	Reference Figure	Location	General Information	Normal Operation	Cause of	Cause of Trouble	Removal	Adjust-Maintain	Circuit
Voltage Regulator			145						
Voltage Regulator Center Relay	3		27	27		138			28 132
Voltage Regulator Front Relay	3		27	27					
Voltage Regulator Galv. Relay	3		27	27					
Voltage Regulator Limit Switch	3		27 134	27		134 138			
Voltage Regulator Motor	3		27	27				32 121	
Voltage Regulator Range of		See Ship Voltage Limits							
Voltage Regulator Rear Relay	3		27	27					28 132
Voltage Regulator Resistors		See Resistors A, B, C, & D							
Voltage Regulator Rheostat	2 3		27	27 29					141
Voltage Regulator Testing		See Test - Voltage Regulator							
W Resistor		See Resistor W							
Water Drains		See Pipe Drains							
Water Traps		See Pipe Drains							
Window - Flare		See Flare Windows							
Wiring - Aux. Gong		41	41			101 114			41 139
Wiring - Circuits		See Circuits							
Wiring - Diagram		See Circuits							
Wiring - Exh. Unit		13 40				100			40
Wheelhouse Valve		See Air Exhaust Valve							

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PRINCIPLE

1. The RICHAUDIO SYSTEM is fundamentally an air sampling apparatus arranged to analyze these air samples for the presence of smoke.

2. The air samples from each space protected by the RICHAUDIO SYSTEM are conveyed to the DETECTING CABINET (Figs. 1 & 2), usually located in the wheelhouse, through a system of individual pipe lines, each terminating in a glass-enclosed compartment. These air samples are continuously drawn to the detecting cabinet by an electrically-driven EXHAUSTER. After reaching the detecting cabinet, the air samples pass through the exhauster and then may be discharged into the wheelhouse or to the outside atmosphere as desired, by operation of an AIR EXHAUST VALVE.

3. The smoke generated in any space will rise and, aided by the suction of the exhauster, enter the piping and be carried to the detecting cabinet. It will then issue from a FLARE in the glass-enclosed visual compartment. Concentrated beams of light, invisible in clear air, are projected from each flare (Fig. 5). Any smoke particles issuing from a flare are thereby intensely illuminated, thus providing the means for VISUAL DETECTION of smoke. Due to the construction of the visual compartment, the air issuing from each flare is caused to swirl about over several flares. Any smoke carried into the detection compartment is, therefore, brought into several light beams, producing a still more conspicuous indication. This sometimes creates the appearance of smoke issuing from more than one flare. The base of each flare, however, is provided with a small WINDOW to permit observation of each air sample individually. Smoke will be actually issuing only from the flares in which it can be seen through these windows (Fig. 5).

4. Each flare is numbered to identify the compartment to which it is connected. A CHART is mounted near the detecting cabinet, listing each space by name with the number which corresponds to the flare number.

5. The air samples are drawn from the cabinet and pass through the exhauster and are then usually discharged into the wheelhouse. If smoke is present, it will also be DETECTED BY SMELL. The discharge from the exhauster should be directed to the open atmosphere only in case of obnoxious odors created by certain cargoes.

6. The combination of the above methods of providing SMOKE DETECTION BY SIGHT AND SMELL is known as the RICH SYSTEM. When the RICH SYSTEM is combined with an arrangement for DETECTION OF SMOKE BY PHOTO-ELECTRIC MEANS, the combination is known as the RICHAUDIO SYSTEM.

7. In the RICHAUDIO SYSTEM each pipe line from the space protected is provided with an automatically controlled ELECTRO-MAGNETIC(SOLENOID) VALVE (Figs. 2 & 6) which serves to momentarily divert the air samples from

EXHAUSTER UNITS

13. The two electrically-driven Exhauster Units, which serve to draw air samples from the various spaces, are mounted on vibration-absorbing supports in a heavy metal weather-proof box usually located on the deck above the wheelhouse. A large exhaust tube connects this box to the Detecting Cabinet. The electrical wiring between the exhausters and the cabinet also runs through this tube. When the Detecting Cabinet is located in a special Fire Watch Room, remote from the wheelhouse, the exhausters are usually located below deck, in a place protected from the weather, in which case the box is sometimes omitted. If the blowers are located below deck, a discharge pipe should lead to the outside atmosphere. See Par. 120 for lubrication of units.

14. One exhauster unit is to be run at all times. It is recommended that they be alternated once a day in order to keep the motor windings moisture free and to keep the bearings in good condition. A switch is provided on the Detecting Cabinet for this purpose.

15. Each exhauster is fitted with a flapper valve which automatically acts as a check valve for the idle exhauster. The purpose of this valve is to keep air from being drawn through the idle exhauster. The valves should operate easily, opening with the starting of the exhauster, closing when it stops. They will require no attention other than to keep them free of obstructions.

THE AIR EXHAUST VALVE

16. An exhaust valve is set in the deck, usually arranged to discharge into the wheelhouse (or the space in which the Detecting Cabinet is located). If obnoxious odors are issuing, it may be turned to the left and the air discharged to the open atmosphere.

DETAILED DESCRIPTION OF DETECTING CABINET

17. The cabinet is divided into three main parts called the Top Compartment, Visual Detection Compartment and the Underlight Compartment (Fig. 1). All are ventilated by the exhaust units.

TOP COMPARTMENT (Figs. 1 & 2)

18. The Top Compartment is covered by the removable top of the cabinet which also holds the Control Panel in position. To remove the top, withdraw the four front thumb screws and slide the top forward. Hold the Control Panel in position, as it is hinged at the bottom to fall forward. When the top is moved out a few inches, reach under the top to hold the Panel, or refasten with a thumb screw and withdraw the top completely.

19. The Top Compartment contains a Voltage Regulator (Figs. 2 & 3), a Timer (Figs. 2 & 4), the top end of the audio tube and the Photo-

Cell, the 4 wiring terminals to the exhausters (left), and (right), the 6 main wiring terminals to the ship's power supply, to the auxiliary gong, usually located in the Engine Room, and, when use, to an external relay which is conneoted to the ship's general alarm.

20. On the Control Panel is mounted (from left to right), the Exhauster Unit switoh, the Meter Control, the Line Re-Check button, the Trouble Buzzer switch and green trouble light, the Smoke Alarm switch and red smoke alarm light, the Line Indicator window, the Meter, and the Cabinet Light switch. Resistor V is mounted on the rear side.

VISUAL DETECTION COMPARTMENT (Figs. 1 & 2)

21. The glass front of the visual compartment is removable, providing access to the flares. Never rely on the exhauster suction to hold this glass front in place since it may fall out if the exhauster is stopped. The Visual Detection Compartment is provided with a removable rear wall behind which various parts are mounted. (Fig. 2) These include resistors K, L, M, N, O, P (when used), Q, R, W, and a terminal block for making connections to S resistors for 220V cabinet, or clips for insertion of resistors to provide for unusual conditions, the fire alarm relay and the cabinet fire gong. The cabinet light is mounted in the top front of the compartment. The S resistors for 220-volt cabinets are mounted externally in any convenient location near cabinet.

22. All spaces for resistors are identified by letters. The resistors are also identified by a letter and in some cases by numbers in addition. Never insert a resistor in clips unless its letter corresponds to that of the space.

UNDERLIGHT COMPARTMENT (Figs. 1 & 2)

23. The Underlight Compartment is provided with a removable front held by six thumb screws.

24. The Underlight Compartment contains the lens boxes, underlights, audio lamp, the bottom end of the audio tube in which are mounted a removable lens and mirror, the automatic Richaudio valves, (Fig. 6), the fuse panel, circuit breakers for the protection of exhauster units, and spare parts. On the underside of the underlight plate are relays used for control and supervision of various circuits.

25. Only permanent connections to the piping to the various spaces are located below the audio lamp plate. Never remove or loosen this plate, which will disturb the focussing position of the audio lamp. If parts are accidentally dropped in this bottom portion they may be reached by removing the front base plate.

PURPOSE OF THE VARIOUS PARTS

TOP COMPARTMENT (FIG. 2)

26. Voltage Regulator: (Fig. 3)

The voltage regulator is a unit in itself and may be completely

removed by first removing the seven wires and the four screws through the base legs, then sliding the entire unit forward.

27. The voltage regulator includes a galvanometer relay which closes contacts to either left or right, depending on whether the voltage drops or raises from its previous value. This relay, in turn, operates the rear (for voltage drop) or center relay (for voltage rise) (when the center relay operates, it in turn operates the front relay) to run the motor in the oorrect direction to cause the rheostat to readjust the voltage. The rheostat, by automatically changing its adjustment, maintains constant voltage on the audio lamp. If the voltage changes considerably from the normal ship's voltage, the rheostat may not be able to make the adjustment. In this case, the motor is stopped by the limit switches, mounted over the rheostat, to prevent the motor from attempting to move the rheostat arm beyond its mechanical limits. These switches also operate the trouble signals to advise that the voltage is beyond the regulating range. The regulator will automatically make adjustments if the line voltage to the cabinet is between 95 and 125 volts (approximately) for 110-volt installations; or between 200 and 235 volts for 220-volt installations. (See Par. 30).

28. Resistor A (resistors A, B, C, D, and E, are part of the voltage regulator) is used to compensate for the length of the feeder line from the ship's power supply to the cabinet and is in series with the galvanometer relay coil.

Resistor B is in series with the rear and center relay (mounted on the voltage regulator).

Resistor C is in series with the front relay.

Resistor D is in series with the motor armature.

Resistor E is used, together with the condenser mounted adjacent, to reduce sparking of the galvanometer relay on 220-volt installations. It is usually omitted on 110-volt installations.

29. With a fairly new audio lamp and clean lens and mirror and with the meter reading 50, the arm of the voltage regulator rheostat will be approximately midway between its mechanical limits at nominal line voltage (110 or 220). On 110-volt installations, there is no adjustment to be made to bring the arm to this position if the line voltage is below this value, other than to raise it to 110 volts at the ship's generators.

30. On 220-volt installations (nominal), if it is customary to maintain an actual line voltage other than 220 volts, the arm may be made to move to a near central position by adjusting the position of the clamp on Resistor S located in the resistor cage outside the cabinet. When this clamp is moved, the arm of the regulator will also move automatically. This adjustment should be made only when the line voltage is at its normal value and the meter reading is 50. Fasten clamp securely.

31. On all installations, changing the position of the meter control rheostat (except slightly) will also cause the voltage regulator to operate. As the manual control rheostat is moved clockwise to raise the meter reading, the voltage regulator rheostat will also move clockwise, reducing the range in which the regulator can make automatic adjustment for a voltage drop.

32. Spare brushes are provided for the voltage regulator motor but these require very infrequent replacement since the motor operates for only a few seconds at a time. The motor should be oiled every six months using a light oil. Do not overoil.

TIMER (Figs. 2 & 4) (Top Compartment)

33. The Timer is a unit in itself and may be completely removed by removing the three connecting wires, the four screws through the base legs, and the three thumb screws holding the multi-contact panel to the right front side. The unit may then be withdrawn, using extreme care to avoid damaging the number drum on the left side.

34. The Timer consists of a continuously running motor, provided with reduction gears, which turns a cam operating on a pawl which, by engaging a ratchet wheel, causes the line indicator number drum to change its setting approximately every four seconds. At the same time, it shifts from one electrical contact to the next to release one electromagnetic valve in the Underlight Compartment and operate the next to cause photo-electric inspection of air samples from each compartment in turn. This same cam opens the Valve Breaker Contacts, while the shift from one contact to the next is being made, to prevent arcing on the small multi-contacts. Resistor T is mounted on the Timer.

35. When a fire alarm occurs, the electro-magnet (motor solenoid) over the ratchet operates, lifting the pawl from the ratchet and opening the Motor Contacts, which causes the motor to stop and releases the valve which diverted smoke into the audio tube, to permit this smoke to issue from the flare for visual observation. Pushing the Line Re-Check Button on the Control Panel releases this electro-magnet to restart the timer motor. The button must be held down long enough to permit the motor to shift to the next valve (if smoke is still issuing) and the audio tube to clear of smoke.

36. The Timer motor should be lubricated at least once every three months. Use a good grade oil (#20 or #30 S.A.E.) on the rear motor bearing. The reduction gearing on the front end of the motor runs in a grease-filled housing. When necessary, add grease through the breather re-fill plug. A high grade #2 (or #3) cup grease should be used. Fill the housing completely, wipe off the excess, replace cap and allow motor to run about an hour, and remove any grease that is forced through the cap. A few drops of oil should be put on the ratchet wheel, the pawl, rollers and motor cam. Use care not to get oil on the number drum.

37. In replacing the Timer, use care not to damage the contact which bears against the multi-contact plate (Fig. 2). If the numbers on the drum do not line up properly with the Line Indicator window, after the top is on, the Timer may be shifted sideways as required. If radial adjustment is necessary, the four screws holding the drum to the shaft may be loosened permitting adjustment.

PHOTO-ELECTRIC CELL (Top Compartment)

38. This cell, provided with two wire leads, marked X and Y, is mounted on the top end of the audio tube (Fig. 2) to the rear of the voltage regulator. The cell can be most easily removed by first removing the voltage regulator, but it can be removed directly if there are no obstructions at the left side of the cabinet. The cell mounts on a glass disc provided with gaskets on each side and is clamped in place with a cover held by two thumb screws. The cell and glass should be cleaned about once a year (or more often if dust-generating cargoes are frequently carried).

39. In re-connecting the cell wires, make sure that these are connected with regard to polarity. Wire X fastens to the left terminal, Y to the right. The terminals and wires are marked.

EXHAUSTER TERMINALS (Top Compartment)

40. These are mounted on the left rear providing four connection screws. The left pair connect to one exhauster (corresponding to No. 1 position of the control panel Exhauster Unit switch), the right pair connecting to the other exhauster. The wires to the exhauster units should be placed to the rear of the photo-cell to avoid interference with the Voltage Regulator.

MAIN WIRING TERMINALS (Top Compartment)

41. These are mounted on the right rear providing six connection screws. The first pair to the left connect to the ship's power lines (direct current only), the left-hand one being positive. The middle pair connect to the external auxiliary alarm gong (usually located in the engine room). The right-hand pair (A) are provided for use when it is desired to operate the ship's general alarm system, in addition to the regular gongs. Some operators desire this connection for use when the ship is in port and the wheelhouse unattended. This connection to the general alarm is disconnected when the ship is at sea. This arrangement requires a special relay which can be obtained from Walter Kidde & Company, Inc.

42. When additional external gongs are desired, such as in the Deck Officer's quarters and Engineer Officer's quarters, a similar special relay must be used, which is connected to terminals A. By use of an external relay connected to terminal A, any number of extra external gongs may be operated.

CONTROL PANEL
(Figs. 1 & 2)

EXHAUST UNIT SWITCH (Figs. 1 & 2)

43. This switch is used to transfer from one exhauster to the other, as marked. It is suggested that this transfer be made at regular times, such as once a day.

METER CONTROL (Figs. 1 & 2) (Control Panel)

44. This is a rheostat used to adjust the light output of the audio lamp (in the Underlight Compartment) which, in turn, controls the Meter reading. This should be adjusted about once a day (more or less often as determined by the nature of the cargo) to compensate for dirtying of the lens and mirror which are used to direct the light from the audio lamp to the photo-electric cell. As the lens and mirror become dirtier and as the light output of the lamp decreases with age (very slowly), the meter reading will fall below 50, its normal position, requiring very slight readjustment of the meter control. If this is not done, a false smoke alarm signal will eventually result (when the meter reads 45). As the meter reading is allowed to approach 45, the sensitivity of the Richaudio System to smoke is increased. When the meter control knob is moved, the voltage regulator may be brought into operation causing the meter reading to change its setting, requiring a second slight adjustment of the meter control. When the arrow of the meter control knob points to the right, to cause a meter reading of 50, the lens and the mirror should be cleaned. As the arrow of the meter control is moved clockwise, the range of the voltage regulator for correction of voltage drops is decreased. As the arrow is moved clockwise, the minimum voltage, which must be maintained on the ship's lines to prevent operation of the trouble buzzer, is raised.

45. If the ship's line voltage changes momentarily, the meter will move from 50 and return quickly; if the change lasts a few seconds, the voltage regulator will automatically readjust the meter reading, returning it to 50 approximately. The meter reading will fall below 45, but no fire alarm will occur when the meter reading falls below 45 due to a line voltage change. (See Par. 55 and 75)

LINE RE-CHECK BUTTON (Figs. 1 & 2) (Control Panel)

46. When the smoke alarms operate, the controlling relays are electrically locked, stopping the Timer. Pressing this button releases the locked controls to permit continued operation. (See Par. 73)

TROUBLE BUZZER SWITCH (Figs. 1 & 2) (Control Panel)

47. This switch is normally left "on" in the raised position. If the buzzer sounds indicating a derangement (See Par. 114), the switch

may be depressed to "Off", silencing the buzzer but leaving the green light showing. If this switch is depressed, the green light will show even though no derangement exists (other than that the buzzer is cut off) unless the switch on the fuse panel in the Underlight Compartment is on "Rich Visual Only", cutting off the entire Audio System. In this case, the buzzer will not sound for a derangement but the green light will show. If a derangement occurs in the audio portion of the cabinet, the switch on the fuse panel should be thrown to the left to operate on Visual Only and the buzzer switch raised. The system should not be allowed to operate indefinitely with the Trouble Switch down, or damage to circuit may result.

48. If the visual system is in operation without the audio portion, the buzzer will sound and the green light will show if an underlight burns out or on failure of the exhauster motor being used.

49. If the entire Richaudio System is in operation, the buzzer will sound and the green light will show if an underlight burns out; on failure of the exhauster motor being used; if the audio lamp burns out; if the voltage on the ship's line is too high or too low; if either the auxiliary gong or wiring to this gong (including blown fuses in the underlight compartment) is defective; or, if the smoke alarm switch is depressed when no alarm exists. (See Par. 114)

SMOKE ALARM SWITCH (Figs. 1 & 2) (Control Panel)

50. This switch is normally left "On" in the raised position. If the smoke alarm gongs sound and the red light shows, the gongs (cabinet and auxiliary gong) may be silenced by depressing the switch to "Off" but the red lamp will remain on until the smoke alarm is cleared. The switch must then be raised to keep the trouble signals from operating. (See Par. 100)

LINE INDICATOR WINDOW (Figs. 1 & 2) (Control Panel)

51. This window permits observation of the numbers on the line indicator drum, one at a time, indicating which line is under photoelectric observation. (See Par. 111)

52. If an alarm occurs at night, the number is made visible by light from the smoke alarm lamp, making it unnecessary to light the wheelhouse lights.

METER (Figs. 1 & 2) (Control Panel)

53. See Meter Control and Resistor V. (See Par. 44 and 55)

CABINET LIGHT SWITCH (Figs. 1 & 2) (Control Panel)

54. This switch is normally left "Off" in the lowered position. When

in the raised "On" position, it causes a light to illuminate the flare numbers for identification at night, if smoke appears.

RESISTOR V (Rear side of control panel)

55. This resistor is mounted alongside the meter (in some cases it consists of two units in series) and controls a secondary current which is passed through the fire alarm relay when the voltage regulator operates (See Par. 73). If the ship's voltage drops suddenly, the light output of the audio lamp also drops, decreasing the current of the photo-electric cell. This would permit the fire alarm relay arm to swing left and possibly close its contact to give a fire alarm signal. At the same time, however, the voltage regulator starts correcting the voltage drop and contacts on the center relay close a circuit through Resistor V to pass a small current through the fire alarm relay to more than compensate for the momentarily decreased output of the photo-electric cell. As a result, the arm of the fire alarm relay swings right instead of left. When the voltage is corrected, this secondary current through Resistor V is cut off and only the normal current from the photo-electric cell passes through the relay. This same action takes place for a rise in voltage. This secondary current causes the meter reading to fall considerably below 50 while the voltage adjustment is taking place.

VISUAL DETECTION COMPARTMENT (Figs. 1 & 2)

FLARES (Figs. 2 & 5)

56. The flares are mounted on a plate forming the bottom of the Visual Detection Compartment, each being the end of a pipe line to a protected space on the ship. Air samples from each space pass into the Visual Detection Compartment through these flares. Focussed beams of light, not visible when clear air is passing, are projected through each flare. The base of each flare is provided with a small window to permit visual inspection of the air samples passing through and also to permit observation of the fine silk threads (Silk Flickers) mounted behind these windows. When air is passing, these threads wave actively, but if there is any stoppage in the pipe line the silk flickers stand dead or become much less active.

57. These flickers also serve to check proper operation of the automatic valves which momentarily divert the air streams into the audio tube for photo-electric inspection for smoke. As each valve operates, the flicker in that line (corresponding to the number shown by the line indicator) becomes dead, resuming its activity when the next valve operates. This action can be followed from one flare to the next, in numerical order, checking at one time if the pipe line is

clear, if the timer is operating and if each valve is operating. (Fig. 6)

58. The light beams from each flare are directed on a light absorbing arrangement in the top of the Visual Detection Compartment. When smoke issues from a flare it swirls about over the other flares, making its presence much more conspicuous but creating the impression that smoke is issuing from many flares. Smoke will be issuing only from the flares in which it can be seen through the small flare windows.

59. The interior of the Visual Compartment is painted dull black to reduce light reflection to the outside. If it becomes necessary to repaint this interior, make sure that similar paint is used.

CABINET LIGHT (Visual Detection Compartment)

60. The cabinet light, used to illuminate the flare number plates, when required, is mounted in the front top of the Visual Detection Compartment. If replacement is necessary, a similar lamp must be used (25-watt 115-volt frosted show case lamp). A 115-volt lamp is used on both 110-volt and 220-volt installations. (See Par. 63)

REAR COMPARTMENT OF VISUAL COMPARTMENT (Fig. 2)

61. Access to this compartment is made by removing the rear plate of the Visual Compartment.

RESISTOR Q (Used on 220-volt installations only) (Rear Compartment)

62. This resistor is in series with Relay D (auxiliary gong supervisory relay) and is stamped Q on the ferrule. This resistor is used on 220-volt installations only. A short circuiting bar is used on 110-volt installations. This resistor is automatically short circuited by operation of Relay C to cause operation of the auxiliary gong.

RESISTOR R (Used on 220-volt installations only) (Rear Compartment)

63. This resistor is in series with the cabinet light and is stamped R. This resistor is used on 220-volt installations only. A short circuiting bar is used on 110-volt installations.

RESISTORS S AND S-40 (Used on 220-volt installations only). (Mounted externally in a protective cage and connected to terminal block in rear compartment).

64. Two resistor mounting spaces are marked S. Resistor S is provided with an adjustable clamp (See Voltage Regulator - Item 30) and is set for 220-volt line voltage to the cabinet at time of manufacture and should be readjusted only if the normal line voltage is other than 220 volts (approximately). These resistors are in series with each other and the audio lamp, and are used on 220-volt installations only. On 110-volt installation, the terminals on the block in the rear compartment are short circuited.

RESISTOR K (Rear Compartment)

65. This resistor is in series with Relay C (Gong Ringing Relay) and terminals 5 and 6 of the Fire Alarm Relay, and is stamped K on the ferrule.

RESISTOR L (Rear Compartment)

66. This resistor, when used, is in series with the exhauster motors. A short circuiting bar usually replaces this resistor. A resistor is used only when the line voltage is normally maintained considerably above 110 volts or 220 volts, or when, in special cases, it is desired to reduce the blower speed. Resistors for this service are stamped L, followed by numerals showing the actual resistance value. An L-30 resistor, for example, is 30 ohms resistance. When required, these resistors can be obtained from Walter Kidde & Company, Inc.

RESISTOR M (Rear Compartment)

67. This resistor, when used, is in series with the underlights. A short circuiting bar usually replaces this resistor. When the ship's voltage is normally kept high (based on 110 volts or 220 volts) or is subject to voltage increases which are maintained for a time, the life of the underlights is considerably reduced, resulting in frequent burn-outs. When this occurs, a resistor is used in M. The life of these lamps, according to their manufacturer, is about 1000 hours or about 6 weeks continuous service. If these lamps do not approximate this life, the line voltage should be measured and if above normal a resistor should be used at M. These resistors are marked M, followed by numerals showing the actual value. An M-30 resistor, for example, is 30 ohms resistance. If this resistor is considered necessary, Walter Kidde & Company, Inc., should be advised of the actual line voltage so that proper value resistor may be supplied. A resistor of too great resistance will decrease the voltage on the lamp below normal, decreasing the light output and also reducing the effectiveness of the visual detection.

On 220-volt, two-underlight, installations, the two underlights are in series. If one burns out, the other lamp goes out, also. In cabinets with 3 underlights on 220 volts, failure of either the left or right underlight causes the other to go out. These two underlights are in series with each other and with resistor M. The center underlight is in series with resistor P and is not affected by the other two underlights.

RESISTOR N (Rear Compartment)

68. This resistor is in series with the Richaudio Valves in the Underlight Compartment and is stamped N 110 for use on 110-volt installations and N 220 for 220-volt installations.

RESISTOR O (Rear Compartment)

69. This resistor, when used, is in series with the Timer motor. A short circuiting bar usually replaces this resistor. When the ship's voltage is normally kept high (based on 110 volts or 220 volts) it is sometimes desirable to use a resistor. This resistor is marked O, followed by numerals showing the actual resistance value. An O-200 resistor, for example, is 200 ohms resistance. When required, these resistors can be obtained from Walter Kidde & Company, Inc.

RESISTOR P (Rear Compartment)

70. This resistor is used on 200 volt, three-underlight installations and is in series with the center underlight, together with Relay J. This resistor reduces the line voltage to the required lamp voltage.

RESISTOR W (Rear Compartment)

71. This resistor is in series with the solenoid in the fire alarm relay. Resistor W is marked "W-110" for 110-volt installations and "W-220" for 220-volt installations.

CABINET GONG (Rear Compartment)

72. This gong sounds when smoke is detected in the audio tube.

FIRE ALARM RELAY (Fig. 2) (Rear Compartment)

73. This relay is an assembly of parts consisting of a meter-type relay (which, once operated, must be mechanically reset), a solenoid and a plunger (for resetting the relay), and a condenser (for spark supression). The relay is connected in series with the photo-electric cell (through terminals 1 and 2) and the control panel meter. When normal light reaches the cell (meter reads 50), the relay arm is to the right of the red mark on the dial. When the meter reading is reduced to 45, the arm should move to the red mark. When the arm is at the red mark, a fixed magnetic arrangement in the relay pulls the arm to the contact and holds it firm. Closing this circuit (terminals 5 and 6) causes relay C to operate which, in turn, operates the smoke alarm signals. To release the fire relay, the meter must read above 45 and the solenoid be operated (through terminals 3 and 4 by pressing the Re-check Button) to move the arm from the contact. This reset is also operated automatically if the buzzer is sounding or if the green light is on.

74. This relay is mounted on two screws through the back of the cabinet and is held in place by wing nuts. In connecting wires to terminals 1 and 2, make certain that the wire numbers correspond to the terminal numbers (for correct polarity).

75. The point at which the relay operates (when meter reads 45) may be adjusted by means of a small screw in the glass front. This screw need be turned only very slightly to cause a considerable change in operating point. In checking the operating point of this relay, first shut off the audio portion of the system by the switch on the fuse panel in the underlight compartment (or shut off the entire system) and check the zero reading of the panel meter. If necessary, adjust the pointer to

zero by means of the small screw in the glass. Then, with the Richaudio System in operation, slowly reduce the meter reading to 45 (by very slowly turning the meter control - or better, by inserting a finger in an opening in the rear side of the audio tube just above the cabinet gong). If the voltage regulator operates, the arm of the relay will swing to the right, returning to normal when the regulator has adjusted the voltage. Allow the meter to remain at 45 for several seconds. If the relay contacts close, reset by means of the Re-Check Button. If not, adjust the relay by means of the screw until operation occurs at 45. Set the meter at 46 and allow the meter to remain at 46 for several seconds. If the relay operates at 46 but does not operate at 46, it is properly adjusted. Adjust the meter to read about 40 and operate the Re-Check Button several times. Then test the setting of the relay again, readjusting if necessary.

76. The re-set solenoid and plunger should be free of all obstructions. If operated and released, it should immediately return to the normal position. This re-set operates when the Re-Check Button is pressed or when the buzzer is sounding or the green lamp is on.

77. The solenoid used in this relay is identical to those used in the automatic Richaudio Valves.

UNDERLIGHT COMPARTMENT (Figs. 1 & 2)

LENS BOXES

78. Each flare is provided with a lens box which contains a lens and mirror for directing and focussing light beams through the flares. These are held in place by a single screw clamp. If dirt collects in these lens boxes, reducing the intensity of the light beam, they may be removed and cleaned. Loosen the clamp screw and pull the lens box down to remove it. Do not dis-assemble the lens boxes. Each is identified by a color corresponding to the color on the clamp rings (excepting the straight lens boxes directly over the underlights which have no color). In replacing, make certain these colors correspond.

79. To focus these lens boxes, place a piece of paper on the flares. Make sure the underlights are fully seated. Move the lens box up and down and turn back and forth until the sharpest, brightest light shows on the paper, centrally located in the flare. Clamp securely in this position. In order to reach some of the rear lens boxes, it is usually necessary to remove some of those in front.

UNDERLIGHTS (Fig. 2) (Underlight Compartment)

80. Each underlight furnishes light to several lens boxes. For this reason, it is necessary that these underlights be specially prefocussed for use with the Richaudio System. When replacement lamps are ordered, return the old ones for credit. Do not use any lamps other than those especially selected and prefocussed for this use.

81. On 110-volt installations, each underlight is independent of the other and individually supervised by relay G and H (and J when there are three underlights). On two-underlight cabinets, 220 volts, the underlights are in series and supervised by relay G. If either is removed or burns out, the other will also go out. Failure of either lamp releases Relay G to operate the trouble signals. On three-underlight cabinets, 220 volts, failure or removal of either the left or right underlight causes the other to go out also, and causes Relay G to release to operate the trouble signals. The center underlight is supervised by Relay H.

BUZZER (Fig. 2) (Underlight Compartment)

82. The buzzer is located in the rear of the underlight compartment, to the left of the audio tube, on a level with the underlights. Operation of the buzzer indicates a derangement.

AUDIO LAMP (Fig. 2) (Underlight Compartment)

83. The Audio Lamp is the large lamp located on the bottom plate of the Underlight Compartment. This lamp is provided with a special type base to permit replacement without disturbing proper focus. To remove the lamp, press down slightly and turn left (about 1/4 turn) until lamp is free, and lift out. To replace lamp, set in socket with the two heavy wires supporting the filament directly to the rear, press down and turn to right until it snaps into position. This lamp is operated at considerably below its normal rated voltage and will continue to operate for a much longer time than the underlights which are operated at full voltage. The brilliancy of this lamp is controlled by the meter control. Constant voltage is maintained on the audio lamp by the voltage regulator. The audio lamp is supervised by relay E. Failure of the lamp releases this relay to cause operation of the trouble signals.

AUDIO LENS AND MIRROR (Fig. 2) (Underlight Compartment)

84. The light from the audio lamp is focussed by a lens and directed through the audio tube by a mirror, both of which are mounted in a removable holder set in the bottom end of the audio tube. As this lens and mirror become dirtier, less light reaches the photo-cell which causes a drop in the meter reading. Adjustment of the meter control, to restore the meter to 50, increases the light output of the audio lamp which will finally reach a maximum. When the meter control arrow points to the right, to cause a meter reading of 50, audio lens and mirror should be removed and cleaned.

85. To remove the lens and mirror, first remove the audio lamp (See Par. 83). Then remove the three thumb screws around the lens and withdraw the holder. In replacing, set the holder on the two guide pins and fasten down securely.

RICHAUDIO VALVES (Fig. 6) (Underlight Compartment)

86. The automatic Richaudio (solenoid) Valves, which divert the air samples from each space into the audio tube for photo-electric inspection for smoke, are contained in the block castings on the sides of the cabinet around the audio lamp. These blocks are provided with a cover plate (held by 3 screws) which clamp the valve solenoids in place. To remove a solenoid, remove both main fuses, remove the cover plate, remove the two wires from the solenoid terminals and lift the solenoid out. The bottom side of the valve blocks are provided with a manifold casting held in place with 9 bolts. Each manifold connects to the adjacent manifold or audio tube by a short piece of heavy rubber tubing. The front side of each manifold is numbered, these numbers being for each valve corresponding to the respectively numbered flare. When a manifold is removed, the valve plungers will fall out. Care should, therefore, be taken to avoid dropping the valve plungers into the base of the cabinet.

87. Normally, all valve plungers rest on the ports in the valve manifolds, blocking the paseage to the audio tube and opening the one to the flare. When the timer is in operation, each solenoid is operated in turn, lifting one valveplunger to open the passage through the manifold to the audio tube and at the same time blocking the one to the flare.

88. There is a maximum of eight valves in each block, but in some installations there are less, as shown by the numbers on the manifold. The unused valves are blocked off with plugs.

89. To replace the valve plungers and manifold, prepare a piece of stiff cardboard or similar thin material about the same size as the top of the manifold. Place the plungers in the block, starting at one end, and hold each in place by the cardboard strip, sliding this along until all are in place. Then, insert the port of the manifold into the rubber connector and raise against the cardboard which may then be withdrawn. Insert the holding screws and thread up until the manifold is about 1/8" from the block, permitting all valve plungers to be seen. Start the system in operation to check operation of each valve visually. Make certain that all plungers have been replaced. Then clamp the manifold tightly.

90. When valve blocks are mounted on the sides of the cabinet, it is necessary to remove these manifolds to make the rear manifolds accessible. When all valve manifolds are clamped tight, check proper operation of the valves by observation of the silk flickers in the flares (See Par. 57).

RELAYS (Underlight Compartment)

91. The supervisory and circuit control relays (Fig. 2) are mounted on the under side of the underlight plate. Each is provided with a sliding cover. These relays are designated by letters but are not marked. Relay C is the front left; Relay D is the center left; Relay E is the rear left; Relay F is the front right; Relay G, second

right; Relay H (on 110-volt installations, or on 3-underlight 220-volt installations) is the third right; Relay J is the fourth right on 3-underlight 110-volt installations.

RELAY C (Underlight Compartment)

92. Relay C is normally released and operates when the Fire Relay (in the rear of the Visual Compartment) operates, causing operation of the alarm signals. If relay C is operated manually (by pressing the coil armature) the alarm signals should operate.

RELAY D (Underlight Compartment)

93. Relay D is normally operated (when the audio part of the cabinet is in operation) and is in series (together with two fuses and resistor Q) with the auxiliary alarm gong. A small supervisory current continuously flows through the wiring to the auxiliary gong and through the gong to hold Relay D in its operated position. Interruption of this supervisory current, due to a broken wire, blown fuse (which may result if this wiring is grounded or short-circuited), or similar derangement, releases this relay to operate the trouble signals.

RELAY E (Underlight Compartment)

94. Relay E is normally operated (when the audio part of the cabinet is in operation) and is in series with the audio lamp. Failure of this lamp releases this relay to operate the trouble signals. Failure of the audio lamp removes all light from the photo-electric cell which causes operation of the Fire Relay, which in turn causes operation of Relay C. Operation of Relay C ordinarily operates the alarm signals, but in this case the release of Relay E cuts off the alarm signals to prevent a false alarm due to failure of the audio lamp.

RELAY F (Underlight Compartment)

95. Relay F is normally operated and is in series with the exhauster motor. Failure in this motor circuit releases this relay to operate the trouble signals.

RELAY G (Underlight Compartment)

96. Relay G is normally operated and is in series with both underlights (on 220-volt 2-underlight installations) or with the left underlight on 110-volt installations, or with the left and right underlights (on 220-volt 3-underlight installations). Failure of an underlight releases this relay to operate the trouble signals.

RELAY H (Underlight Compartment)

97. Relay H is normally operated. It is in series with the right underlight on 110-volt installations; it is in series with the center underlight on 220-volt 3-underlight installations. Failure of an underlight releases this relay to operate the trouble signals. It is not used

on 220-volt 2-underlight installations.

RELAY J (Underlight Compartment)

98. Relay J is normally operated. It is used only in 110-volt 3-underlight installations and is in series with the center underlight. Failure of this underlight releases this relay to operate the trouble signals.

CIRCUIT BREAKERS - EXHAUSTER UNITS (Fig. 2) (Located in Underlight Compartment)

99. Circuit breakers are provided in both sides of each exhauster unit circuit. The purpose of the circuit breakers is to cut out exhauster unit motors before main fuses blow due to overloads caused by a faulty motor circuit. The breakers are so designed that momentary overloads due to starting will not cause them to operate.

The operation of any circuit breaker is indicated by the green trouble light and trouble buzzer. After correcting fault, the operated circuit breaker may be reset by turning to "on" position. It is impossible to reset the breaker until the fault is eliminated.

If both exhauster units become inoperative, the entire Richaudio System should be shut off.

FUSE PANEL (Fig. 2) (Underlight Compartment)

100. The fuse panel mounts two pairs of fuses and a two-position switch. The TOP PAIR OF FUSES (marked MAIN - 6 AMP) are in the feed line from the ship's power circuit. The left hand one is positive, the right is negative. Never attempt to operate the Richaudio System on alternating current. Removal of these fuses disconnects the entire system. It is important that fuses of 6 ampere rating be used to provide full protection to the system. If either of these fuses should blow repeatedly, the system should be inspected, especially for grounds. If tests show the system is grounded, place all circuit breakers to "off" position. (See location on Fig. 2.) Disconnect the auxiliary gong circuit by removing fuses. See Par.101 for locations. If fault still exists, it is in detecting cabinet itself. If it is cleared, then test motor circuits and auxiliary gong circuits for fault. Do not use a higher fuse rating than 6 amperes. It is also recommended that non-refillable fuses be used in all cases. Use of refillable type fuses makes it easily possible to insert higher rating refills without any outside indication of this condition.

101. The BOTTOM PAIR OF FUSES (marked AUX. GONG - 1 AMP.) are in the two lines to the external auxiliary gong. Since these lines are usually of considerable length, there is a possibility that they may be accidentally grounded, short-circuited or cut. If either of these fuses is blown (causing operation of trouble signals) when no fire alarm exists, the cause will probably be a ground in the external wiring. If a fuse blows at the time of a fire signal, the cause will probably be either a ground or short circuit in the external wiring or gong. Fuses of low rating are used in this circuit to insure blowing these fuses for trouble in this line, rather than blowing the main fuses. If, for some reason, no gong is used in the Engine Room or at other remote location (Bureau of Marine Inspection and Navigation - U.S.A. requires a gong in the engine room), it will be necessary to connect an ordinary incandescent lamp (25 to 50 watts) across the auxiliary gong terminals to provide a circuit for the supervisory current to hold Relay D in its operated position. If this is not done and Relay D is tied up in its operated position, the Smoke Alarm Switch could be left unintentionally in the down position,

without causing a trouble signal. In this case, the gong would not operate at the time smoke is detected. This lamp will light when the cabinet gong rings. (See Par. 139)

102. The TWO-POSITION SWITCH on the fuse panel is a control used to permit operation of the visual portion of the cabinet (Rich Visual only) without the audio portion when to the left; or to permit operation of the visual and audible together (Visual and Audible) when to the right.

103. If a derangement occurs in the audio portion of the cabinet, which cannot be corrected at the time, this switch should be set to the left to disconnect the audio system, leaving the visual Rich System in operation. Do not leave the entire Richaudio System connected with the Trouble Switch left down except while determining the cause of the trouble. (See Par. 111)

SPARE PARTS (Fig. 2) (Underlight Compartment)

104. Receptacles are provided for holding two spare audio lamps and six spare underlights. In addition, a covered compartment should contain miscellaneous spare parts as listed below:

24 Silk Flickers	1 Valve Coil (solenoid)
4 6 -Ampere Fuses	1 Valve Plunger
2 1 -Ampere Fuses	3 Rubber Connectors
4 Exhauster Motor Brushes	2 Timer Shift Springs
4 Timer Motor Brushes	2 Timer Brush Springs
2 Voltage Regulator Motor Brushes	2 "Red" (Green) Lamps

Miscellaneous Screws

GENERAL OPERATION

105. 1. Normal Running
2. Detection of Smoke
3. Trouble Signals

NORMAL RUNNING

106. In normal operation, prepared to detect smoke, no lights show on the control panel and the gongs and buzzer are silent. The Exhauster Unit Switch may be in either position, the Trouble Buzzer and the Smoke Alarm Switches are raised ("On") and the Cabinet Light Switch is down ("Off"). The meter reads 50 (at the arrow) and the number of the

Line Indicator changes every four seconds, approximately. All silk flickers wave actively, excepting the one corresponding to the number shown by the Line Indicator. The air exhaust valve should be opened to the wheelhouse (or space in which it is located). The top of the cabinet, especially near the Meter Control, gets fairly hot but this is a normal condition.

107. If the switch on the fuse panel is set to the left (Rich Visual only) the meter reads 0, the number shown by the Line Indicator does not change, and all silk flickers remain active continuously.

ADJUSTMENT

108. It is important that the meter reading be kept at 50 by slight readjustment of the Meter Control. The meter reading should be observed about once a day, readjustment being made if necessary. In normal service, the meter reading gradually falls, due to dust collecting on the lens and mirror in the Underlight Compartment, the frequency of readjustment being determined by the amount of dust being drawn from the protected spaces. (See Par. 44)

EXHAUSTER UNITS

109. It is recommended that the exhauster units be alternated on a regular change-over schedule, once each day. As a means of checking to make sure this is done, it is suggested to run Exhauster No. 1 on odd calendar days and Exhauster No. 2 on even days. This procedure serves to keep the motors free of moisture, and reduces any tendency to "freeze" due to corrosion of the bearings.

DETECTION OF SMOKE

110. When smoke issues from a flare, no audible alarm is sounded until the number of the Line Indicator reaches this flare number. The smoke will then become "dead" in the flare and the meter reading will drop. If the smoke is sufficiently dense, the meter reading will drop to 45 or below, causing operation of the alarm signals (cabinet gong, red light and auxiliary gong). The alarm signals may clear momentarily if the voltage regulator operates, but will start again when the regulator cuts out. (See Par. 133) When the alarm signals operate, the meter reading will rise and the smoke will again become active in the flare. The Line Indicator number will remain fixed, usually indicating the only line carrying smoke. All flares should be carefully examined for smoke by observation through the small windows, comparing one with another. Although smoke may be visible over several flares, it will actually be passing only from those in which it is visible through these windows. Smoke may be issuing from more than one flare, even though the fire may be confined to one space, due to leakage below decks, from one space to another, but the smoke will probably be most dense in the flare for the space in which the fire exists.

111. The number shown by the Line Indicator should be taken as a guide only; the actual location of the smoke source should be determined by visual inspection of the flares.

112. By comparing, visually, the appearance of the air stream passing by the several flare windows, smoke of extremely light density can be seen due to the intense light beams in the flares. Smoke can be detected in this manner which will not be dense enough to cause an audible signal or to be visible over the flares.

113. When the smoke alarm signals have operated, the gongs may be silenced by depressing the smoke alarm switch to "Off", leaving the red lamp on. If desired, the re-check button may be held depressed until the Line Indicator number changes, and the meter reading moves above 45, when the automatic inspection of each line will continue until a line carrying smoke is reached, when the alarms will operate again. If the alarm is cleared by pressing the re-check button, while the Smoke Alarm Switch is "Off", the red lamp will go out and the trouble signals will be operated (buzzer and green lamp) which may be silenced by turning "On" the Smoke Alarm Switch.

TROUBLE SIGNALS

Important Note: No audible fire alarm can be given while trouble is indicated. If trouble cannot be cleared immediately, switch system over to Rich Visual only (See Par. 107) as continued operation under trouble conditions may cause further damage to the equipment.

114. The trouble signals operate (buzzer and green light) for one of the causes listed below. To determine which of these caused the signal, it is suggested that the possible causes, listed below, be tested in the order given. Setting the Trouble Buzzer switch to "Off" silences the buzzer but leaves the green light on.

A. Smoke Alarm Switch depressed ("Off") when no actual alarm exists.

B. Exhauster Units: Turn buzzer on and transfer to other exhauster. If trouble signals stop, first exhauster motor is defective.

C. Underlight: Remove front bottom panel. If underlight is out, replace with new one. Seat firmly in socket. On 220-volt installations, failure of one underlight may cause a second to go out also. Replace first one and then the other, if necessary, to determine which is defective.

D. Audio Lamp: If the audio lamp is burned out, set the fuse panel switch to Rich Visual only. To remove this lamp, press down slightly and turn left (about 1/4 turn) until lamp is free, and lift out. Set a new lamp in the socket with the two heavy wires supporting the filament directly to the rear, press down and turn to right until it snaps into position. Set switch to Visual and Audible. Then adjust the Meter Control for meter reading at 50.

E. Ship's Voltage Too High or Too Low: If the voltage falls below 95 or rises above 125 volts (approximately) on 110-volt installations, or below 200 or above 235 on 220-volt installations, the voltage regulator will not be able to automatically adjust the voltage on the audio lamp. To determine if the voltage is out of range, the voltage may be measured with a voltmeter across the main fuses, the left one being positive. If no voltmeter is available, remove the cabinet top and note the position of the arm on the rheostat of the

voltage regulator. If it is near the bottom end of the range, the voltage is too low. If the line voltage cannot be corrected at the ship's generators, at the time, it will be necessary to operate the Visual Rich System without the audio portion until the correct voltage is restored.

F. Auxiliary Gong (or circuit): If the cause of the trouble signals is not one or more of the above, the derangement exists in the auxiliary gong or the wiring to this gong. This may be tested by removing the cover of relay D (second relay from front left side). Turn the buzzer switch "On". Operate the relay by pressing the armature at the end of the coil. If this stops the trouble signals, the derangement is definitely in the auxiliary gong circuit.

115. Remove both main fuses and test for ground to one of the Auxiliary Gong fuses.

116. If this wiring is grounded or short circuited, one or both of the auxiliary gong fuses may be blown. Do not replace the blown fuses until the external wiring derangement is corrected.

117. If no ground exists, remove the two wires to the gong from the terminals in the right top of the cabinet and test for broken wires or short circuit. If either condition exists, remove the auxiliary gong and test the gong to determine if the trouble is in the gong or in the wiring.

MAINTENANCE AND INSPECTION

118. AT ALL TIMES

A. Meter reading should be at 50 (if audio system is operating; otherwise, at 0.)

B. Ship's voltage at cabinet should be between 100 and 125 volts (on 110-volt installations); or, between 200 and 230 volts (on 220-volt installations). Never attempt to operate the Richaudio System (or the Rich Visual System) on alternating current which would permanently damage parts of the system. If there is a possibility that alternating current may be accidentally connected to the system, a special relay may be obtained from Walter Kidde & Company, Inc., to be connected in the power supply line which will automatically disconnect the system if alternating current is applied.

C. Number of Line Indicator should change every 4 seconds, approximately (if audio system is running).

D. Silk flickers should wave actively, except for line corresponding to Line Indicator number which should be dead if Richaudio system is operating; otherwise, all should be active.

119. DAILY

A. Adjust meter reading to 50.
B. Change over to other exhauster unit. As a means of checking to make sure this is done, it is suggested to run Exhauster No. 1 on odd days and Exhauster No.2 on even days.

120. EVERY THREE MONTHS

A. Oil exhauster units. Use S.A.E.20 W. sparingly.
B. Oil timer motor. Use S.A.E. 20 W. or 30 W. sparingly. (See Par. 36)

121. EVERY SIX MONTHS

A. Oil voltage regulator motor. Use light instrument oil sparingly.
B. If audio lens and mirror have not been cleaned previously, they should be removed and wiped off. (See Par. 44)
C. If the lens boxes have not been previously cleaned, they should be examined and cleaned, if necessary.
D. Run smoke tests on all lines. This may be done by use of smouldering waste or smoking a cigarette close to an accumulator. The smoke should be maintained for several minutes in each line.

122. EVERY TWO YEARS

It is recommended that all pipe lines be blown out at least once every two years to remove accumulations of dirt. If pipe lines are shown to be clogged by cessation of waving of silk flickers (which should be checked by smoke test) they must be cleaned at once.

CAUTION: DO NOT USE water or oxygen for blowing out the pipe lines. The use of oxygen is especially dangerous as the possible presence of even a minute quantity of oil may cause an explosion.

CIRCUIT ARRANGEMENTS

See Diagram 91300

EXHAUSTER UNITS

123. Series circuit through relay F, circuit breaker, exhauster motor, circuit breaker, exhauster switch and resistor L (or short circuiting bar at L).

UNDERLIGHT - Left (110-volt installations)

124. Series circuit through relay G, left underlight and resistor M (or short circuiting bar at M).

UNDERLIGHT - Right (110-volt installations)

125. Series circuit through relay H, right underlight and resistor M.

UNDERLIGHT - Center (110-volt 3-underlight installation)

126. Series circuit through relay J, center underlight and resistor M.

UNDERLIGHTS (220 volt 2-underlight installation)

127. Series circuit through relay G, both underlights and resistor M.

UNDERLIGHTS - Left and Right (220-volt 3-underlight installation)

128. Series circuit through relay G, both left and right underlights, and resistor M.

UNDERLIGHTS - Center (220-volt 3-underlight installation)

129. Series circuit through relay H, center underlight and resistor P.

TROUBLE BUZZER AND GREEN LAMP

Important Note: No audible fire alarm can be given while trouble is indicated. If trouble cannot be cleared immediately, switch system over to Rich Visual only (See Par. 107) as continued operation under trouble conditions may cause further damage to the equipment.

130. Operates, when switch is "On", on release of any of relays D, E, F, G (H and J), or if either limit switch of voltage regulator operates. (See Par. 114) If buzzer fails to operate with switch "On", but green lamp lights, the buzzer is defective. If lamp fails to light but buzzer operates, the lamp is burned out or is loose in the socket. If neither buzzer nor lamp operates for derangement, examine relay (or limit switch whichshould have operated) including contacts. See Diagram 91300 for contact arrangements.

PHOTO-CELL, METER AND FIRE ALARM RELAY

131. Connected in series. The cell used is of the self-generating type, converting light energy into electrical current, which holds the Fire Alarm Relay clear of its contacts, the meter indicating the current being generated. The amount of light reaching the cell (which determines the current it generates) is dependent on the light output of the audio lamp, degree of cleanness of lens and mirror, clearness of air in audio tube (decreased by smoke) and degree of cleanness of glass cover of photo-cell. (See Par. 44)

FIRE ALARM RELAY RESET

132. When the fire alarm relay closes its contacts, it is necessary to move the contacts apart mechanically to restore the relay to normal. A solenoid and plunger, controlled by the Re-check Button, operates this reset. This solenoid is in a series circuit consisting of the Line Re-check Button, resistor W and the solenoid.

The solenoid is also operated automatically if the buzzer operates or if the green lamp is on. This reset solenoid plunger behind the relay should move freely.

SMOKE ALARM SIGNALS

Important Note: No audible fire alarm can be given while trouble is indicated. If trouble cannot be cleared immediately, switch system over to Rich Visual only (See Par.107) as continued operation under trouble conditions may cause further damage to the equipment.

133. These are the cabinet gong, red lamp and auxiliary gong. These should operate if the meter reading falls below 45 (approximately), which should cause operation of the fire alarm relay. Operation of this relay causes operation of relay C. (This relay is in series with resistors S and S40 on 220-volt installations.) Operation of relay C closes its contacts to operate the gongs and the red lamp. The lamp lights directly from the relay contacts but the gong switch is in series with the gongs to permit these to be cut off. In addition, the two auxiliary gong fuses are in the line to the auxiliary gong. If either of these fuses blows out at time of a fire signal, this external line to the auxiliary gong (or the gong) is either short-circuited or grounded. When a fire alarm occurs the alarms will remain locked until released by operation of the Re-check Button. If the voltage regulator operates, however, the alarms will clear (gongs will stop and red lamp go out) for the few seconds the regulator is in operation. The alarms will come in again when the regulator cuts out. (See Par. 134)

134. When the line voltage to the Richaudio System drops considerably, the meter reading falls below 45 which ordinarily would cause a fire alarm. When the voltage drops, however, the center relay of the voltage regulator operates to cause the regulator to compensate for this voltage drop;at the same time, it closes a circuit through resistor V to feed a small current through the fire alarm relay. (See Par. 55) In addition, contacts of the center relay of the voltage regulator open the circuit to the alarm signals. When the regulator completes its adjustment, the normal circuits are remade and the current through V is cut off. If the voltage falls so low that the regulator cannot compensate for the drop, the left limit switch of the voltage regulator is brought into action to stop the regulator motor, to cause the trouble signals to operate and to operate the reset to prevent smoke alarm signals which would otherwise occur. If the voltage falls out of range, the audio system should be shut off (leaving the visual running) until the normal line voltage is re-established. Failure of the audio lamp removes all light from the photo-electric cell which would cause operation of the alarm signals, were it not that failure of this lamp releases relay E which cuts off the alarm circuits.

135. If the gongs operate but the red light does not show, the lamp is burned out, or is loose in its socket.

136. If the smoke alarm switch is raised and the red lamp shows but the cabinet gong does not operate, the gong is defective.

137. If the auxiliary gong does not operate, one or both of the auxiliary gong fuses may be blown, indicating a ground or short circuit in the external wiring or the gong itself.

138. If none of the alarm signals operate when the meter reading is kept below 45, and the voltage regulator is not operating or the trouble signals operating, the fire alarm relay may not be closing its contacts, indicating improper adjustment. If the relay contacts are closed, relay C should be operated. If relay C is operated, its contacts or those of the left limit switch or of the center relay of the voltage regulator may be dirty, preventing electrical contact. The alarm signals should operate if relay C is operated manually by pressing the armature against the coil.

AUXILIARY GONG SUPERVISION

139. When the auxiliary gong circuit is normal, relay D is held operated by a small supervisory current flowing continuously through resistor Q, (short circuiting bar on 110-volt installations) relay D, the auxiliary gong fuses, the wiring to the gong, the gong itself and the smoke alarm switch. This circuit may be tested for proper supervisory action by depressing the Smoke Alarm switch which should release relay D to operate the trouble signals.

CABINET LIGHT

140. This lamp is a 25-watt 115-volt frosted showcase lamp and is in series with the Cabinet Light switch and resistor R (short circuiting bar on 110-volt installations). A 115-volt lamp is used on both 110- and 220-volt installations.

AUDIO LAMP

141. The audio lamp is in series circuit consisting of resistors S and S (short circuiting bars on 110-volt installations), motor driven rheostat of voltage regulator, relay E, the audio lamp and the Meter Control rheostat. Failure of the audio lamp releases relay E to cause operation of the trouble signals. A contact on relay E also cuts the alarm gong circuit, to prevent a false fire alarm.

TIMER

142. The Timer motor runs continuously (unless the fuse panel switch is at Rich Visual Only) and is in series with resistor O (or short circuiting bar at O), and the motor contacts above the ratchet wheel to the left. When a fire alarm occurs, the solenoid above the ratchet operates to break these contacts to stop the motor and also to release the valve which operated to divert the smoke through the audio tube to cause the alarm. The solenoid is operated by closing of contacts of relay C and is in a series circuit of contacts of relay C, the solenoid, resistor T (mounted on the Timer) and resistor O (or short circuiting bar O). When this solenoid operates, the pawl should lift clear of the ratchet (adjustable stop), and the motor contacts should break about 1/16 of an inch (adjustable).

VALVE SOLENOIDS (Richaudio Valves)

143. The valve solenoids are operated, one at a time, by circuits

through the contacts of the multi-contact plate on the right side of the Timer. On installations of 17 lines or more, there is one point for each valve; on installations of 16 lines or less, there are two or more points for each valve, corresponding to the numbers on the indicator drum. The valve solenoid, when operated, is in series circuit consisting of the motor contacts over the solenoid on the timer, the valve breaker contacts which are opened momentarily on each revolution of the cam, the contact on the multi-contact plate, the valve solenoid and resistor N. The valve breaker contacts on the timer, which break on each revolution of the cam, are adjustable. They are provided to break the circuit to the valves when the circuit is being shifted to the next valve to prevent arcing at the small silver contacts of the multi-contact plate. If adjustment is necessary, this screw should be turned to reduce the time these contacts remain open until sparking is first noticed on the multi-contact points. The screw should then be backed out one full turn and locked. No sparking should occur at the multi-contact points (unless the indicator drum is turned manually).

VOLTAGE REGULATOR

144. When the voltage regulator is operating correctly, the voltage across the third and fourth terminals (from the left) will be approximately 90 volts. The rheostat is provided with three terminals pointing to the left. If one end of a wire is touched to the bottom terminal and the other end held to the resistance winding of the rheostat below the arm, the regulator should automatically operate, moving the arm upward a distance approximately equal to the amount of resistance winding that has been short circuited (unless the top limit switch is caused to operate). If the end of the wire is moved back and forth on the resistance winding, the arm should automatically follow. When the regulator is operating, the meter reading will drop considerably, suddenly returning to 50 when the regulator cuts off. The regulator will be operating correctly if the meter reading returns to its approximate position (within a range not wider than two meter divisions).

145. In many cases, it may appear that the voltage regulator operates too often. If the ship's line voltage is checked with a voltmeter, the reading may seem to be nearly constant. Actually, however, the voltage may be varying beyond allowable limits insofar as the Richaudio System is concerned since this system is dependent on holding a closely adjusted voltage on the audio lamp if the system is to respond to a low smoke concentration.

The Richaudio System itself may be used to determine if the line voltage is actually varying beyond allowable limits; or if the voltage regulator is deranged.

To make a check test, remove the B resistor of the Voltage Regulator (second from rear) at some instant when the regulator is not operating and the meter is at 50. This will prevent the regulator from operating but will leave all other circuits complete. The reading of

the meter, therefore, will be a measure of the ship's voltage but changes will show a greater variation than the ordinary voltmeter. If the meter reading moves slightly less than one division from 50, the voltage regulator would have operated if the B resistor has been in place. Generally, it will be found that the meter changes its reading constantly, possibly gradually reaching 45 or below (when a fire alarm should occur) and rising to 55 or even higher. This is generally the case in port, especially on ships equipped with electric winches. If this is the case, the regulator has been responding correctly. This can be further checked by allowing the meter reading to move away from 50 and then inserting the B resistor. The regulator should restore the reading to 50.

If, however, on removing the B resistor, the meter remains dead on 50, without showing any kicks or slow changes and for much longer periods than the regulator has previously remained dead, it may be assumed that some derangement exists in the regulator.

****

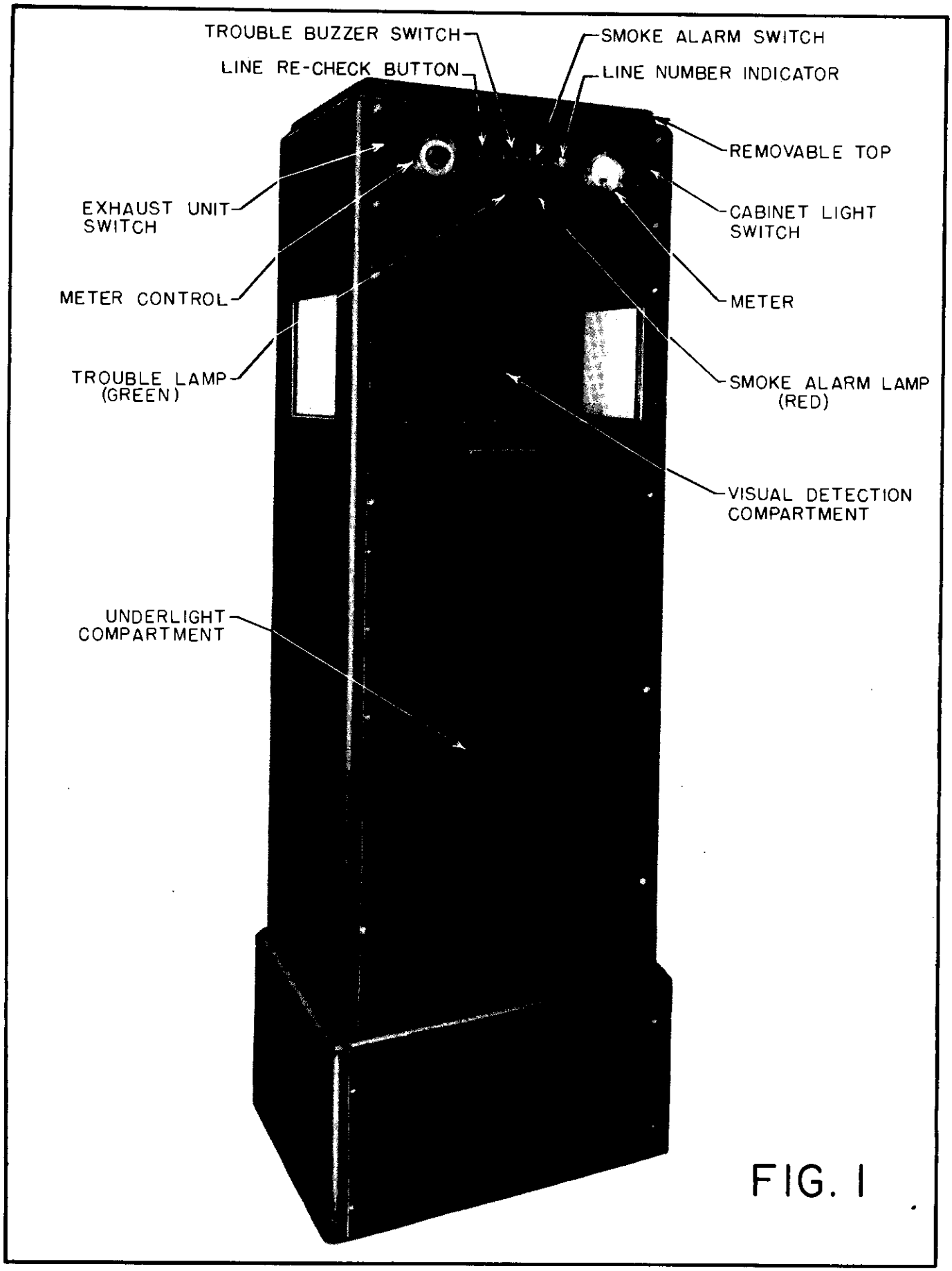

TROUBLE BUZZER SWITCH
SMOKE ALARM SWITCH
LINE RE-CHECK BUTTON
LINE NUMBER INDICATOR
REMOVABLE TOP
EXHAUST UNIT SWITCH
CABINET LIGHT SWITCH
METER CONTROL
METER
TROUBLE LAMP (GREEN)
SMOKE ALARM LAMP (RED)
VISUAL DETECTION COMPARTMENT
UNDERLIGHT COMPARTMENT

FIG. 1

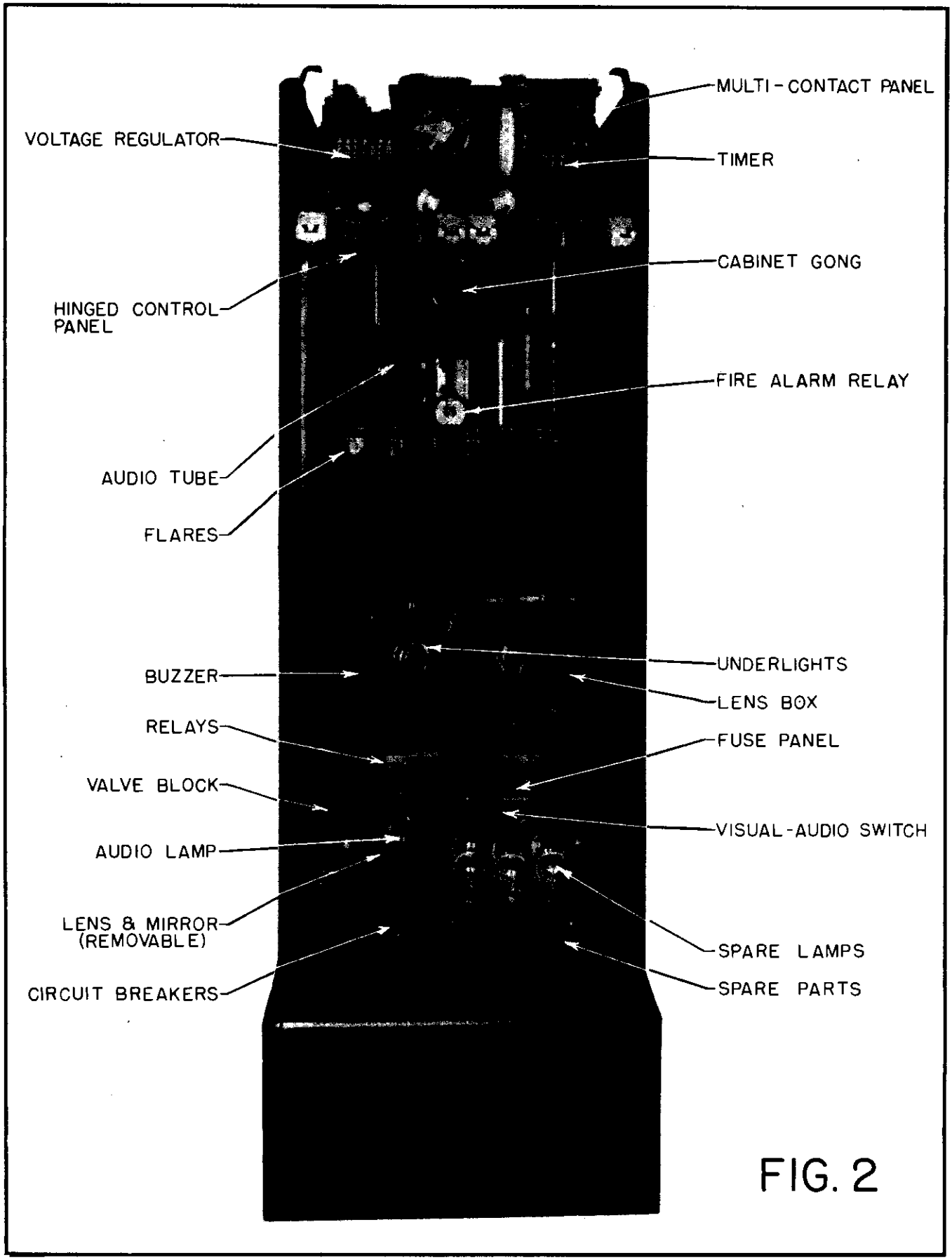
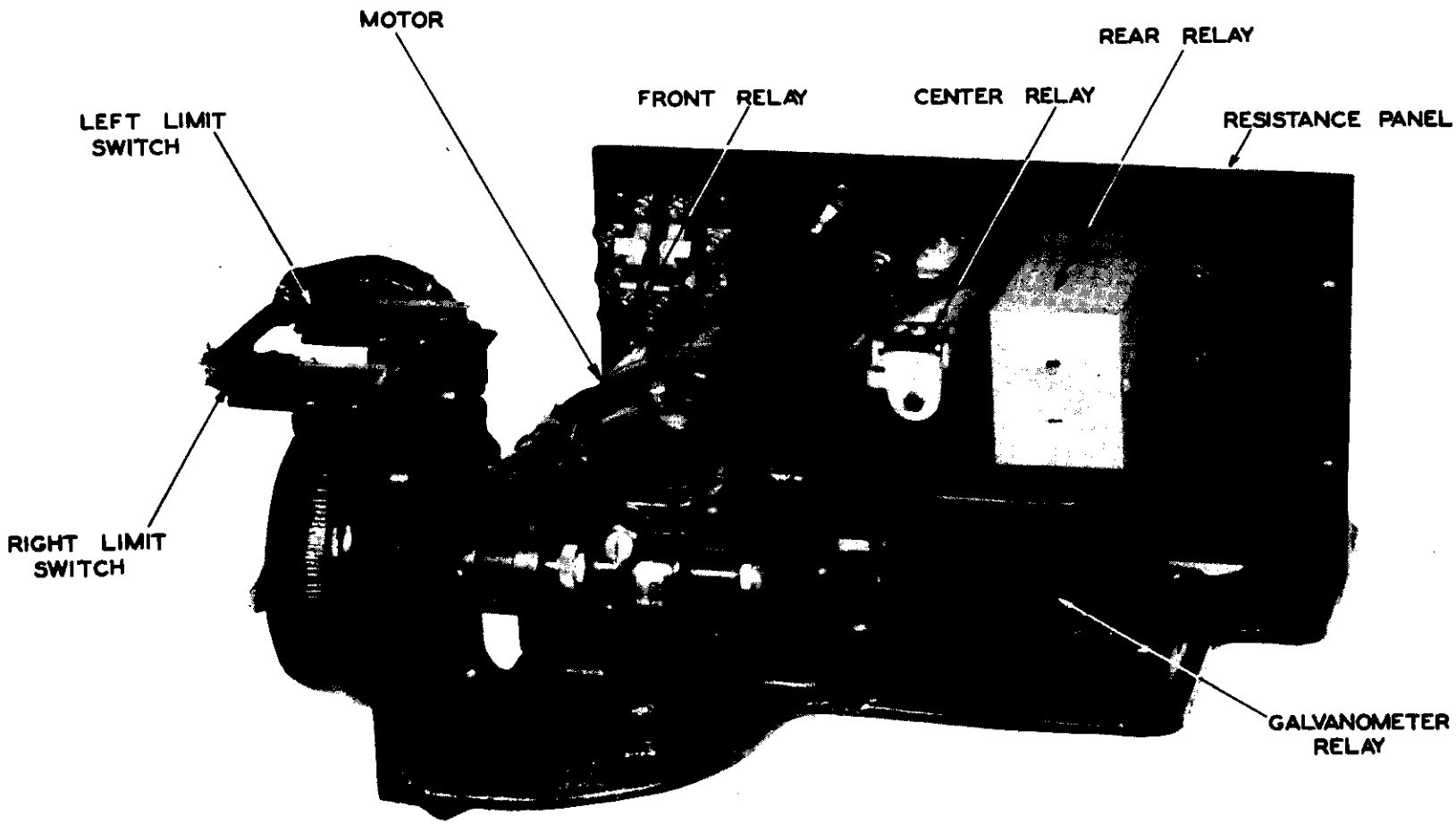
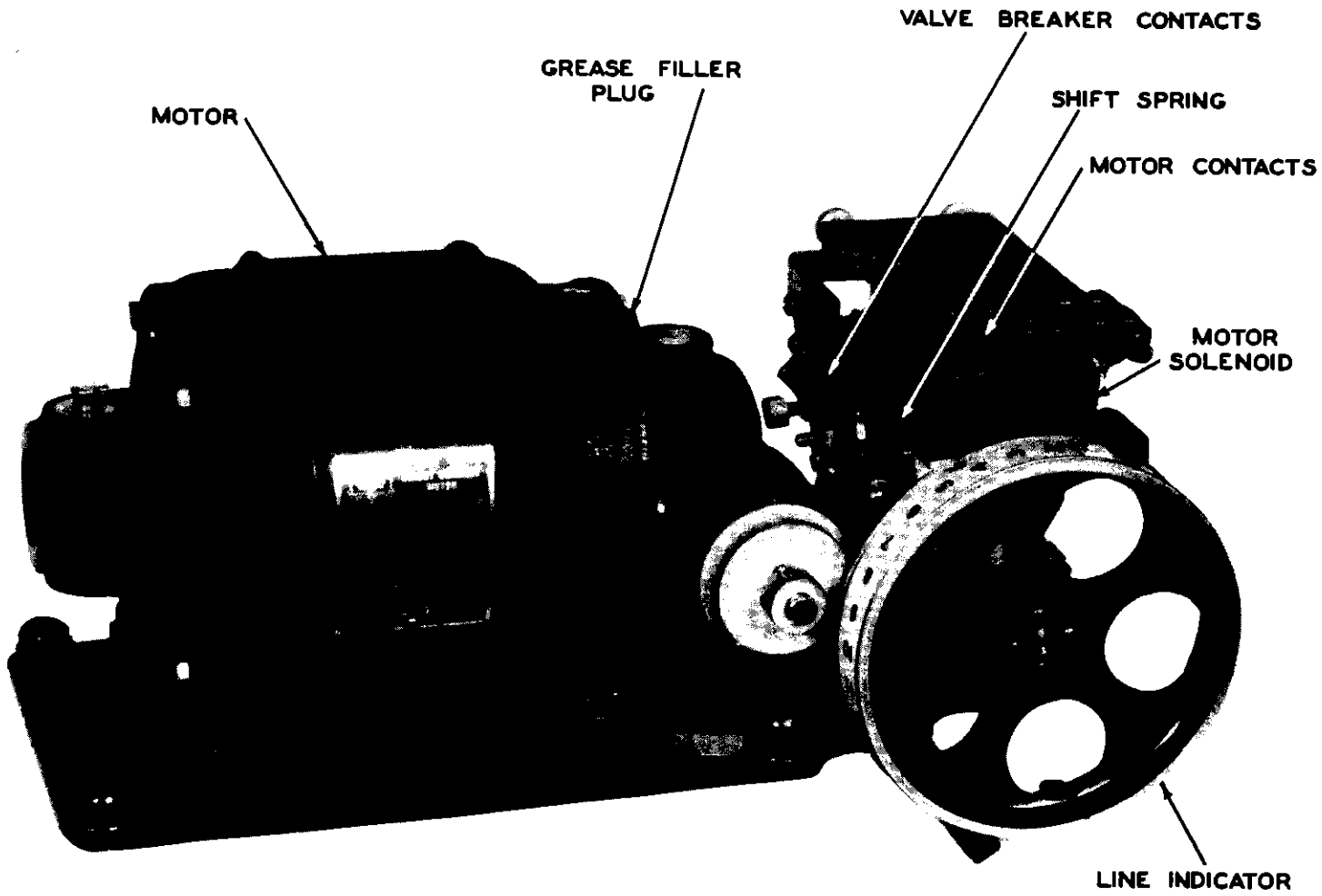

MULTI-CONTACT PANEL
VOLTAGE REGULATOR
TIMER
CABINET GONG
HINGED CONTROL PANEL
FIRE ALARM RELAY
AUDIO TUBE
FLARES
UNDERLIGHTS
BUZZER
LENS BOX
RELAYS
FUSE PANEL
VALVE BLOCK
VISUAL-AUDIO SWITCH
AUDIO LAMP
LENS & MIRROR (REMOVABLE)
SPARE LAMPS
CIRCUIT BREAKERS
SPARE PARTS

FIG. 2



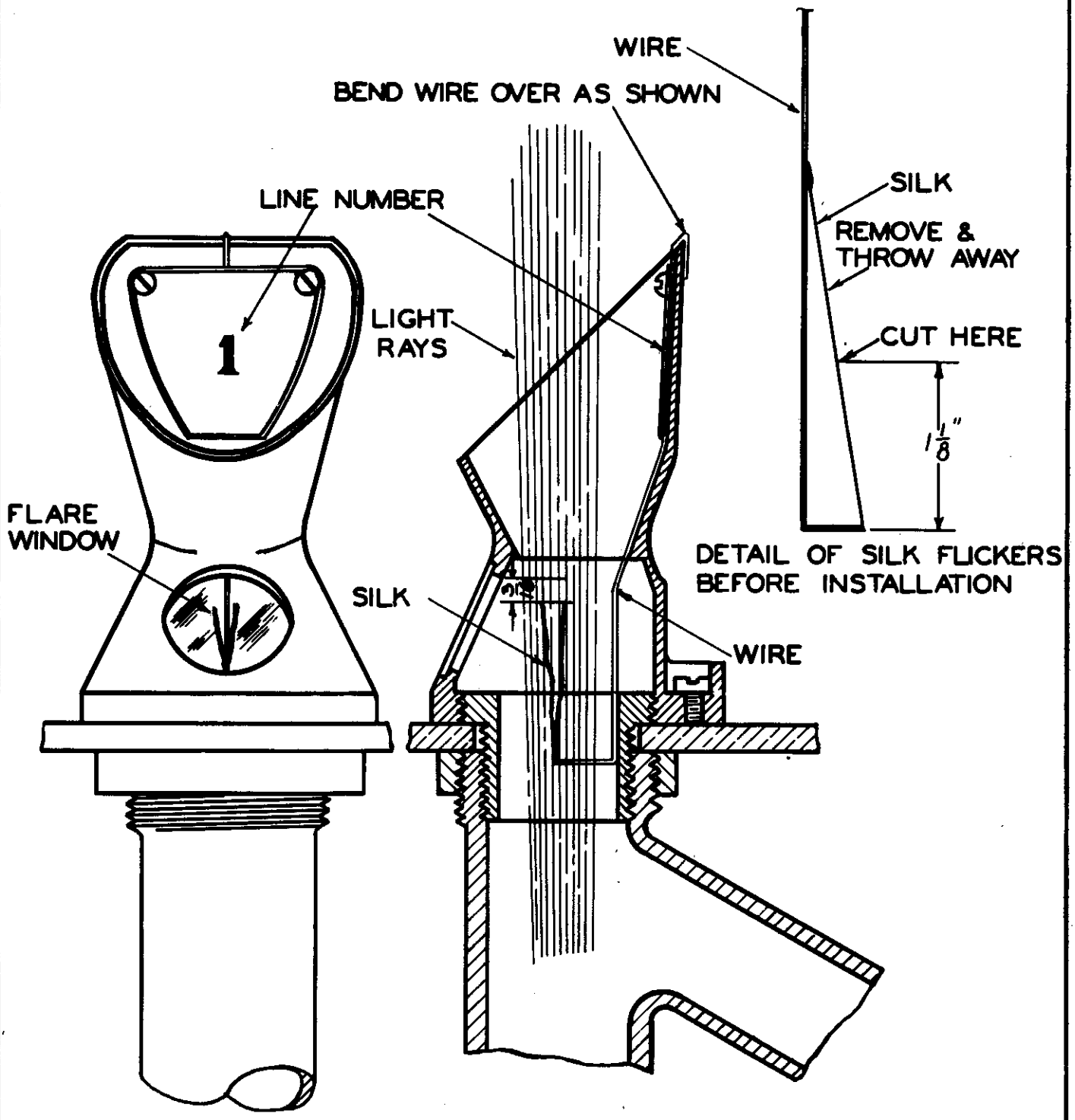
VOLTAGE REGULATOR

FIG. 3


VALVE BREAKER CONTACTS
GREASE FILLER PLUG
SHIFT SPRING
MOTOR
MOTOR CONTACTS
MOTOR SOLENOID
LINE INDICATOR

TIMER

FIG.4

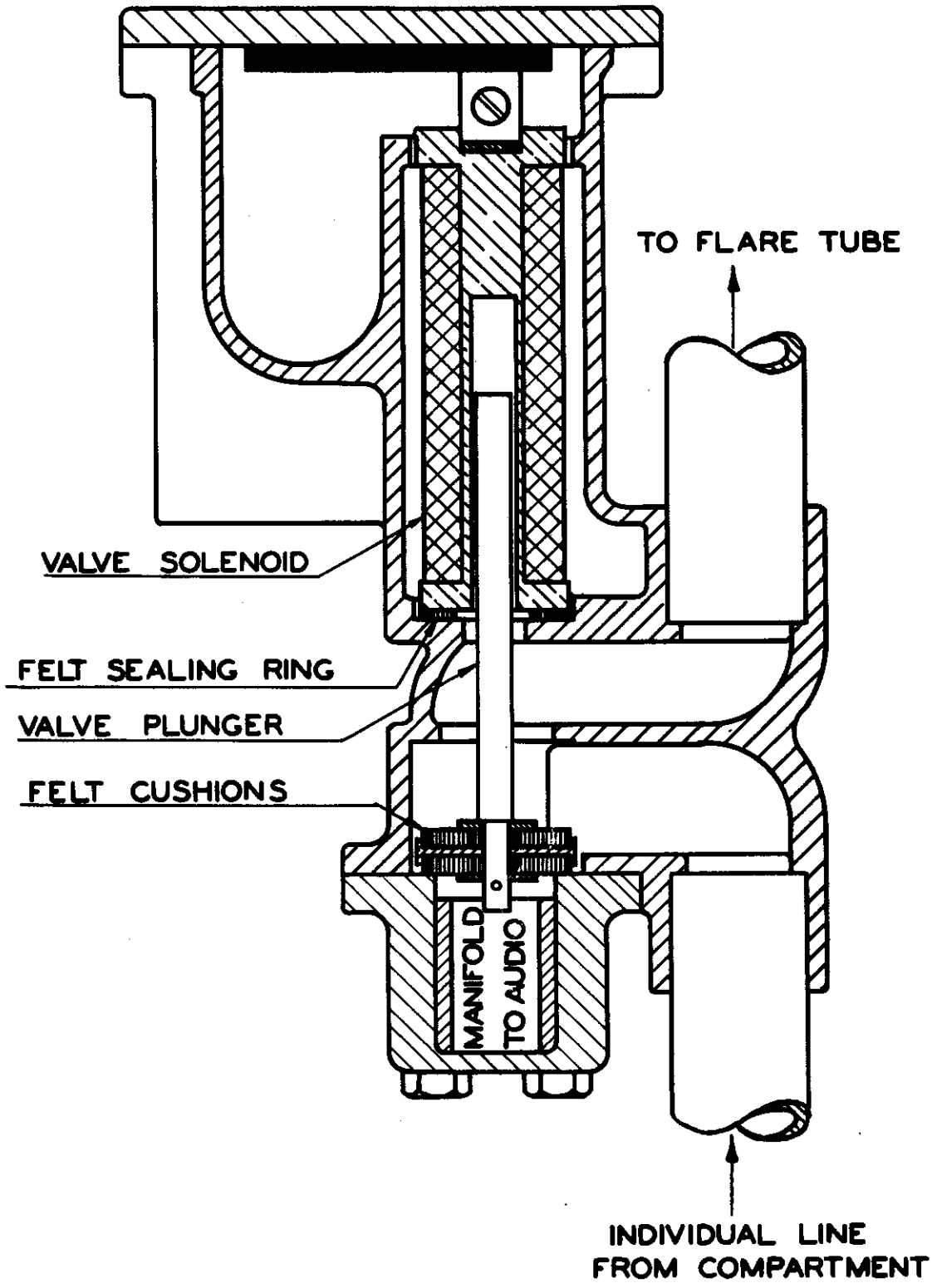


IF FLICKER FAILS TO WAVE ACTIVELY AND LINE IS SHOWN TO BE CLEAR BY SMOKE TEST, SHIFT POSITION OF FLICKER TO PLACE IN THE MAIN AIR STREAM.

METHOD OF MOUNTING SILK FLICKERS IN FLARES

FIG. 5

A-51



RICHAUDIO VALVE

A-52

FIG. 6

TERMINAL (CONTACT) NUMBERS LOOKING AT TERMINAL END OF RELAY

5 — OPERATES V.R. MOTOR
3
6
4 — OPERATES FRONT RELAY TO REVERSE MOTOR. ↄ
7 — OPENS FIRE ALARM CIRCUIT

CENTER RELAY-VOLTAGE REGULATOR
NORMALLY RELEASED
SHOWN RELEASED
OPERATES WHEN LINE VOLTAGE DROPS

TERMINAL (CONTACT) NUMBERS LOOKING AT TERMINAL END OF RELAY

5 — OPERATES V.R. MOTOR ↄ
3
6 — SHORT CIRCUITS RESISTANCE A.
4
7 — NOT USED

REAR RELAY-VOLTAGE REGULATOR
NORMALLY RELEASED
SHOWN RELEASED
OPERATES WHEN LINE VOLTAGE INCREASES

UNDERLIGHTS AND UNDERLIGHT SUPERVISION AND RESISTANCES

FOR	UNDERLIGHT	110 VOLTS	USE	DIAGRAM
2	110			C
3	110			Q
1	220			B
2	220			A
3	220			A&B

PAWL LIFTER
TIMER MOTOR
TIMER TERMINALS
MOTOR DRIVEN BREAKER
SELECTOR SWITCH
VALVE MAGNETS
LINE RECHECK
CABINET LIGHT
METER CONTROL
AUDIO LAMP
PHOTO-ELECTRIC CELL
FIRE ALARM RELAY AND RESET
METER
TROUBLE BUZZER
TROUBLE LIGHT
BUZZER SWITCH
MOTOR DRIVEN RHEOSTAT
VOLTAGE REGULATOR MOTOR
CENTER RELAY
FRONT RELAY
REAR RELAY
LEFT SWITCH
RIGHT LIMIT SWITCH
GALV. RELAY
LEFT REAR
RIGHT REAR
NOT USED ON 110 V.
SMOKE GONG
SMOKE LAMP
GONG SWITCH
AUX GONG FUSES
MAIN FUSES
AUDIO CUT-OFF SWITCH
MAIN TERMINALS
POSITIVE
NEGATIVE
SHIPS GENERATOR D.C. ONLY
AUXILIARY GONG (ENGINE ROOM)
RELAY TO SHIP'S GENERAL ALARM (OPTIONAL)
EXHAUSTER TRANSFER SWITCH
CIRCUIT BREAKERS
EXHAUSTER UNIT TERMINALS
NO. 1
NO. 2
MAIN AND AUXILIARY EXHAUSTERS
VOLTAGE REGULATOR TERMINALS

FRONT RELAY-VOLTAGE REGULATOR
NORMALLY RELEASED
SHOWN RELEASED
REMAINS RELEASED ON VOLTAGE INCREASE TO MOVE RHEOSTAT COUNTERCLOCKWISE. ↄ
OPERATES WHEN VOLTAGE DROPS TO MOVE RHEOSTAT CLOCKWISE. C

LEFT LIMIT SWITCH - NORMALLY AS SHOWN. IF VOLTAGE IS TOO LOW CONTACTS 1 OPEN TO RELEASE CENTER RELAY TO STOP MOTOR; CONTACTS 2 CLOSE TO OPERATE TROUBLE SIGNALS; CONTACTS 3 OPEN CIRCUIT TO FIRE ALARM SIGNALS.

RIGHT LIMIT SWITCH - NORMALLY AS SHOWN. IF VOLTAGE IS TOO HIGH CONTACTS 1 OPEN TO RELEASE REAR RELAY TO STOP MOTOR; CONTACTS 2 CLOSE TO OPERATE TROUBLE SIGNALS; CONTACTS 3 NOT USED.

LIMIT SWITCH CONTACT 1 SHOULD BREAK BEFORE RHEOSTAT REACHES MECHANICAL LIMIT. CONTACT 2 SHOULD MAKE (AND 3 BREAK) BEFORE CONTACTS 1 BREAK.

EITHER CONTACTS OPERATE TROUBLE SIGNALS.

RELAY F,G,H,J.
NORMALLY HELD OPERATED
SHOWN RELEASED.
RELEASES ON FAILURE IN PARTICULAR CIRCUIT.

TERMINAL (CONTACT) NUMBERS LOOKING AT TERMINAL END OF RELAY

CUTS OFF FIRE ALARM SIGNAL CIRCUIT
OPERATES TROUBLE SIGNALS

RELAY E
NORMALLY HELD OPERATED
SHOWN RELEASED.
RELEASES ON FAILURE OF AUDIO LAMP.

OPERATES AUX. GONG
OPERATES TIMER SOLENOID TO STOP MOTOR.
OPENS TROUBLE SIGNAL CIRCUIT FROM RELAY D.
OPERATES CABINET GONG & RED LIGHT.
NOT USED

RELAY C
NORMALLY RELEASED - SHOWN RELEASED - OPERATES WHEN FIRE RELAY OPERATES.

OPERATES TROUBLE SIGNALS

RELAY D
NORMALLY HELD OPERATED
SHOWN RELEASED.
RELEASES ON DERANGEMENT OF AUXILIARY GONG CIRCUIT OR OPERATION OF RELAY C.

TERMINAL (CONTACT) NUMBERS LOOKING AT TERMINAL END OF RELAY

GENERAL NOTES

FOR 110V SYSTEMS RESISTORS Q, R, AND S-S ARE ZERO.

IN ALL CASES RESISTORS M, L, AND O ARE ZERO BUT CLIPS ARE PROVIDED TO PERMIT INSERTION OF RESISTORS IN CASE HIGH VOLTAGE EXISTS IN ANY INSTALLATION.

ALL RELAYS ARE SHOWN IN NORMAL SERVICE POSITION. RELAYS MARKED * ARE OPERATED. ALL OTHERS ARE RELEASED.

ON DIAGRAM ALL POINTS MARKED + CONNECT TOGETHER.

" " " " " — " "
" " " " " T " "

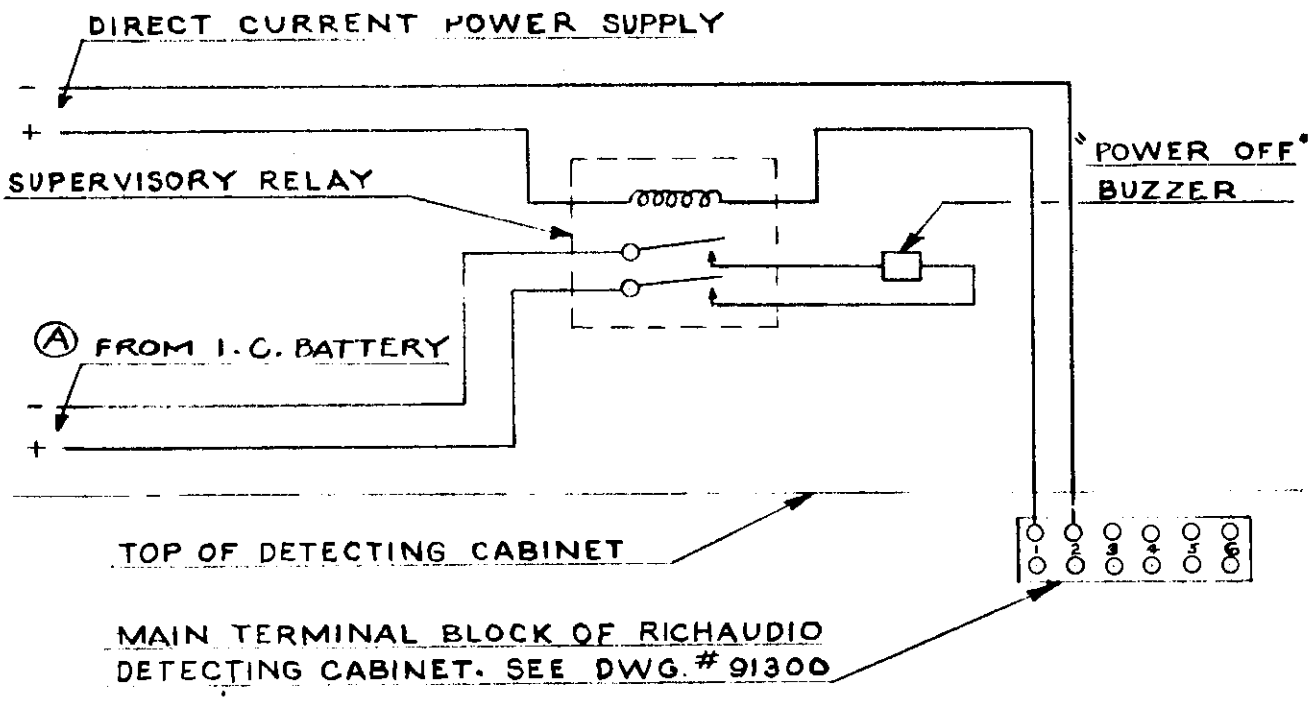
B	ADDED CIR. BREAKERS	TNH	11-20-39
A	RES. "W" WAS RES. "U"	H.P.	1-27-39

40 - 41

RICHAUDIO SYSTEM
WALTER KIDDE & COMPANY, INC.
140 CEDAR ST.
NEW YORK

WIRING DIAGRAM
110 & 220 VOLTS D.C.

91300E



Method of Supervising Power Supply to Richaudio Smoke Detecting Cabinet

A low resistance series relay is connected in one side of the power supply lines at a point conveniently close to the cabinet. The entire current supply passes through the relay to hold it operated. If this current flow is interrupted, due either to failure of the power supply or to the blowing of fuses within the cabinet, the relay releases permitting its contacts to close the circuit to the "Power Off" signal. The audible signal obtains its actuating power from the emergency power supply over a circuit separately fused from the circuit supply to the Richaudio System.

ASSEMBLY NO.

MARK	REVISION	BY	DATE	CH'K'D
A	WAS EMERGENCY GENERATOR SUPPLY	JL	5-31-40	

FRACTIONAL DIM. ± 1/64" DECIMAL DIM. ± .005" UNLESS OTHERWISE NOTED

Walter Kidde & Company, Inc.
60 WEST ST., BLOOMFIELD, NEW JERSEY

RICHAUDIO SYSTEM
POWER SUPERVISOR

MATERIAL	FINISH	MACHINE FINISHES	SCALE	DATE
STD. PART NO. CODE NO.		f1 ROUGH FILE OR GRIND f2 REMOVE FINS & BURRS f3 ROUGH MACHINE f4 SMOOTH MACHINE f5 POLISHED SURFACE	~	4-19-40
			DRAWN: JK CH'K'D:	SK-14616 A

5C-8-43

INSTRUCTIONS FOR REMOVAL AND REINSTALLATION OF NON-QUICK RELEASE CYLINDERS

INSTRUCTIONS FOR REMOVAL OF CYLINDERS

These instructions are to be carefully observed in the order given below when any one or group of cylinders is to be removed at any time.

1. Loosen the nut holding the connecting loop to cylinder valve. Swing loop away.
2. Screw nipple cap on valve outlet
3. Loosen oak rack nuts and remove the oak racks.
4. Remove cylinder.

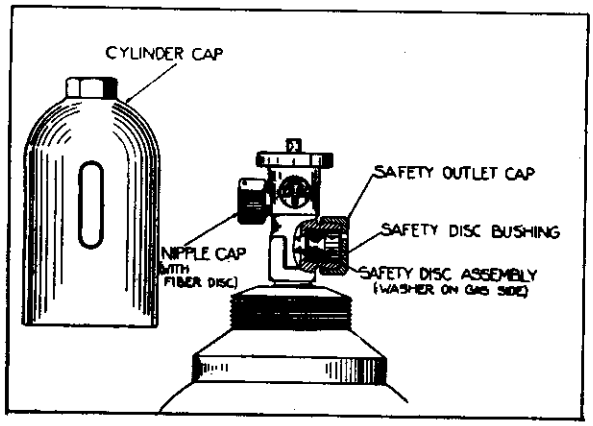
NOTE: SET CYLINDER IN SUCH A POSITION THAT IT CANNOT FALL DOWN AND DAMAGE VALVE. IF NECESSARY, LAY CYLINDER DOWN.

INSTRUCTIONS FOR RECHARGING CYLINDERS

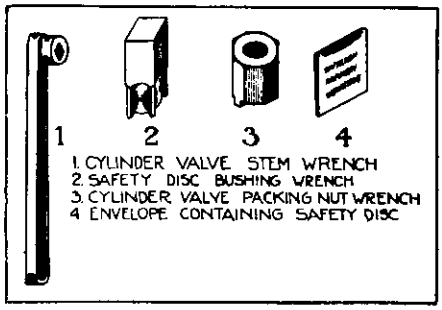
When the cylinder is to be recharged, screw on the nipple cap and cast iron cylinder cap (shown below) and return to Walter Kidde & Company, Inc., or the nearest carbon dioxide manufacturer. A list of carbon dioxide manufacturers is given on the last page of this book.

When returning cylinder to other than Walter Kidde & Company, Inc., be sure to provide the manufacturer with the necessary wrenches and spare safety discs, which are to be found in spare parts box.

INSTRUCTIONS FOR RE-INSTALLATION OF CYLINDERS



CYLINDER VALVE PARTS



SPARE PARTS

Upon return of fully charged cylinder, remove cylinder cap and nipple cap, and return them to the engineers' storeroom. DO NOT REMOVE THE SAFETY OUTLET CAP. Cylinder is now ready for installation.

1. Set cylinder in place with valve outlet pointing in proper direction.
2. Install oak racks and tighten bolts.
3. Connect loop to cylinder valve outlet wrench tight.

INSTRUCTIONS FOR REMOVAL
OF
PULL-OPERATED AND WEIGHT-OPERATED CYLINDERS

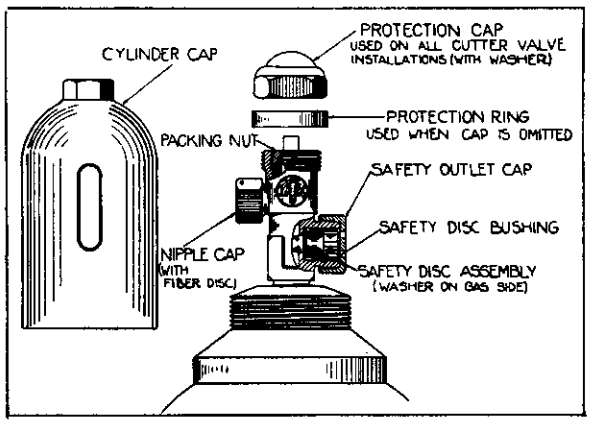
These instructions are general for removing cylinders operated either by weight or by pull, and are to be carefully observed **in the order given below** when any cylinder or group of cylinders is to be removed at any time.

CAUTION: When removing a charged cylinder, avoid turning the lever **clockwise** (when facing valve with lever nearest you) as this will discharge the carbon dioxide gas with possible injury to workmen.

1. If the cylinder has been discharged and is of the **pull-operated** type, return the lever of the cutter valve to its normally set position. To do this, rotate the lever counter-clockwise (when facing valve with lever near you). A group of cutter valve levers may be rotated to set position by merely pulling the end lever.

   If cylinder is of the **weight-operated** type, remove the weight from the end of lever. This is done by slipping the connecting link, holding the weight, past the cross-pin at end of lever.

   When removing cylinders, it is not necessary to disconnect the lever from cable on either weight or pull-operated cylinders.
2. If cylinders are connected to the manifold by loops of the rigid type, loosen both coupling nuts. Do not back off the nuts entirely. If flexible loops are provided, the nuts need not be loosened.
3. Remove the cutter valve and lever assembly from cylinder valve by loosening the left and right nut holding cutter valve to cylinder valve. Do not remove lever from cutter valve. Carefully swing cutter valve, lever and loop away.
4. Screw on safety outlet cap. See sketch for identification of parts. The safety outlet cap should always replace the cutter valve before cylinder is removed from the cylinder rack.
5. Remove cylinder racks.
6. Remove cylinder. It is recommended that the cylinder cap be screwed on, to prevent damage to cylinder valve during removal. This cap, however, is not included in the empty weight of the cylinder.
7. If the cylinder has been discharged, examine cutter in cutter valve and remove the cut-out section of the safety disc, which will be found in extreme inner end of cutter.



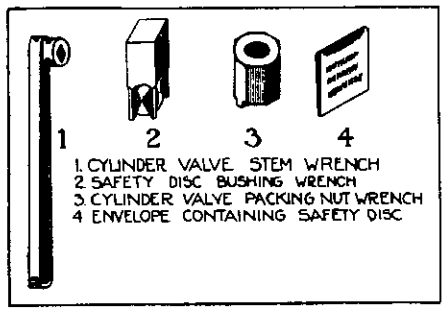
CYLINDER VALVE PARTS

INSTRUCTIONS FOR RECHARGING

KIDDE & LUX cylinders should be recharged with "bone dry" carbon dioxide. This can be done at any recharging station listed in this instruction book or see KIDDE or LUX System or Walter Kidde Sales Agency in your telephone directory. Cylinders in the vicinity of New York that are sent to us for recharging should be sent to our plant at 60 West Street, Bloomfield, N. J.

When a cylinder is being sent for recharging, make certain the safety outlet cap has been assembled to cylinder valve (as directed in Item 4 above). The large steel cylinder cap should be screwed over the cylinder valve to protect it during shipment.

When returning cylinder to other than Walter Kidde & Company, Inc., provide the recharging station with the necessary wrenches and spare safety discs as shown in the sketch. This equipment will be found with the spare parts, or in the control box; and is required in the recharging of an empty or partially filled cylinder. Specify Package No. 2517 for cylinders marked "ICC-3A-2205" or "ICC-3A-2300"; Package No. 2518 for cylinders marked "ICC-3A-2015"; Package No. 2514 for cylinders marked "ICC-3A-1800" or "ICC-3A".



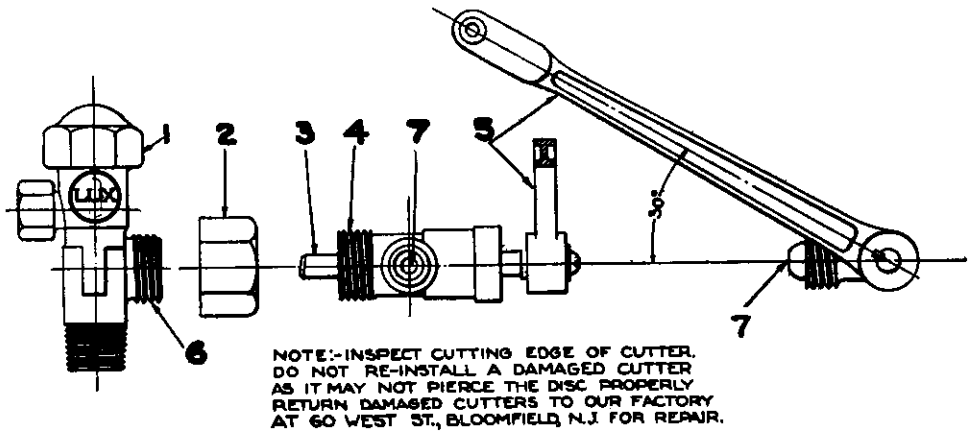
SPARE PARTS

INSTRUCTIONS FOR RE-INSTALLATION
OF
PULL-OPERATED CYLINDERS

Upon return of fully charged cylinder, place in cylinder rack before removing large steel cylinder cap. (See sketch on preceding page for identification of parts.)

1. Install the cylinder racks or cylinder straps, and tighten bolts only enough to allow turning of cylinder as may be required later.
2. Remove the large steel cylinder cap and the perforated safety outlet cap and return them to the store room. Do not remove the top brass protection cap or side brass nipple cap.
3. Turn cylinder so that safety outlet points in the proper direction; and install the cutter valve according to the following directions. It is important to follow these directions exactly to avoid possible injury to workmen and loss of gas.

METHOD OF INSTALLING CUTTER VALVE



CAUTION: Avoid turning the lever at any time after cutter valve has been installed as this will advance the cutter, cut the safety disc and release the gas.

(a) Hold cutter valve and lever assembly and turn lever (5) counter-clockwise to cause cutter (3) to recede into cutter valve body (4) as far as possible.

(b) Put left and right nut (2) about one turn on cutter valve thread.
NOTE: A washer IS NOT to be used between cutter valve and cylinder valve.

(c) Hold cutter valve so that outlet (7) is in proper position (lever should then be about 30° above horizontal). Turn left and right nut to catch safety disc outlet (6) and make up threads by hands. Do not tighten nut until copper loop has been connected as under (4).

4. If cylinders are provided with flexible loops, disregard this item entirely. If the loops are of the rigid type, tighten both coupling nuts of loop securely.
5. Tighten left and right nut (2) on cutter valve securely, making sure that about an equal number of threads show on each side.
6. Tighten the bolts of the cylinder racks or cylinder strap securely.
7. Make certain cable is securely connected to the end of each lever.

Kidde Recharging Service Stations

United States and Canada

Carbon dioxide cylinders manufactured by Walter Kidde & Company, Inc., bearing trade names of "Kidde-LUX", "LUX", and "Kidde" used for fire extinguishing, airplane flotation, and life raft inflation purposes can be recharged by any of the following recharging service stations. Those marked with an asterisk (*) are in possession of a Kidde Recharging Pump and can provide immediate service through the use of this pump.

UNITED STATES

ALABAMA

Birmingham	*Associated Engineers 747 Martin Building Crystal Pure Carbonic, Inc.
Mobile	*Marine Specialty Co. 57 N. Water St.

ARIZONA

Phoenix	Les DeMund Central Warehouse Building The Liquid Carbonic Corp.

CALIFORNIA

Bakersfield	*H. Russell Taylor 105 W. Moneta Ave.
Berkeley	Pure Carbonic, Inc.
Eureka	*F. Breeden & Son 705 Second St.
Fresno	*H. P. Jorgensen & Co. 806 Broadway
Glendale	E. Ives 630 Kenneth Rd.
Los Angeles	*E. Ives 1225 E. 8th St. *Western Fire Prot., Inc. 611 E. Third St. The Liquid Carbonic Corp. Pure Carbonic, Inc.
Oakland	*L. N. Curtis & Sons 451 Hudson St.
San Diego	*Walter Kidde & Co., Inc., c/o R. V. Morris & Co. 1202 Kettner Blvd.
San Francisco	*Industrial & Marine Fire Equipment Co., Inc. 311 California St. The Liquid Carbonic Corp.
Santa Barbara	*Coast Serv. Sta. Equip. Co. 810 Montecito St.
Stockton	*Stockton Chemical Co.
Wilmington	Paul W. Hiller 315 Avalon Blvd.

COLORADO

Denver	Urquhart Service 16th St. at Blake The Liquid Carbonic Corp.

CONNECTICUT

Darien	*Brencher's Service Station 221 Post Rd.
Groton	Dumont Marine Service, Inc. Long's Dock, 243 Thames St.
New London	*Dumont Marine Service, Inc. 524-26 Main St.
Stratford	*Stuart L. White 553 Laughlin Rd., West

FLORIDA

Jacksonville	*Moore Pipe & Sprinkler Co. 1150 W. State St. Crystal Pure Carbonic, Inc. The Liquid Carbonic Corp.
Miami	*J. Frank Knorr 528 N. W. 7th Ave.
Tampa	*Fred A. Cortina River Heights Boat Yard

GEORGIA

Atlanta	W. B. Calverley Room 208 1000 Peachtree St., N. E. Crystal Pure Carbonic, Inc. The Liquid Carbonic Corp.
Savannah	*John D. Robinson Co. 11 Bay St., W.

IDAHO

Wallace	Coeur d'Alene Hardware & Foundry Co. 612 Bank St.

ILLINOIS

Chicago	Walter Kidde & Co., Inc. 35 E. Wacker Drive The Liquid Carbonic Corp. Pure Carbonic, Inc.
Peoria	The Liquid Carbonic Corp.
Vandalia	*Richard Lawless 1124 North 5th St. Carbon Dioxide Recharging Service 35 East Wacker Drive

INDIANA

Indianapolis	*D. O. Brown 324 Bankers Trust Bldg. The Liquid Carbonic Corp. Pure Carbonic, Inc.
Terra Haute	Wylie McGregor 709½ Wabash Ave.

IOWA

Council Bluffs	*A. R. Peterson 8 Pearl St.
Des Moines	Solid Carbonic Corp. 106 S. W. Second St.

KENTUCKY

Louisville	J. B. Lewman 45 Hill Rd., Castlewood Pure Carbonic, Incorporated

LOUISIANA

New Orleans	*Herbert S. Hiller 116 Chartres St. The Liquid Carbonic Corp.

MAINE

Portland	*Frank J. Gill (Lux Fire Service Co.) 13 Pearl St.

MARYLAND

Baltimore	*Harry Fried 3230 Carlisle Ave. Pure Carbonic, Incorporated

MASSACHUSETTS

Boston	H. W. DeVeer (Lux Fire Equipment Co.) 626 Park Square Bldg.
Cambridge	*H. W. DeVeer (Lux Fire Equipment Co.) 136 Broadway The Liquid Carbonic Corp. Pure Carbonic, Incorporated
Worcester	*Haven W. Goodwin (Lux Fire Protection Co.) 137 Front St.

MICHIGAN

Alpena	*Alpena Fire Department
Bay City	*Bay City Fire Department
Cadillac	*Cadillac Fire Department
Charlevoix	Fred E. Cartier 115 Antrim St.
Detroit	*T. M. Gillespie 3900 Grandy Ave. The Liquid Carbonic Corp. Pure Carbonic, Incorporated
Escanaba	*Escanaba Fire Dept.
Grand Rapids	Folger Company 527 S. Division St.
Jackson	*Wilbur Welding and Supply Company 203 Homewild Ave.
Kalamazoo	*Manufacturers Sales Co. 229 Parchmont Ave.
Lansing	*Lansing Fire Dept.
Newberry	Newberry Fire Dept.
Roscommon	Roscommon Fire Dept.
Saginaw	*H. E. Miller 2829 Cooper Ave.
Sault Ste. Marie	Sault Ste. Marie Fire Dept.
South Haven	South Haven Fire Dept.
St. Ignace	*St. Ignace Fire Dept.
Wyandotte	Pure Carbonic, Incorporated

MINNESOTA

Duluth	*W. P. & B. S. Mars Co. 324 W. Michigan St.
Minneapolis	The Liquid Carbonic Corp. Pure Carbonic, Incorporated
St. Paul	*Chemical Sales & Safety Co. 1941 University Ave. The Liquid Carbonic Corp.

MISSOURI

Kansas City	Walton-Viking Company 2518 Holmes St. The Liquid Carbonic Corp. Pure Carbonic, Incorporated
St. Louis	American Fomon Equip. Co. 3811 Childrens Ave. The Liquid Carbonic Corp. Pure Carbonic, Incorporated

MONTANA

Billings	*Artificial Ice & Cold Storage Co.
Butte	*Northwestern Machine & Welding Co. 111 W. Galena St.

NEBRASKA

Kearney	Ralph W. McBrayer 11 West 26th St.
Omaha	A. R. Peterson 527 N. 33rd St.

NEW JERSEY

Allenhurst	*Denegar Manufacturing Co. 317 Allen Ave.
Bloomfield	*Walter Kidde & Co., Inc. 60 West St. P. F. Eichoer A. L. Gauther
East Paterson	*Welding Supply Co. 65 Van Riper Ave.
Margate	*Harry H. Keim 8605 Atlantic Ave.
Newark	Pure Carbonic, Incorporated
North Bergen	*Carbonic Sales Co. 5837 Hudson Boulevard
No. Plainfield	Approved Fire Protection Co. 118 Westervelt Ave.
Sussex	*Tri-States Welding Supply Co. R. F. D. 3
Trenton	*H. M. Royal, Inc. 689 Pennington Ave.

NEW MEXICO

Albuquerque	*R. L. Harrison Co., Inc. 209-217 North 4th St.

NEW YORK

Albany	*T. P. Sanders Kidde-Lux Products Co. 124-126 Sheridan Ave. The Liquid Carbonic Corp. Pure Carbonic, Incorporated
Brewster	Fenaughlty Mfg. Co. 69 Oak St.
Buffalo	*American Allsafe Co. 1245 Niagara St. The Liquid Carbonic Corp. Pure Carbonic, Incorporated
Hempstead	*Edwin S. Crane 67 Front St.
Johnson City	*Rossiter Safety Equipt. Co. c/o Johnson City Fire Dept. Central Fire Station
Kingston	Irving Egnor 41 Garden St.
Long Island City	The Liquid Carbonic Corp. 4-03 48th Ave.
Mt. Vernon	*Bailis Bros. 331 Locust Ave.
New York City	Walter Kidde & Co., Inc. 140 Cedar St. (return to our plant at 60 West St., Bloomfield, N. J.) *Joseph Littell 1336 Theriot Ave., Bronx *Hansen & Hasle 135 Myrtle Ave., Brooklyn *Victor Anderson Foot of Carroll St., City Island
Newburgh	*Louis H. Dubois (Phone: Washingtonville 35)
Northport	*Long Island Fire Equipment Co. 64 Bayview Ave.
Nyack	*Capt. Wm. Paul Babcock c/o Kolb Garage N. Midland Ave.
Pelham	*Harry Pickard 318 Fifth Ave.
Port Washington	*A. & R. Marshall 403 Main St.
Poughkeepsie	*Northeast Company Delafield St.
Rochester	*C. E. Shear 141 Marlborough Rd.
Southampton	*Carl A. Hennicke Hampton Road
Syracuse	*Rossiter Safety Equipt. Co. Rm. 2B, University Bldg. 120 E. Washington St.
Tarrytown	*R. J. Hathaway 24 Hamilton Place

NORTH CAROLINA

Charlotte	E. H. Gilliam Co. 1824 East 4th St. Crystal Pure Carbonic, Inc.

OHIO

Akron	Roscoe Allerton 2443 E. Market St.
Canton	*Canton Supply Company 938 Cleveland Ave., S. W.
Cincinnati	Harold E. Pelta Room 803, St. Paul Bldg. 111 East 4th St. Economy Fire Extinguisher Sales & Service 322 East Second Street The Liquid Carbonic Corp. Pure Carbonic, Incorporated
Cleveland	*S. R. Smith 1200 W. 9th St. The Liquid Carbonic Corp. Pure Carbonic, Incorporated
Columbus	*Wm. J. Dusenbery 655 S. Ohio Ave.
Dayton	*Paul Hoerner 623 Easton St.
Mansfield	Mansfield Oxygen Acetylene Supply Co. 211 North Diamond St.
Toledo	*Jack Costa 2920 Broadway
Youngstown	Fire Ext. Sales & Service Co.

OKLAHOMA

Tulsa	*W. L. Walker Co. 1009 South Main St.

OREGON

Portland	F. S. Gannett Fyr-Fyter Products Co. 509 Bedell Bldg. The Liquid Carbonic Corp. Pure Carbonic, Incorporated

PENNSYLVANIA

Erie	*Patterson & Stirling 219 W. 11th St.
Harrisburg	Appleby Bros. & Whittaker Co. Inc. 216 South Second St. Pure Carbonic, Incorporated
Philadelphia	*L. Earl Hall 3215 Arch St. The Liquid Carbonic Corp. Pure Carbonic, Incorporated
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Scranton	*L. B. Potter Co. 426 Sixth Ave.
Wilkes-Barre	Pure Carbonic, Incorporated

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TENNESSEE

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Knoxville	*Royal Crown Bottling Co. 1502 McCalla Ave.
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Nashville	Alf. H. Williams (Fire Equipt. & Service Co.) 150 Fourth Ave., North *Friedman Electric Co. 2804 West End Ave.

TEXAS

Amarillo	*A. D. Gugenheim Co. 227 West 7th St.
Dallas	*Greene Bros., Inc. 1812 Griffin St. Crystal Pure Carbonic, Inc. The Liquid Carbonic Corp.
El Paso	*Jay L. Harman Company 307 San Francisco St.
Ft. Worth	Parker Browne Company
Houston	*H. E. Bowman Company 2102 Leeland Ave. The Liquid Carbonic Corp.
San Antonio	E. J. Mackey 302 Shadwell Drive The Liquid Carbonic Corp.

UTAH

Salt Lake City	Universal Safety Appliances Co. 69 E. 4th South St.

VERMONT

Burlington	*Chief Donald J. Kelley Fire Dept. Headquarters South Winooski Ave.

VIRGINIA

Norfolk	*Paxton Co. 64 Commercial Place The Liquid Carbonic Corp.
Richmond	*L. B. Sheffield 2206 Mooument Ave.
Roanoke	*Bernard's Machine Works 512 Commerce St., S. W.
Rosslyn	Fowler Carbonic Co.

WASHINGTON

Seattle	*Alexander Cow, Inc. 557 Central Building The Liquid Carbonic Corp.
Spokane	The Liquid Carbonic Corp.

WISCONSIN

Manitowoc	*R. A. Philips 602 Oak St.
Milwaukee	*Winter Recharge Service Co. 647 West Virginia St. The Liquid Carbonic Corp. Pure Carbonic, Incorporated

CANADA

Edmonton	Gorman's Ltd. Liquid Carbonic Canadian Corp. Ltd.
Halifax	Stairs, Son & Morrow, Wm. Liquid Carbonic Canadian Corp. Ltd.
London	*Fire Extinguisher Service & Sales 736 Maitland St.
Montreal	*Walter Kidde & Co. of Canada Ltd. 444 St. Paul St., East Walter Kidde & Co. of Canada Ltd. 1449 Crescent St. The Canadian Fire Hose Co. Ltd. 827 Notre Dame St. Liquid Carbonic Canadian Corp. Ltd.
Ottawa	*People's Gas Supply Co. Ltd.
Regina	Fire Fighting Equipt. Co. 507 Kerr Bldg.
Toronto	*Safety Supply Co. Hermant Building Liquid Carbonic Canadian Corp. Ltd.
Vancouver	*Burgess Bros. & Co. Ltd. 119 W. Pender St. Liquid Carbonic Canadian Corp. Ltd.
Verdun, P. Q.	*Walter Kidde & Co. of Canada Ltd. 3138 La Salle Blvd.
Winnipeg	Filer-Smith Machinery Co. 703 Confederation Life Bldg. Liquid Carbonic Canadian Corp. Ltd.

* Possess Recharging Pump.

Should you have any difficulty please write to Walter Kidde & Company, Inc., 140 Cedar St., New York City.

F. 266Y 40M 6-43

Record of Cylinder Weights

NAME OF INSTALLATION

No. of Sheets

Sheet No.

OWNER OR OPERATOR

SIGNATURE OF INSPECTOR

DATE OF WEIGHING

Weights shown in pounds
kilograms

CYLINDERS SERIAL No.	TARE WEIGHT	GROSS WEIGHT	NET WEIGHT	CYLINDER TO BE REFILLED MARKED X	CYLINDERS SERIAL No.	TARE WEIGHT	GROSS WEIGHT	NET WEIGHT	CYLINDER TO BE REFILLED MARKED X

Walter Kidde & Company, Inc.
Main Office — Belleville, N. J.

PRINTED IN U. S. A.