E. *If leaks appear.*—Should any leak appear, take the necessary corrective steps, i. e., tighten the connection or install a new washer. Sometimes even new washers are faulty and need replacement. When all connections appear tight, make a pressure drop test as stated in paragraph (F) below. Tolerances in acetylene fittings are quite close and it is absolutely necessary that the alignment leading into the threaded holes be accurate.

(1) *How to make up a connection.*—The correct way to make up a fitting is to enter the steel fitting end into the hole all the way with the washer seated and the nut drawn back. The body of the nipple or tubing, be it an F-10, F-20, F-40, or F-60,

should enter the threaded (female) connection, centered enough so that the nut can be screwed in at least half way by hand; not just half a turn or so, but four or more turns. A little care will avoid crossed threads and unnecessary use of a wrench. In tightening up acetylene fittings, remember that the nut is brass and the gasket washer is aluminum. Do not exert too much pressure. With the leverage possible with a standard 27-28-mm. wrench, it is a simple matter to completely flatten out an aluminum washer. The more the washer is flattened, the harder and more brittle it gets. If a joint cannot be made tight with a normal pull, just enough that the washer is felt to give, there is something wrong. Investigate—maybe the washer fell off.

(2) *Special non-sparking wrenches.*—Be sure to use the special nonsparking wrenches designed for acetylene fittings; do not improvise. A brass nut on an F-10 connection, or other special acetylene fitting which has had the corners rounded off, is not easily replaceable, involving as it does the removal and replacement of a brazed or silver-soldered nipple or collar.

(3) *Note.*—Sets of wrenches made of nonsparking metal have been furnished all aids to navigation servicing units. Only nonsparking-type wrenches and other tools should be used in connection with acetylene apparatus when said tools are available.

F. *Pressure drop test.*—Shut off the gas at the cylinder and install a 30 atmosphere test gage in the location of the blind plug in one of the other pockets. If the connection on the test gage is too small to fit, use a test gage adaptor. Open the cylinder for a few seconds and tap the gage lightly, carefully noting the pressure and then close the cylinder valve. Allow the pressure to remain for at least 15 minutes (preferably an hour) and note if there is any drop in the pressure. Make sure that the valve on the cylinder is tight, otherwise the test is valueless. It is recommended that a line shut-off valve (V-270) be installed between the test cylinder valve and the test pipe. After the valve (V-270) has been closed, the cylinder may be disconnected to prevent any build-up of pressure from the cylinder. If there should be a change in temperature or the temperature of the piping system is considerably below that of the cylinder, a slight drop of pressure may result. If the conditions are reversed, a rise of pressure may be observed. Even if there are temperature changes present, a drop of only $\frac{1}{2}$ to 1 atmosphere will result. Thereafter, the pressure should remain constant. However, if a leak is present, the pressure will continue to fall.

G. *Connecting lantern.*—If the installation is tight, the lantern may be bolted on and connected, the gas turned on, and the lantern connection tested with soap solution. Although the flasher in the lantern may soon be heard in operation, it may be 20 minutes or more before the pilot on the flasher will support a flame or a flash will be produced. During this period, *the lantern top must be left open* to prevent an accumulation of gas.

H. *Lighting pilot—Caution.*—Before lighting the pilot, be sure that the lantern is free of gas. Apply a match to the acetylene burner and adjust the pilot flame by means of the adjusting screw in the burner

head, using the hexagonal-shaped socket fitting found on one of the adjusting screws. The pilot flame should be big but not luminous. Turn the adjusting screw to the left until a luminous spot appears. *This is an over-adjustment.* Now turn the adjusting screw to the right until the luminous spot disappears. *This is the correct adjustment* and the pilot should now show a large blue flame. If the pilot light flame is too low, it will blow out. If it is too high, it will carbonize, smoke up the lantern panes, and eventually extinguish the light. In daylight the pilot flame may be cupped in the hand or viewed through a tube. No yellow light should appear if the pilot is properly adjusted. A single pilot should consume about one-third cubic foot of gas per day.

I. Setting flasher characteristic.—Follow the instructions contained in sections 20-7-15 and 20-17.

J. Before leaving the installation of a minor light, place the cylinder protecting caps and blind plugs, belonging to the cylinders in service, neatly at the base of the bank of cylinders where they will be readily available when the next servicing period comes due.

20-16 SERVICING BUOYS AND MINOR LIGHTS

20-16-1. General—

A. Tenders, light attendant stations, and frequently other units are called upon to service acetylene lighting apparatus in the field. This may consist of recharging at regular intervals, relighting, or exchange or repair of defective parts, and may be a permanent or temporary remedial measure. All units regularly servicing aids should carry as complete a set of spares as practicable, commensurate with the types of apparatus used within their area of responsibility. See Chapter 27 for details and methods of working aids in the field.

20-16-5 Service Troubles—

A. Acetylene lighting equipment may require servicing for one of the following reasons:

(1) *Outage.*—This is of paramount importance. A lighted buoy showing no light may be a menace to navigation rather than an aid. See paragraph 20-16-10 (A).

(2) *Defective flasher.*—This is equally of paramount importance as it has been said that "No aid is better than a false aid." A flasher may be found operating off characteristic, burning fixed, or not burning at all. See paragraph 20-16-10 (B).

(3) *Burners and pilots.*—Usually found carboned up from too high a pilot flame. They seldom need replacement unless leaking at the junction of the metal holder, or badly plugged. See paragraph 20-16-10 (C).

(4) *Lanterns.*—Frequently damaged by collision. Tops often need replacement. See paragraph 20-16-10 (D).

(5) *Focal height.* Sometimes out of adjustment, thereby diminishing the visibility of the light. See paragraph 20-16-10 (E) and also Chapter 21.

(6) *Stormpanes.*—Sometimes found cracked or broken. See paragraph 20-16-10 (F).

(7) *Lenses.*—Sometimes found broken, or astro-gals not aligned with astro-gals of stormpanes. See paragraph 20-16-10 (G).

(8) *Shades.*—Often found broken, resulting in a false color being exhibited. See paragraph 20-16-10 (H).

(9) *Cylinders empty.*—An A-25 cylinder may be temporarily secured to the structure pending the arrival of a tender or good weather to permit recharging.

20-16-10 Causes and Remedies—

A. Outages.—These may be due to one of the following reasons:

(1) *Extinguished by the wind.*—Look for cracked or loose stormpanes, lens, or damaged lantern top. Be sure to ventilate lantern before relighting.

(2) *Buoy submerged in water.*—Look for water in the base of the lantern.

(3) *Carboned pilot.*—Look for smoked up lens, thick deposit of soot over the burner, yellow flame of pilot.

(4) *Defective flasher.*—See if flasher is still operating. A light "pop" can be heard each time it functions.

(5) *Collision.*—In the case of a buoy, the shock of collision may extinguish the pilot.

(6) *Cylinders empty due to leak or lack of service attention.*—If pilot and flasher are not operating, test cylinder pressure by connecting a test gage at the manifold within the buoy superstructure or at the lantern. Should it ever be necessary to retap the pocket staybolt due to corrosion of the threads, use only a Whitworth tap and extreme care. When cylinders are found empty before the servicing period is due, go over each connection and test for leaks carefully after installing full cylinders.

B. Defective flashers.—When a flasher is found to be operating fixed or off-characteristic, and adjustment of the flash and eclipse screws fails to remedy the defect, *it is necessary to replace the entire flasher unit. Internal adjustments and repairs to flashers should not be attempted in the field.* All tenders should carry spare flashers of the type commonly in use in the area. Unless the lantern is damaged, it is usually easier to replace just the flasher unit by the following procedure:

(1) Check the spare flasher for proper characteristic. It is easier to set it up on the test bench aboard ship than to attempt it aboard the buoy.

(2) Shut off the gas at the manifold.

(3) Remove the faulty flasher; check drain hole in lantern; clean it out if necessary.

(4) *Exchanging flasher.*—Be sure the four holding down screws of the new flasher are properly secured. Installing these on station is easier if the following is done: After removing the defective flasher, take two 10-32 brass machine screws about 1 inch long with the heads cut off. Screw these two studs into two opposite flasher holes in the bottom of the lantern pot to serve as a guide for the new flasher. Place two holding-down screws in the opposite holes of the flasher, lower into place and secure, leaving the two headless screws in place. Two holding-down screws are sufficient.

(5) Be sure all connections are tight and use a new aluminum washer in each case.

(6) Turn on the gas and test all connections with soap solution.

(7) Care must be used in lighting a flasher when the lantern is burning in a horizontal or inclined position as the heat may crack the lens.

(8) The flasher may not operate for several minutes due to the presence of air in the chambers. Give it at least 20 minutes before deciding it too, is defective.

(9) Check pilot and flasher characteristic and be sure lantern top is secured before leaving.

C. Defective burner and pilot.—It is seldom necessary to renew burners and pilots in the field, except where a badly carboned pilot has become plugged or a burner has developed a leak at the joint in the metal holder.

(1) **Exchanging burner.**—When replacing a burner, do not use too much force in threading the burner into proper position in relation to the pilot. A burner screwed in hand tight will not leak if sufficient "putty" is applied to the threads. Do not use ordinary white lead for this purpose. A specially prepared "putty" is available from A. G. A. Co. Apply just enough to fill the threads.

(2) **Exchanging pilot.**—Remove a single pilot by bending the metal fingers clear which are found around each of the burner arms, and grasping the upright pilot pipe with a pair of gas (narrow nose) pliers, carefully twist and pull upward. A double pilot may be removed by placing a screw driver under the cooling vanes on either side and prying carefully upward.

(3) **Conversion of double to single pilot.**—Double pilots on 130-mm. flashers are no longer standard and it is necessary to convert such flashers as are so equipped to single pilots. Do this as follows:

(a) Remove the pilot and burner connections from the double pilot head, unscrew the head from the spindle, and replace with the single pilot head.

(b) Check focal height. The average A. G. A. single pilot head is approximately $\frac{1}{16}$ inch higher than the double pilot head. See paragraph (E) below.

(4) **Alternate method.**—(Using the old double head.)

(a) Remove double pilot and burner.

(b) Cut $\frac{3}{16}$ inch off from a single pilot stem, file off burrs and blow out.

(c) Enter the stem all the way down one of the pilot holes. If the stem is not an easy fit, use another or dress it down as necessary.

(d) Grasp the pilot arm and upper stem and bend upwards and back until the pilot is horizontal. Then bend down, thus putting an offset bend in the stem. Continue until the flame pocket of the pilot is fair over the center of the burner hole.

(e) Remove the pilot, replace the burner, and re-install the pilot.

(f) If properly done, the flame pocket will fit neatly in the V of the burner. Try both pilot holes for best results.

(g) The unused pilot hole should be tapped out for a 10-32 brass screw which should be screwed down firmly against the head.

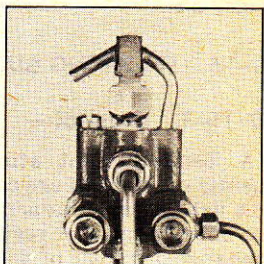
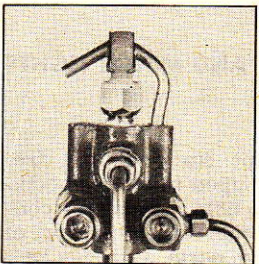
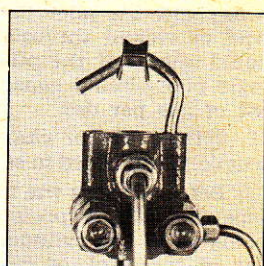
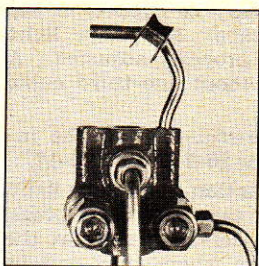
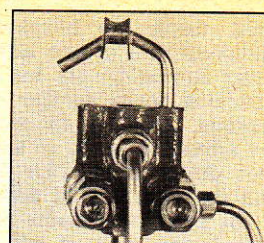
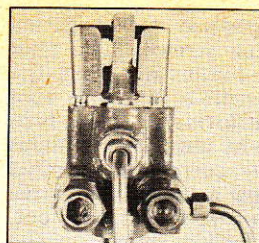


FIGURE 20-81.—Adapting single burner pilot to old-type double burner pilot head.

(h) Close the unused pilot valve tightly.

D. Defective Lantern.—Lanterns are easily damaged by collision and may require replacement in the field. They may be more easily mounted if a stud is screwed into one of the mounting holes to serve as an alignment guide. *The stud should be replaced with a regular bolt after serving its purpose.* Lanterns, with the exception of the 150-mm. size, are equipped with a test plug for use with a test gauge and adaptor. Buoys having the 150-mm. size lantern must have a combination shut-off valve and manifold located in the buoy structure for test purposes. Care must be exercised when opening the lantern of a buoy lying on its side or inclined, as the lens will usually fall out.

E. Improper focal height.—When the lantern fails to emit a clear sharp beam under dark conditions, improper focal height is often the cause. This means that the center of the flame is not in the center of the lens. A quick check for focal height may be made by placing a straight edge across the top of the stormpane section and measuring down to the top of the burner. A measuring stick can be marked off and kept with the servicing tools. The distance should be as follows:

- 150-mm. $4\frac{3}{8}$ inches using $\frac{1}{4}$ cubic foot burner.
 200-mm. (A. G. A.) $6\frac{3}{4}$ inches using $\frac{1}{2}$ cubic foot burner.
 200-mm. (Service) $6\frac{1}{4}$ inches using $\frac{1}{2}$ cubic foot burner.
 375-mm. $11\frac{5}{8}$ inches using 1 cubic foot burner.

For further instructions relative to focusing, see Chapter 21.

F. Broken stormpanes.—Stormpanes are frequently found cracked or broken and may be readily replaced in the field. The brass screws which secure the strips to the astrogal bars in the 200-mm. lanterns are 8-32 x $\frac{1}{2}$ inch round head brass machine screws. Those used in the 375-mm. lantern are 14-20 x 1 inch screws. Care must be used in removing these screws as the 8-32's may twist off easily. If the screws are found tight, place the screwdriver in the slot and tap lightly while applying pressure to unscrew.

To remove a broken stormpane:

- (a) Remove all bits of broken glass and putty.
- (b) Save the wood pieces which will be found embedded in the putty as these are used to prevent contact between the glass and the metal.
- (c) In installing new glass, fill the recesses provided for the glass with putty, insert wood pieces, and press glass firmly in place.
- (d) Place a thin layer of putty where the brass strip will bear and install strips.
- (e) The screw holes may be located more easily by inserting a common nail down through the hole in the strip and into the tapped hole of the frame. Oscillate the nail until a fair lead is made for the screw.
- (f) *Caution.*—Do not use too much force in tightening the screws if it is a cool day. Expansion will take place under warmer conditions and may break the glass.
- (g) The putty used should be a mixture of one-third pure white lead in oil to two-thirds putty, mixed with whiting until the mass stops sticking to the hand.
- (h) After the strips are screwed down, fill in any existing voids with putty and clean the stormpane.

G. Broken lenses.—Since the lens of the 150-mm. lantern is of pressed glass and forms an integral part of the lantern, there being no stormpanes, it is easier to replace the entire lantern in the event of a broken lens. If no spare is available, it is better to remove the lantern and replace the lens aboard ship. The tie rods are awkward to assemble and the small nuts are easily dropped overboard. The lens of the 200-mm. Service-type lantern is a standard pressed glass lens with spun brass rings around the top and bottom edges. It is easily replaced. Most 375-mm. lenses are made up of a series of concentric ground or cut glass rings installed in a bronze framework. Both the 200- and the 375-mm. lenses are held in place by a ring and spring tension when the lantern top is closed. A few of the older type of pressed glass triangular segment lenses are in service and can only be installed when the buoy is in a vertical position, as the lens will not stay in place otherwise so as to permit closing the lantern top.

H. Broken shades.—In the 150-mm. lantern the shade forms an integral part of the lantern ventilation system, therefore a shade must be used regardless of the color of the light. The 200-mm. Service-type lanterns take a standard type C colored shade, held in place by spring "fingers," and are easily installed. The 375-mm. shade does not have the metal rings and must be carefully fitted over the spring of the shade holder. Since the shade is held in place by carefully adjusted flat spring "fingers" attached to the draft tube which protrudes down from the lantern top, care should be taken in removing the lens from the lantern so as not to damage or bend these "fingers" out of position. The fingers should not be compressed more than one-fourth inch with the top screwed down. See section 20-6-30 for additional data on shades.

I. Summary of remedies:

I. If flasher is audible (in operation)

- (1) Open the lantern.
- (2) Air out acetylene (detectable by characteristic odor). This is important, because a 3 percent concentration of acetylene is explosive.
- (3) Lantern having been thoroughly aired, inspect the pilot.
 - (a) If the pilot is apparently unclogged, relight and check the pilot adjustment (large but non-luminous flame).
 - (b) If the pilot is clogged, exchange, relight, and adjust.
- (4) Determine gas pressure. This may be accomplished at several points; at the lantern if equipped with a pressure gage valve, at the manifold, or at the cylinder.
 - (a) If pressure is near or below 2 atmospheres, replace cylinders or cut in a reserve cylinder.

II. If flasher is inaudible (not operating)

- (1) If a sunvalve is installed, determine if the pilot is burning.
 - (a) If pilot is burning, bypass the sunvalve (turn the valve cock to the left). (See section 20-10-5.) Flasher should start operating. Cover the sunvalve when beginning test operations so that the operation of the sunvalve may be checked before leaving the light.
 - (b) If bypassing sunvalve does not start the flasher, proceed to step (2) below.
- (2) Determine gas pressure.
 - (a) If near or below 2 atmospheres, exchange cylinders and check all piping. Follow procedure outline in section 20-16-20 below.
 - (b) If gas pressure is well in excess of 2 atmospheres, proceed to step (3) below.
- (3) Break connections between the gas line and the lantern and determine if gas is present at that point, or test with a gage if the lantern is equipped with a gage valve. Check sunvalve piping to see if clear.
 - (a) If gas is present, exchange flasher-regulator and relight.

(b) If gas is not present, check the high-pressure line from the lantern to the manifold (including particularly the valves and filters).

J. Miscellaneous precautions:

(1) Do not attempt internal servicing or overhaul of lighting apparatus on station or aboard a buoy.

(2) Be sure the sunvalve is adjusted. (See sec. 20-10-5.)

(3) Be sure all connections which were broken (loosened) during tests are made gastight (use soap solution test). (See sec. 20-15-5.)

(4) If no cause for the outage can be discovered, examine the installation carefully for signs of tampering or vandalism.

(5) Observe the aid at every opportunity, especially if no obvious cause for the outage was discovered.

20-16-15 Service Testing Procedure—

A. Follow the steps outlined for testing minor lights in section 20-16-25 (I). The test manifold on buoys equipped with a 150-mm. lantern will be found inside the daymark of the buoy tower. Buoys with 200-mm. lanterns usually have a test plug and valve located in the side of the lantern.

20-16-20 Recharging Lighted Buoys—

A. *The installation of acetylene cylinders is an important function and can be hazardous if done carelessly.*—When the gas pressure of a buoy falls below 2 atmospheres, the buoy should be recharged. This may be done by bringing the buoy alongside or on deck of a tender, or in the case of small buoys in sheltered waters, from alongside a buoy boat or ship's boats. *Only nonsparking tools should be used in working with acetylene wherever possible.*

B. *Procedure.*—Whenever the cylinder pocket of a buoy is to be opened either at sea or at a depot, the procedure below should be followed:

(1) Examine the vent. Remove the brass or plastic housing and test the rubber vent tube with the fingers to ascertain whether the rubber is still pliable and whether or not the slit opens properly. If the rubber vent operates properly, remove the brass plug in the pocket cover(s). Nonsparking tools should be used. Carefully ascertain whether or not there is any evidence of acetylene gas in the pocket.

(a) If the vent tube is working satisfactorily and if no gas is detected, the pocket cover may be removed as described in (2) below, the entire operation being carried out using nonsparking tools.

(b) If the vent is defective or if gas is detected in the pocket, *extreme care* should be used in removing the cover, using only nonsparking tools. After the cover is removed, the work of disconnecting the acetylene cylinders should be delayed for at least 30 minutes allowing for further purging.

(2) Remove the cover. Covers which have been properly installed should not prove difficult to remove. Sticking covers may be pried off by inserting a wedge of nonsparking material, taking care not to damage the gasket, or by tapping lightly around the edge of the cover with a nonsparking mallet. Take care not to bend the cover. Should the pipe plug in

the pocket cover become frozen and impossible to remove, loosen the cover hold-down bolts carefully. Do not turn down the swing bolts until the cover has been completely loosened. Inspect the pocket for the presence of acetylene gas as noted in (1) (b) above.

(a) Flooding a space completely with water is the surest way to remove acetylene gas, and should this be done, a mechanical foam nozzle pick-up tube provides an easy means of removing water from the buoy pocket by the eductor principle.

(b) *Never insert a metal-tipped hose into a pocket to ventilate it, either by suction or compressed air.* The hose may whip around violently when the air is turned on, causing sparks.

(3) Shut off valves on each cylinder.

(4) Remove the pressure gage plug in the manifold or break (loosen) a connection at any point in the acetylene piping system on the buoy superstructure to relieve the pressure in the piping.

(5) Disconnect the section of tubing between the cylinder and the staybolt located in the side of the buoy pocket. Keep these pieces of tubing marked as to which pocket they belong.

(6) Loosen the wooden wedges, make a reference mark on the pocket wall opposite the cylinder valve outlet, and lift the cylinder out. This may be done (in the case of A-25 and A-50 cylinders) by screwing a specially prepared lifting cap on the neck of the cylinder (see par. 20-16-25 (D)). Be sure the threads of the cylinder neck are in good condition. Make fast to the lifting cap with the tender's whip or a small handy billy suspended from the lantern cage and hoist the cylinder carefully. It is a poor practice to hoist or otherwise handle a cylinder by making fast directly to the neck of the valve.

(7) Test the new cylinders before installing. Often empty cylinders are mixed with full ones accidentally. Mark them appropriately as soon as they are removed.

(8) Insert the cylinders, lining up the valve outlet with the reference mark on the wall of the buoy pocket. It is difficult to twist a cylinder once it is inside the pocket. Some large pocket covers have cylinder bail guards. These are located on the underside of the cover and extend down into the pocket to fit over the bail so as to prevent the cylinder from moving. In this case, not only must the cylinder be lined up for the piping but also to match the drop bolt slots in the cover with the bolts in the pocket casting.

(9) Reconnect the tubing, using *new* aluminum washers.

(10) If the washers are a loose fit, they may be crimped slightly.

(11) Turn on the gas and check connections for leaks. Wedge the cylinders securely, check the cover gaskets for good condition. If old-type gaskets, apply dry graphite, and replace the pocket covers. Tighten the drop bolts evenly. (*Neoprene gaskets used on recently manufactured or modified buoys need no sealing compounds.*)

(12) Test all connections for leaks, using soap solution.

(13) Twenty minutes or more after the gas is turned on, ventilate the lantern and light the pilot. Make no adjustment to the pilot for at least 30 minutes after turning on the gas. If the burner flame

fails to catch with the lantern top closed, adjust the pilot to the minimum height required to regularly light the flash, but in no case should the pilot flame show a trace of yellow.

(a) Check the characteristics. See part 20-17 for detailed explanation of characteristic.

(14) See Chapter 27 for more complete data on recharging aids.

20-16-25 Recharging Minor Lights—

A. *When to recharge.*—Acetylene cylinders should be removed before they are completely discharged because if allowed to discharge below 1 atmosphere, some of the acetone may be carried into the piping and flasher mechanism. This pertains to buoys as well as minor lights. A rapid drop in temperature will cause a decrease in the gas pressure sufficient to cause an outage. A safe rule is to renew the cylinders if the pressure is below 2 atmospheres. An exception to this rule may be made if it is practicable to check the pressure every other day, or if the light is easily reached in event the temperature takes a decided drop, or if the luminous period is one-tenth or less and the burner is of such size that the computed running time will safely overlap the day of the next scheduled visit.

B. *Transporting cylinders in boat.*—Minor lights are usually situated in places where direct approach by tenders is impossible, therefore, it is necessary to transport the cylinders by small boats. Lay the cylinders carefully and securely in the boat and do not drop one on another. It is preferable where possible to remove the full cylinders from the boat and place them as near the tower door as possible before loading the empties. All empty cylinders should be so marked.

C. *Replace plugs and caps on empty cylinders.*—Whenever changing acetylene cylinders (buoys as well as minor lights), close the line shut-off valve to the lantern and close each cylinder valve, unscrew the pipe fittings on cylinders, and install blind plugs and caps. If the previous servicing has been done in an efficient manner, the caps and blind plugs for the cylinders to be changed will be located on the wooden cylinder base or in the immediate vicinity where they can be readily found.

D. *Special lifting cap.*—If loading an A-50 cylinder involves hoisting or lowering, screw a special protection cap, fitted with a lifting bail or having slots for a hook, all the way home on the threaded collar of the cylinder, first making sure that the cap fits the cylinder and that the threads on both fit snugly and are in good condition. Always use this special lifting cap when hoisting or lowering cylinders from tender to boat or boat to light, or use a sling around the cylinder body. Never use a rope strap around the valve assembly. Replace the special lifting cap with a regular protection cap as soon as the empty cylinders are placed in the boat, to prevent damage to the valve. See figure 20-5 for a special A. G. A. adjustable lifting cap. This cap is particularly useful when the cylinder neck ring threads are worn and an ordinary cap would fit loosely.

E. *Secure cylinders and record serial numbers.*—Secure each full cylinder in the rack as soon as it is hoisted in place. Do not use a wrench on the cylinder body or valve in order to line the valve up with pipe connections. Record the serial number of cylinders removed and cylinders installed.

F. *Caps, blind plugs, and washers.*—When installing the full cylinders, remove the caps and blind plugs and place them where they can be found readily when next needed. Renew all F-13 aluminum washers.

G. *Lead of pipe to cylinder.*—Be sure that cylinder valves are located so that the pipe connections lead fair into them. The best way to do this is to draw back the brass nut and fit the end of the steel nipple into the threaded valve opening so that the body of the nipple is perfectly centered in the threaded opening. If this is done properly, the brass nut will screw into the valve easily, by hand. A little care will avoid damage to the threads and hexagonal section of the nut, and unnecessary use of the wrench can be avoided. In tightening up the brass nut, do not pull too hard on the wrench. The aluminum washer is comparatively soft, and with the leverage possible with the standard 27-28-mm. wrench, the washer can be easily flattened out. The more the washer is flattened the harder and more brittle it becomes. If the connection is not tight with an ordinary pull of the wrench there is something wrong; perhaps the washer fell off. Back the nut out and examine the fitting. Replace the washer.

H. *Damaged pipe.*—Over a long period of time an occasional cylinder tubing may become damaged, the brass nut may be found battered, or the copper jacket on the tubing split. If unable to make immediate repairs, note the location of the damage such as "left side, cylinder No. 2 from front of tower", and see that a replacement is made available the next time the light is serviced. It is dangerous to allow a piece of tubing with broken copper covering to remain installed since corrosion will take place, thinning the wall of the steel tubing.

I. *Check installation for pressure and test for leaks as follows:*

(1) Shut off acetylene at each cylinder. Close the valve with the key wrench hand tight only. If the valve is stuck, tap the key wrench lightly with a block of wood or some other nonsparking material.

(2) If there is no permanent test gage installed, remove the blind plug from the gage outlet in the manifold. See that there is a good washer on the gage, and then screw the test gage into the manifold, tightening with an open-end wrench. The gage should be turned so that its face is away from the person testing to afford protection from flying glass in case the gage bursts under pressure.

(3) Open the valve gently to allow pressure to build up slowly on the gage. This will prevent injury to the gage mechanism. Record the gage reading.

(4) Shut off the acetylene valve as in step (1). Release pressure on the gage by "cracking" the connection. When the gage indicator drops back to zero, disconnect the gage. Remove the old washer from the blind plug and replace with a new washer.

Screw the blind plug into the gage outlet of the manifold and tighten with a wrench.

(5) *Soap solution.*—Open the acetylene valve on each cylinder fully and test all cylinder valves and connections throughout the system for leaks with soap solution. In freezing weather, add up to 20 percent alcohol to the solution, the amount depending on the temperature. Care should be taken to prepare the soap solution to the proper consistency, as a solution which is too thick will very often allow leaking gas to blow through without forming a bubble. The use of a sponge squeezed tightly by the palm of the hand around the connection to be tested brings excellent results. It often shows up leaks in close spaces that otherwise would be overlooked. Whenever time permits, a double check should be made, especially after connecting cylinders. *Insuring the tightness of connections will save many hours of labor and costly servicing later on.* Do not forget to test the safety plugs in acetylene cylinders; they are often subject to leaks.

(6) Replace all chain plugs over the valve stems.

20-16-30 Tools and Other Items Used in Servicing—

A. Following is a list of tools and other items normally used in connection with servicing acetylene apparatus. See Chapter 27 for lists of tools and spare parts used in all types of aids to navigation work.

Metal tool box.

Pressure gage with adapter fitting.

Cylinder valve key wrench (tee) (2).

Set of large and small socket wrenches.

Set of combination box and open-end wrenches.

Special open-end wrenches; 8-, 12-, 13-, 15-, 27-, 28-, 33-mm. size (*nonsparking type*).

Set of conventional open-end wrenches.

Set of pliers; gas (narrow nose), long nose, side and diagonal cutting, and adjustable.

4-inch and 8-inch adjustable crescent wrenches.

Set of screwdrivers, assorted sizes.

Clamping ring and crowfoot wrenches.

Pair of tweezers.

File, small half round, 8 inches.

Hammer, ball peen.

Hammer, copper.

Rule, 6 feet.

Burner sealing compound.

Graphite grease.

Matches.

Sunvalve shield or piece of canvas.

Sunvalve adjusting key.

Stop watch.

Carbon cleaning tool.

Soap can, sponge or brush.

Glass cleaner and soft cloth for polishing lens.

Canvas bag for carrying tools aboard a buoy or minor light.

Test pipe, 10 feet long with F-10 connections on each end.

Assorted burners, pilots, chain, and blind plugs, aluminum washers and machine screws.

Cylinder protection screw-on cap.

Special cylinder lifting screw-on cap.

NOTE: Certain of the above wrenches are now available in nonsparking metal. Wherever possible, such nonsparking wrenches shall be used, and particularly when opening buoy pockets.

20-17 CHARACTERISTIC TIMING

20-17-1 Definition—

A. The term "characteristic" refers to a cycle of flashes and eclipses which occur at regular intervals. By such means any light may be distinguished from other lights in the area. Acetylene flashers are adjustable to give a wide range of characteristics depending on the size of burner and type of flasher used. A flasher cannot be made to operate properly as a fixed light. When this occurs, it is an indication that the internal mechanism has been improperly adjusted. However, if a fixed light is desired, a regulator (especially adjusted) may be piped directly to a burner.

20-17-5 Common Characteristics

A. Listed below are several types of flashers, showing some of the characteristics with which they are commonly set.

50-mm. and 130-mm. single flashers

Flash	Eclipse	Period	Rate of flash (per minute)
*0.2	0.6	0.8	75
*.2	1.8	2.0	30
*.3	.7	1.0	60
*.4	.6	1.0	60
*.4	3.6	4.0	15
*.5	.5	1.0	60
*.5	2.0	2.5	24
*1.0	1.0	2.0	30
*1.0	4.0	5.0	12
*1.0	5.0	6.0	10
*1.0	9.0	10.0	6
2.0	1.0	3.0	20
2.0	2.0	4.0	15
2.0	4.0	6.0	10
2.0	8.0	10.0	6
3.0	3.0	6.0	10
5.0	5.0	10.0	6

NOTE.—Only those marked with (*) may be set on the 50-mm. flasher. All may be set on 130-mm. type.

130-mm. multiple flashers

Flash [†]	Eclipse	Flash	Eclipse	Period (seconds)	Rate of groups (per minute)
0.2	0.6	0.2	3.0	4	15
.3	.9	.3	4.5	6	10
.5	1.5	.5	7.5	10	6

130-mm. complex flashers

Flash	Eclipse	Flash	Eclipse	Period	Rate of groups
0.3	0.3	1.2	7.2	9	5 groups in 45 seconds.
.4	.4	1.6	5.6	8	5 groups in 40 seconds.

130-mm. compound flashers

Flash	Eclipse	Long eclipse (seconds)	Period (seconds)	Rate of groups
0.2 (6 times)	0.6 (5 times)	4.2	8.4	5 groups in 42 seconds.

See par. 20-7-15 (G) for characteristics set for modified multiple flasher for interrupted quick flash (I. Q. FL.).

20-17-10 Means of Setting Characteristic—

A. Flashers are adjusted or set to the desired characteristic by turning the flash and eclipse adjusting screws, and are timed by the use of a stop watch. Although the ordinary use of a stop watch is well known, timing a flasher requires special care. Press the stem down part way to take up the slack, then use a squeezing motion similar to firing a pistol rather than a quick snap. Begin the count at the end of a flash rather than at the beginning, and end the count at the end of a flash also.

20-17-15 Characteristic Setting, General Procedure—

A. The setting of a characteristic involves more than just a certain number of flashes per minute. The ratio of flash to eclipse is of importance because it is on this ratio that the supply of acetylene gas is based for a given installation. How long the light will burn on a given supply of gas is calculated on the burning time in relation to the total cycle of the characteristic. This is known as the luminous time ratio. Since many characteristics call for a flash of tenths of a second, and it is necessary to get them accurate, the ordinary use of a stop watch is inadequate.

B. *Preliminary characteristic.*—For the purpose of timing, slow down the fractional flashes to whole flashes, keeping them in exact ratio. They can be readily speeded up afterwards to the desired rate. (See par. (C) below.) Multiply the fractional value of both the flash and eclipse by a common multiplier to obtain whole numbers. For example:

It is desired to set a characteristic of 0.4 flash and 3.6 eclipse. The total period is 4.0 seconds and occurs 15 times a minute. Using 10 as a common multiplier gives 0.4×10 equals 4 seconds and 3.6×10 equals 36 seconds. This results in a slowed down characteristic of whole numbers but still in the same ratio of (1-9). This new characteristic of 4 seconds flash and 36 seconds eclipse is easy to set. However, the periods are longer than necessary and will require too much time to adjust. Therefore, divide each by four, giving 1 second flash and 9 seconds eclipse as the correct preliminary characteristic, maintaining the same ratio as before (1-9).

C. *Final characteristic.*—Do not touch the Eclipse valve after the preliminary characteristic has been set. Turn the flash screw to the right, thus speeding up the flashes until the desired rate of 15 flashes per minute is obtained. With the flasher set to the required number of flashes per minute, the originally desired characteristic is automatically ob-

tained, since in the process of increasing the number of flashes per minute, the flashes and eclipses are shortened in the same proportion.

20-17-20 Characteristic Setting, Specific Procedure—

A. See section 20-7-15 for detailed instructions for each type of flasher.

20-17-25 Timing Hints—

A. Always set the flash length first.

B. Hold the stop watch in one hand; place the other hand on the adjusting screw with the slack taken up in the direction of the next movement.

C. When timing the flash length of a preliminary characteristic, it is easier to allow the watch to run continuously and observe the mark when the light comes on and off, etc.

D. Accurate timing cannot be done by snapping the watch at the beginning of a flash; it is impossible to anticipate the exact moment when a flash will begin. Snap the watch at the end of the flash.

E. When timing at the end of a flash, the one which has just gone out does not count. The next flash coming up is No. 1.

F. After completing the setting of the preliminary characteristic, screw the flash adjusting screw almost all the way in immediately. This will quickly approach the desired rate of flash since the minimum flash attainable is not much under one-half second, and often the duration of the desired flash will be in that neighborhood.

G. Do not screw the adjusting screws too hard, particularly the eclipse screw. To do so flattens out the copper discs which make up the valve assembly thus causing them to lose their resiliency and making adjustment critical and difficult.

20-17-30 Miscellaneous Notes—

A. *Interflash flasher.*—An occasional Interflash flasher will be found in use, and while their internal mechanism differs somewhat from the A. G. A. flasher, the method of adjustment is the same, both as to characteristics and pilots.

B. *Flashers with cluster burners.*—On rare occasions, flashers will be found with a cluster of from 3 to 6 burners. This, of course, calls for a special burner head; however, this arrangement alters in no way the method of adjusting the characteristic. Flashers carrying cluster burners, while similar in mechanical respects to the 130-mm. flasher, are provided with flasher chambers with increased volume, either by use of spacer rings applied to a standard 130-mm. flasher or by the use of a larger flasher chamber whose diaphragm is 240-mm. in diameter. These flashers are used in unattended lights containing lenses up to and including second order in size. Most of these installations are in remote locations where sufficient cylinders are housed to provide for a long service period.

20-18 SERVICE TIME OF LIGHT

20-18-1 Definition—

A. The service time of a light is the number of days a light will operate before recharging is required.

20-18-5 Computing Service Time—

A. The service time depends on the number and size of the cylinders, the light characteristic, and the burner size, and may be calculated from the following formula:

$$T = F \frac{N \times A}{(24 \times L \times B \times S) \text{ plus } 0.33} \text{ where}$$

T = the service time in days.

F = the safety factor (generally 0.9).

N = the number of cylinders.

A = the rated capacity of acetylene of each cylinder in cubic feet.

L = the luminous time ratio, i. e., the ratio between the duration of each flash and the total period.

The sum of the duration of the flash and the duration of the eclipse equals the total period.

(For other than single flashing characteristics, the luminous time ratio is the ratio of the sum of all the flashes in a complete period, to the period.)

B = the burner size in cubic feet per hour.

24 = the hours per day.

S = a factor whose value depends on whether or not a sunvalve is used. (With a sunvalve it is 0.7; without, it is 1.0.)

0.33 = the per diem consumption of a single pilot in cubic feet.

B. Compute the service time of a light with the following characteristic; flash 0.5 second; eclipse 3.5 seconds; and the following equipment; four A-50 (200 cubic feet) cylinders and a 200-mm. lantern containing a $\frac{3}{4}$ cubic foot burner. There is no sunvalve. The luminous time ratio (L) is seen to be 0.5 divided by the sum of 0.5 and 3.5, which is $\frac{1}{8}$. Thus the values to be substituted in the formula are:

$F = 0.9$

$N = 4$

$A = 200$

$L = \frac{1}{8}$

$B = \frac{3}{4}$

$S = 1.0$

$$T = 0.9 \frac{4 \times 200}{(24 \times \frac{1}{8} \times \frac{3}{4} \times 1.0) + .33} = 279 \text{ days}$$

In the same example, had there been a sunvalve, the computation would have been as follows:

$$T = 0.9 \frac{4 \times 200}{(24 \times \frac{1}{8} \times \frac{3}{4} \times 0.7) + .33} = 378 \text{ days}$$

See figures 20-2, 20-2A or 20-2B for tables of cylinder capacity for given pressure and temperature.

20-18-10 Reliability of "Gaging" Cylinders—

A. Since there is a distinct relationship between change of temperature, the difference in the known atmospheric temperature, and the internal temperature of a cylinder (which can only be estimated unless the ambient temperature has remained constant for a long period), and the pressure of the acetylene gas, the practice of "gaging" an acetylene installation to determine the remaining service period is not always reliable. A check of pressure will give a general indication of the need for recharging, or will show up an abnormal condition such as a leak, etc. If the tables (figs. 20-2, 20-2A or 20-2B) or the nomograms (figs. 20-82 and 20-83) are used in computations, it must be remembered that the temperature involved is the internal temperature of the mass within the cylinder, and accurate estimation thereof must be attempted. (Although impracticable in the field, the only reliable manner in which the quantity of gas remaining in a cylinder can be determined is by checking its weight.)

B. The service period of an acetylene installation should be based only on accurate records maintained by the officer-in-charge of a light or light attendant station, commanding officer of a tender, or the district office, rather than on intermittent "gaging."

20-18-15 Gas Consumption Chart—

A. The acetylene gas consumption chart (figs. 20-82 and 20-83) can be used either to determine how many acetylene cylinders to install for any given installation or to calculate the service time remaining in a partially discharged installation. The chart is based on the formula given in paragraph 20-18-5 (A). (See note below.) Two examples are given below, the first of which shows how to select the number of cylinders to give a specific servicing time and the second how to calculate the servicing time remaining in an existing installation.

NOTE: The charts (figs. 20-82 and 20-83) were computed for the value of 180 cubic feet capacity formerly used for A-50 cylinders and 88 cubic feet for the A-25. The values for A-300 cylinders remain the same. It is suggested that the charts be used "as is" without attempt to interpolate for the presently accepted values of 200 cubic feet for A-50 and 100 cubic feet for A-25 cylinders. Thus any error will always be on the side of caution.

B. *Number of cylinders needed.*—For example: How many A-50 acetylene cylinders should be installed at an aid which has a lantern equipped with a $\frac{5}{8}$ -cubic-foot burner operated on a characteristic of 0.5 second flash, 3.5 seconds eclipse, if the desired period of operation is 2 years? (a) Without sunvalve and (b) with sunvalve.

Solution: Use the left-hand half of the chart (fig. 20-82). Compute the luminous time ratio as defined in paragraph 20-18-5. This is found to be $\frac{1}{8}$. Proceed on the chart as follows:

(1) Start at the $\frac{1}{8}$ luminous time ratio point and go horizontally to the $\frac{5}{8}$ burner line.

(2) Go vertically to the 730-day (2-year) line.

(3) Go horizontally to the left margin and read 10 cylinders required on the A-50 line. This is the solution if no sunvalve is used.

(4) If sunvalve is used proceed as before from the $\frac{1}{8}$ luminous time ratio point to the $\frac{5}{8}$ burner line.

(5) Proceed vertically to the horizontal line H-H.

(6) Move upward and to the right parallel to the 45° guide lines to the inclined sunvalve line V-V.

(7) Go vertically to the 730-day line.

(8) Move horizontally to the left margin to a point between 7 and 8 on the A-50 line. Thus 8 cylinders would be required if a sunvalve is used.

C. Remaining service period.—Where a bank of acetylene cylinders is only partially charged, it is much more difficult to estimate the remaining life than it is in the case of a fully charged bank. This is primarily a result of the fact that pressure is not the only criterion to be used in estimating the amount of gas left in each cylinder. The effect of temperature (and temperature has a considerable effect!) must be taken into account. The following paragraph illustrates the procedure that must be followed if accurate results are to be obtained.

D. For example: A bank of eight A-50 cylinders has been installed at an aid in which a 1-cubic foot burner has been operated on a characteristic of 2 seconds flash, 8 seconds eclipse. The pressure gage reads $5\frac{1}{2}$ atmospheres and the air temperature for the preceding 48 hours has varied from +10° F. to +50° F. How many days life remain in the bank? (a) Without sunvalve, and (b) with sunvalve.

Solution: The average temperature has been 30° F. At this average temperature, which will be assumed as the interior temperature of the cylinder, and $5\frac{1}{2}$ atmospheres of pressure, the table of figure 20-2A shows that 142.6 cubic feet of gas remain in each cylinder. All of this gas cannot be utilized. There

should be withdrawn from the cylinder only that amount of gas which will drop the pressure to not less than 2 atmospheres. This final pressure is in accordance with established practice in servicing acetylene operated aids to navigation. The amount of gas which remains in the tank at 2 atmospheres will in turn depend on the temperature at the time. It will therefore be necessary to assume a final temperature in order to arrive at a solution to the problem. In this particular problem suppose it is known that the probable expiration date will be some time in the fall when the average temperature will be about 50° F. The table shows that at 50° F. and 2 atmospheres pressure, 41.5 cubic feet of not-to-be used-up gas will remain in the cylinder. There is thus available for use 142.6 minus 41.5 or 101.1 cubic feet of gas per cylinder or a total of $8 \times 101.1 = 808.8$ cubic feet for the bank of 8 cylinders. To solve the problem, make use of the right hand chart (fig. 20-83) and proceed as follows:

(1) Determine the luminous time ratio as $\frac{2}{2+8}$

or 0.2 and start at this point.

(2) Go horizontally to the 1-cubic foot burner line.

(3) Go vertically to a point horizontally opposite 808.8 cubic feet as read on the scale on the left margin.

(4) Read the answer at just below the 150-day line, estimated at 140 days.

(5) If sunvalve is used, proceed as before, making use of the 45° guide lines to get to the sunvalve line V-V. In this case the final answer is read as 200 days.

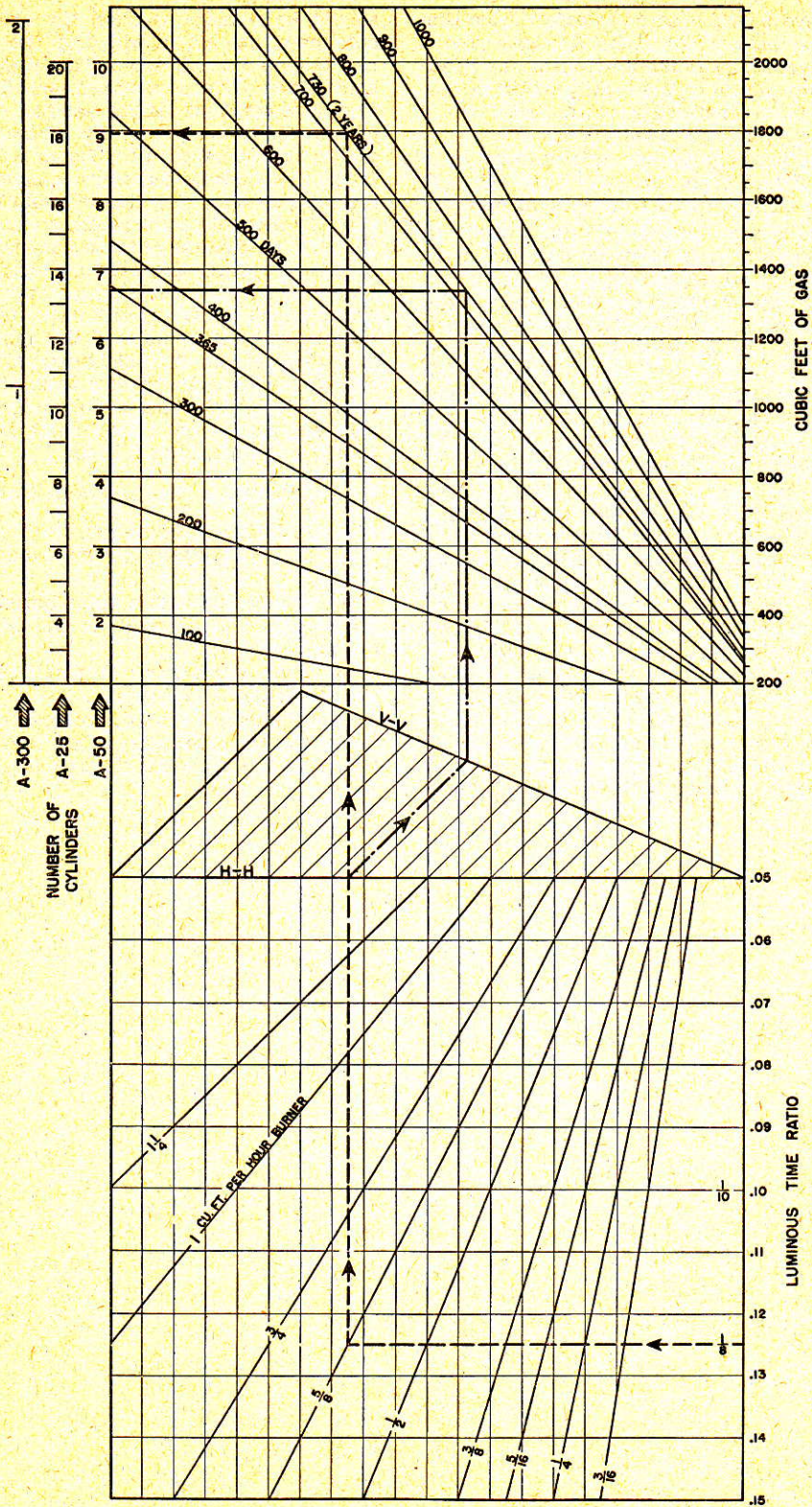


FIGURE 20-82.—Acetylene gas consumption chart.

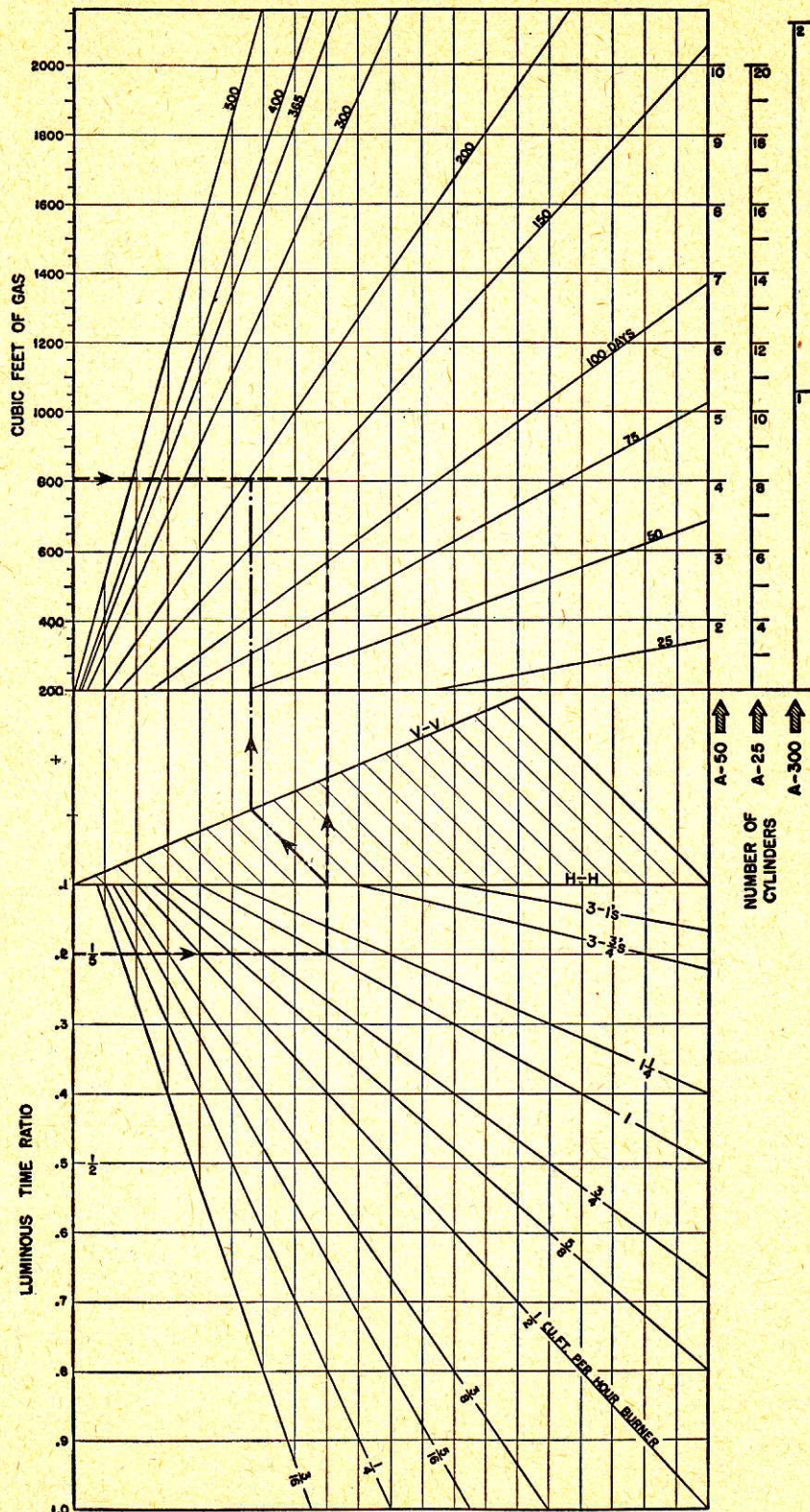


FIGURE 20-83.—Acetylene gas consumption chart.

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