Maintenance of

STONE'S L.B.B.

TURBO-GENERATORS

including

RECHARGING AND OVERHAUL

also

NOTES ON HEADLIGHTS

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MAINTENANCE OF

STONE'S L.B.B. TURBO-GENERATOR

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L.B.B. TURBO-GENERATOR

General Information.—Stone's L.B.B. Turbo-Generator is designed for an output of from 350 to 500 watts and is supplied either for 24 or 32 volts.

It comprises an impulse steam turbine, direct-coupled to a single phase alternating current generator.

The turbine develops full load with steam pressure of 100 lbs. per sq. inch and upwards (7 kilos per sq. c/m).

The magnetic field of the generator is maintained by permanent magnets of high retentiveness and if the magnetic circuit is broken by the withdrawal of the Rotor, the magnets will be weakened, necessitating recharging.

It is therefore essential that the special instructions given in " Caution ", page 13, should be followed whenever the removal of the rotor is found necessary.

Notes on Erection.—To facilitate dismantling, the steam and exhaust pipes should be provided with unions near the turbo-generator. Similarly, the conduit outlet of the terminal box should be provided with a nipple and the conduit end fitted with a socket and back-nut.

The steam-pipe may be fitted either right or left hand (not vertically). The plugholes have ½" British Standard Pipe threads.

The exhaust outlet of types T.G.A. to T.G.D. may be arranged to discharge either vertically upwards or downwards, or horizontally right or left hand, by unbolting and adjusting the exhaust end cover as required. Type T.G.F. and T.G.H. is designed to exhaust upwards. A new steam joint must be made when cover is replaced.

The exhaust hole is threaded 1½" B.S. Pipe thread.

The water drain hole in turbine casing is screwed ⅜" B.S. Pipe. No stop-cock is required on drain pipe.

The conduit outlet on terminal box is screwed ¾" B.S. Pipe.

Before coupling up turbine to a new steam pipe, blow through piping with live steam to clear out dirt and scale.

SERVICE MAINTENANCE

(Index numbers in the following instructions refer to the sectional drawing on back page—they are NOT part numbers).

Lubrication.—The two ball-bearings (1) and (4) which are ring lubricated, require occasional attention—**Wakefield's T. G. Lubricating Oil is recommended.** Fill the two oil cups on the terminal box side of machine until full.

Do not employ cylinder oil as the bearings are not exposed to full steam temperature and its viscous nature would prevent the oil rings running freely on the shaft.

STONE'S L.B.B. TURBO-GENERATOR.

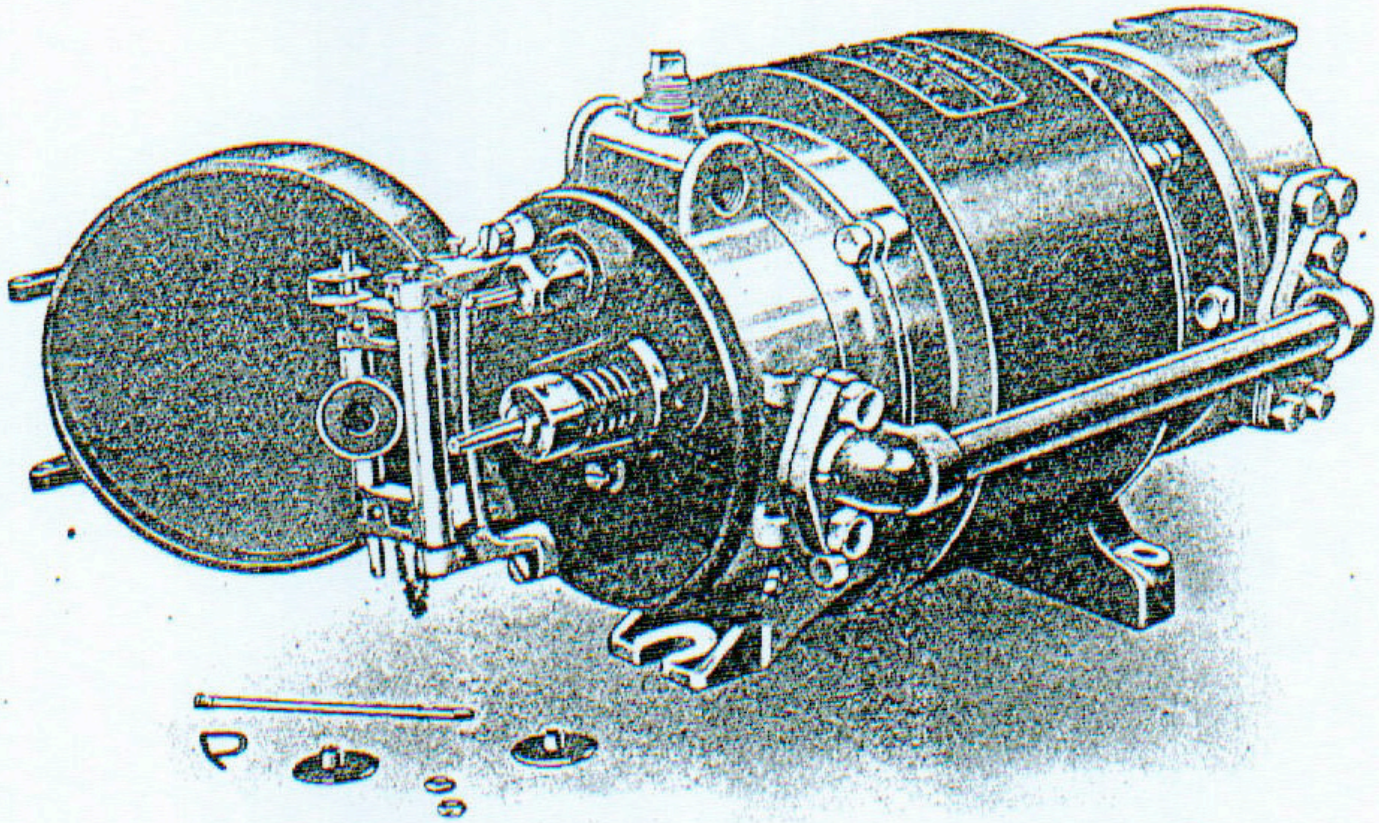

FIG. 1.
Rocker swung back giving access to valve and governor.

If necessary to renew oil, drain by removing plugs (14) (15).

Glands.—There are **no Glands** which require repacking.

Leakage of steam or water from the turbine casing is prevented by means of a labyrinth gland. This requires no attention.

Steam Strainer.—The strainer (47) is located within the plug opposite the steam pipe. It should be removed occasionally and cleaned. This is particularly important when boiler feed-water is dirty or hard or when boiler "compound" is used.

If damaged, replace by a new strainer.

NOTE.—If the strainer is of the cartridge type with an end-cap, be careful to insert with cap end next to the plug.

Valve.—The valve (53) is located within the cover at the governor end of the machine.

Remember that the **satisfactory running of the turbine depends almost entirely on the free working of the valve.** Should the running be irregular, or starting difficult, the valve should be tested for freedom of action. Proceed as follows :—

Remove spring pin and withdraw quadrant adjusting pin (45) releasing valve stem. Remove lock-nuts (27) and outer thrust plate (51) on governor stem (26) and swing back the rocker (43). The valve stem which is now accessible should be free to slide in or out without appreciable friction. (*See Fig.* 1.)

If it is not free, unscrew the valve body with a close-fitting $\frac{9}{16}$" spanner, or a special ring spanner, remove the stop-ring (56) from the inner end and push out the valve.

NOTE.—Be careful not to bend the valve stem when removing or replacing. If bent, do not attempt to rectify but replace by a new valve and stem.

Use petrol for cleaning—DO NOT use an abrasive.

When reassembling, do not omit to replace stop-ring in the end of the valve sleeve and finally the spring pin in the quadrant.

NOTE.—When refitting the stop-ring (56) see that the ends are not bent outwards—otherwise the limit of travel of the valve will be extended past the full-open position and the quadrant setting will not be correct.

Before reconnecting the quadrant (44) to the valve stem (55), push the stem in (without forcing it) until it meets the stop-ring (56). This represents the **full-open** position of the valve. Hold the rocker so that the outer thrust-block (48) bears against the outer thrust-plate (51). Swing the quadrant (44) until one of its holes registers with the hole in the valve stem. Insert the adjusting pin (45) and the spring pin which secures it.

If the turbo-generator has been out of use for a considerable time, it is advisable to test the valve for freedom of action before re-starting. Also remove and clean the steam strainer.

A falling-off in speed, indicated by the lights becoming dim, is due, usually, either to the valve not being free or to dirt in the strainer. (*See also "Speed Adjustment"* p. 7.)

Thrust Blocks.—The thrust blocks (48) and (49), which transmit the action of the governor to the rocker, are made of a self-lubricating material and require no attention until it becomes necessary to replace them on account of wear. One or both should be renewed when the total "play" between the thrust-plates (51) and (52) exceeds $\frac{1}{32}$".

When fitting new thrust blocks, the clearance between the blocks should be ·004" measured with feelers; too little clearance will cause excessive wear and an extreme case may result in the turbine failing to start. To obtain the required clearance, the thrust block should be reduced by rubbing on a fine emery cloth strip on a true, flat, metal surface.

Governor.—The governor normally requires no attention and should not be tampered with, but should it be necessary to remove it, the locking screws (20) in the body must be slackened. Access to these is gained through the plug-hole on the terminal box side of governor end casing (11) through which a long thin screwdriver may be inserted.

The governor can then be removed with the special box-spanner provided. A sharp blow, given with a mallet on the end of the "Tommy" bar, is sufficient to loosen it, the inertia of the rotor and magnetic pull of the generator field offering sufficient resistance against the blow.

When replacing the governor, be careful to screw it up tightly on the shaft and secure the locking screws.

To dismantle the governor itself, unscrew the adjusting nut (18).

Starting.—Before starting, open the throttle valve slightly for a few moments to warm the turbine and clear out water. The turbine should start easily either with or without load provided that steam pressure is sufficient.

SPEED ADJUSTMENT.—Correct setting of the governor is most easily arrived at by measuring the full-load voltage. For this purpose **a voltmeter specially calibrated for the high frequency of the alternating current generated, is absolutely necessary**—a voltmeter calibrated for usual power frequencies is quite useless.

Some slight adjustment in the setting of the governor to increase the speed, may be necessary after a considerable

time in service owing to a slight weakening of the spring or to the very slow but gradual "ageing" effect on the permanent magnets, as is experienced with magnetos.

To alter the speed, insert the small "Tommy" bar (a piece of steel $\frac{5}{32}$" diameter) into one of the holes in the governor adjusting nut (18).

When facing the governor end of the machine, turn the nut **clockwise**. This compresses the spring (23), and **raises the speed**; turning the **nut counter-clockwise lowers the speed.**

The governor adjusting nut (18) is self-locking, but when completing the adjustment, the nut-lock (22) must be allowed to fall into a slot (indicated by a "click").

After adjustment, see that the full load voltage corresponds to the rated voltage of the lamps.

SHOP MAINTENANCE

Tools Accessories and Instruments.—The maintenance shop should be equipped with the following special tools, accessories and instruments which may be obtained from J. Stone & Co. Ltd. :—

1. **Tool kit** containing special tools for L.B.B. Turbo-generator. Namely :—
   (*a*) Box Spanner for governor body; (*b*) Extractor for ball bearings; (*c*) Extractor for Bucket Wheel; (*d*) Ring Spanner for Bucket Wheel Nut; (*e*) Peg Spanner for ball bearings; (*f*) "Tommy" Bar for (*a*) and (*e*); (*g*) Locking strap for Bucket Wheel; (*h*) (*j*) Tubular drifts for ball bearings (*See Fig.* 6), and Ring Spanner for valve body and strainer cap (*not illustrated*), and (*c*).
2. **Keeper** (*See Fig.* 6).

3. **Charger** suitable for 24 to 32 volt circuit (Note—this voltage is recommended, as the inductive discharge when breaking a current on high voltage is dangerous). (*See Fig.* 6.)

4. **Ammeter**—D.C., complete with shunt, to read 5-0-150 amperes (if for 24-32 volt circuit).

5. **Voltmeter**—A.C., calibrated for high frequency current, to read 0-40 volts.

6. **Ammeter**—A.C., calibrated for high frequency current, to read 0-25 amperes, complete with shunt.

If current for remagnetising is to be taken from a battery or any other constant voltage supply, the following will be required :—

7. **Variable Resistance** for charger, with multiple contacts, complete with quick-break switch.

Charging.—The process of remagnetising, or "charging" as it is termed, is extremely simple, but, as it involves the use of special electrical apparatus it should only be entrusted to experienced electrical staff. After re-magnetising and re-assembling, the turbo generator should be tested for output and voltage, and the speed adjusted as found necessary (see pages 7 and 8).

NOTE.—Use only the special instrument referred to under "Speed Adjustment", page 7.

As a precaution, it is recommended that opportunity should be taken to remagnetise the generator, whenever it has been dismantled for any reason, before it goes back into service.

Dismantling for Charging.—It is not necessary to dismantle the turbine end of the machine for charging.

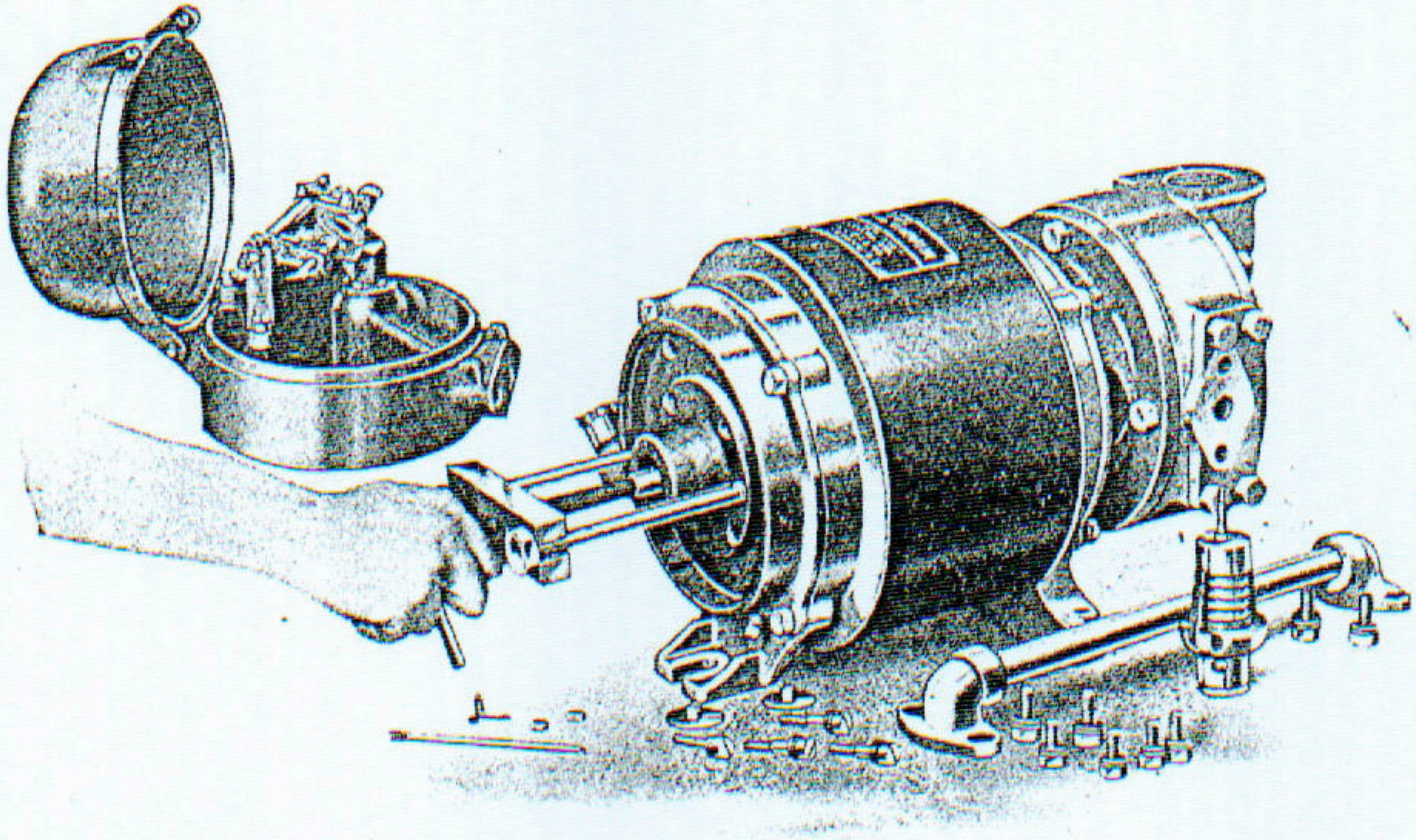

FIG. 2.
Using extractor to pull off bearing housing cap.

Commence at the governor end and proceed as follows:

1. Withdraw hinge pin and swing back governor end cover (21).
2. Unscrew lock-nuts (27) on governor stem (26) and remove outer thrust-plate (51).
3. Remove spring pin and withdraw adjusting pin (45) in quadrant then swing rocker (43) with thrust-block carrier (50) clear of governor stem (26) and remove inner thrust-plate (52).
4. Unbolt and remove steam-pipe but do not remove the nozzle at the turbine end.
5. Remove screws inside governor end casing (11), and after loosening the case with a copper or lead mallet, remove it complete with valve and valve rocker.
6. Slacken locking-screws (20) in governor body (19) which lock it on the shaft.
7. Apply the special box spanner and unscrew governor by a blow on the "Tommy" bar with a mallet. The residual magnetism offers sufficient resistance against a sharp light blow to effect this. **Note.** The Governor body has a right-handed thread.
8. Remove the bolts in the governor end housing cap (31) and apply the extractor, screwing the two long bolts provided, into the two threaded holes in the housing. By tightening the "Tommy" screw against the shaft end, the housing will be drawn off. (*See Fig.* 2.)
9. Slacken back the lock screw in the bearing nut (2) and apply the peg spanner to the nut which may then be loosened by a sharp blow on the "Tommy" bar. Remove the bearing washer (3) below the nut and also the oil ring (39).

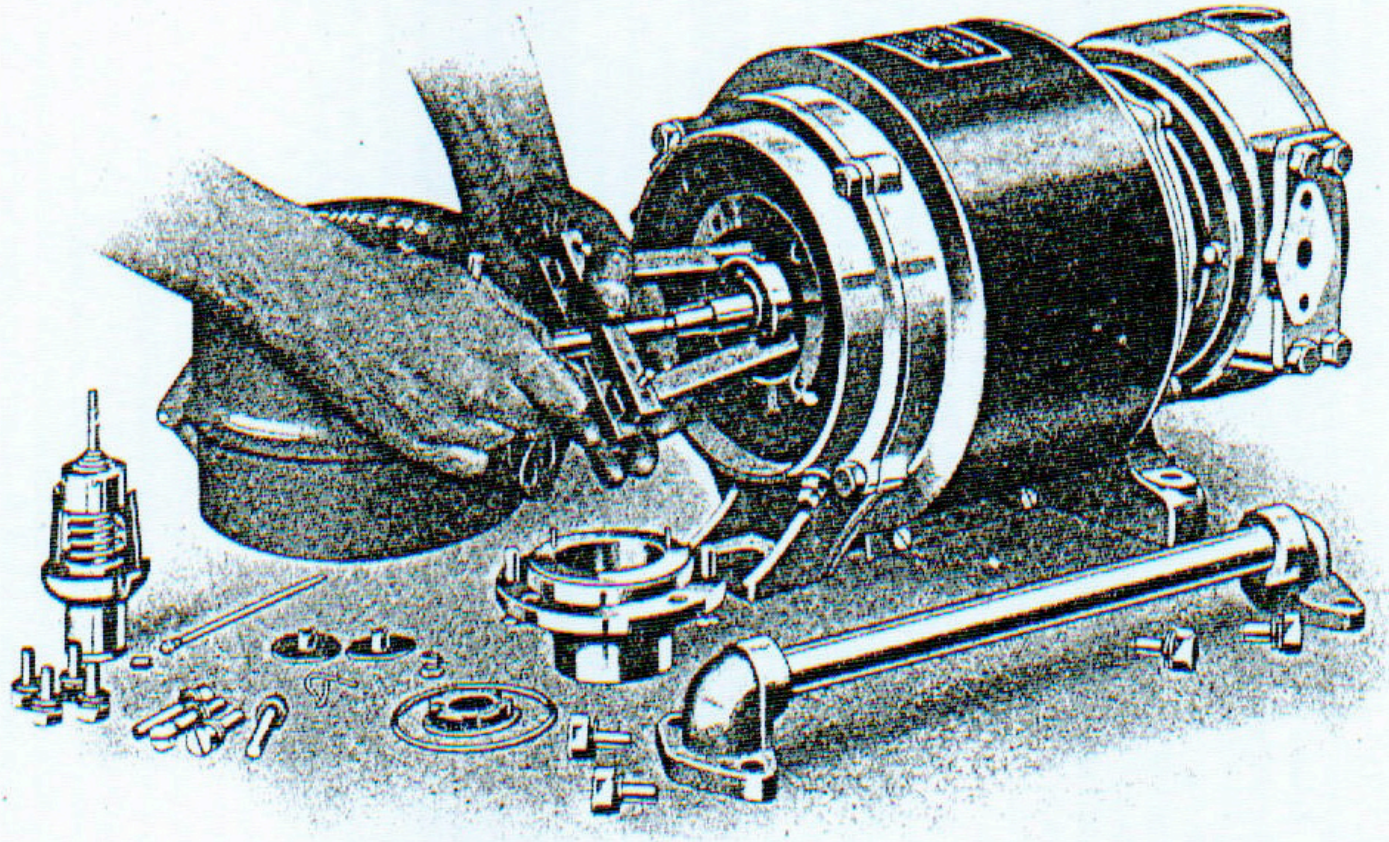

FIG. 3.
Using extractor to pull off ball-bearing.

10. Using the " claws " instead of the bolts, apply the extractor to the ball-bearing and draw it off the shaft. Remove the oil sleeve and deflector (41). (*See Fig.* 3.) If tight, remove with housing (29).

11. Unscrew bolts holding the governor-end housing (29), loosen by light blow with mallet applied through a screwdriver at the joint and remove housing. The rotor (46) is then exposed.

12. Now turn to the turbine end of machine and unscrew the bolts securing the turbine-end housing (33) and loosen the housing by a light blow with a copper mallet on the turbine case. The rotor is then ready for removal.

CAUTION. DO NOT withdraw the rotor before reading the following :—

NOTE.—Removing the Rotor.—The field of the generator is excited by powerful permanent magnets of high retentivity. The rotor while in position acts as a keeper and maintains the magnetic circuit through it. Should this circuit be broken, even momentarily, the magnets will be weakened and require recharging. If it is **not intended to recharge the machine, a keeper must be inserted simultaneously as the rotor is withdrawn from the generator.** In the absence of a keeper, a charger may be used as a substitute.

If the machine is to be recharged subsequently, no such special precautions are necessary.

13. To introduce the keeper (or charger used as such), let an assistant support the turbine casing while

the keeper is pushed in from the governor end, thus displacing the rotor without breaking the magnetic circuit.

Charger.—The charger is a powerful electro-magnet with poles designed to fit closely between the pole-pieces of the generator.

It requires from 100 to 120 amperes, direct current, at 24-32 volts (say 3 k.w.) to charge the magnets. A T-5 "Liliput" train-lighting dynamo will provide this current for the short time required. If a dynamo of this size is not available, a battery of train-lighting cells may be employed. If only small cells are available, two batteries of an equal number of cells should be used in parallel.

One pole of the charger is chamfered off at its extremity, and when inserting it between the pole pieces, this pole should be placed on the terminal box side of the generator. The positive is marked with a (+) and should be connected to the current supply accordingly.

Recharging with a Train-Lighting Dynamo.—The dynamo is slung on the test arm, connected up direct to the charger with a D.C. ammeter, reading 5-0-150 amperes in circuit but no switch or cut-out.

After checking the polarity, it is run up in speed so as to give a current of 100-120 amperes, which need only be maintained for a few seconds. The speed is then cut down gradually until it stops. Do not break any connection until the dynamo has stopped.

Recharging with a Train-Lighting Battery.—When a battery is employed, the following equipment will be required :—

(*a*) Quick-break knife switch, with a long break, for the inductive field of the charger.

(*b*) Variable resistance and multiple switch with about 10 " live " steps. On the last step, with all resistance in circuit, the current flowing should not exceed 5 amperes. The circuit should be broken by the knife switch and not on the last step of the multiple switch.

(*c*) Direct current ammeter reading 5-0-150 amperes.

Insert the charger between the poles and make connections with knife switch "open" and the multiple contact switch on the last step **with all resistance in circuit.**

After checking the connections and polarity of the charger, switch on by closing the knife switch and increase current by moving the multiple switch arm, gradually cutting-out resistance until the ammeter reads 100 to 120 amperes. After maintaining full current for a few seconds move back the handle slowly, to cut-in full resistance, and open the knife switch when the current has dropped to 5 amperes. Do not remove the charger.

Should, in error, the current be applied in the wrong direction, this may be rectified by reversing the connections of the charger and again applying the current as directed. In this case it is advisable to repeat the process a second time.

The machine will generate equally well even if magnetised with the wrong polarity, but it is advisable to retain uniformity.

Replacing the Rotor.

14. **After recharging the MAGNETIC CIRCUIT MUST NOT BE BROKEN.**

To replace the rotor in the stator, insert at the turbine end while an assistant supports the charger as it leaves the stator. (*See Fig.* 4.)

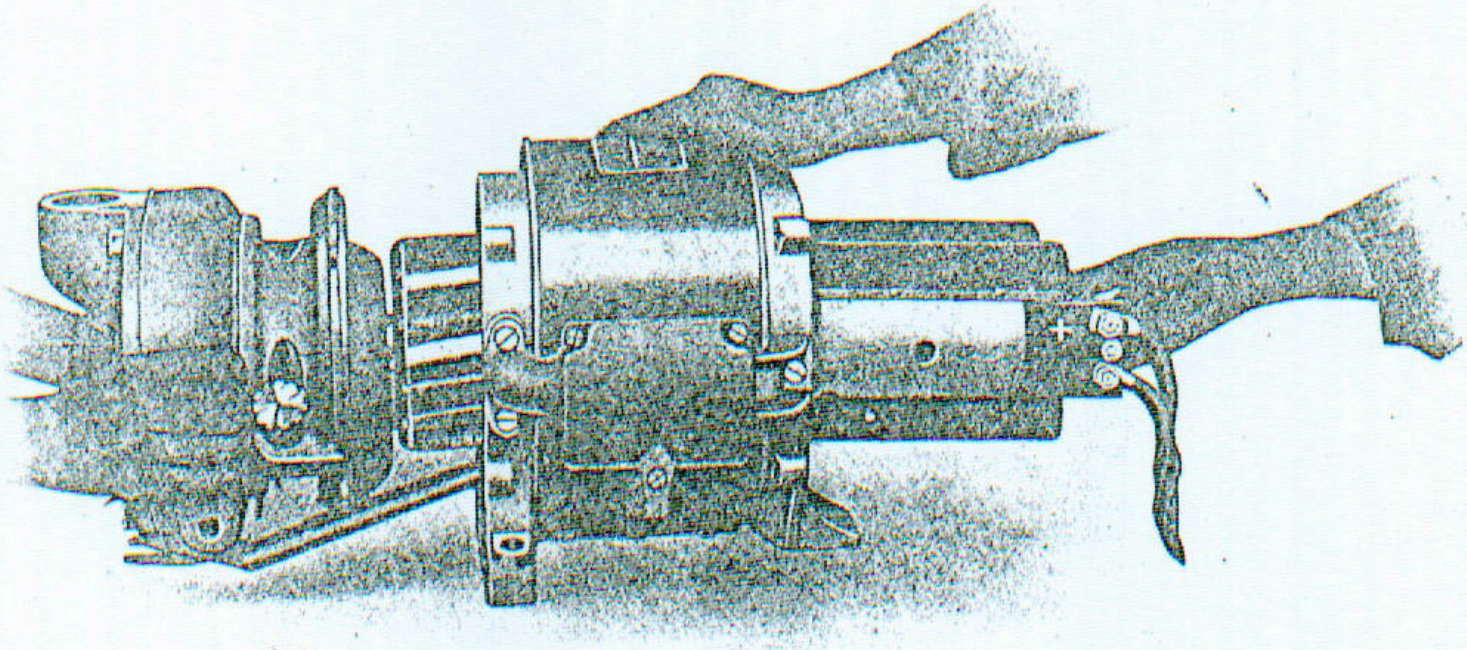

FIG. 4.

Entering rotor pushing out charger.

The rotor must not be removed after re-charging unless substituted by a keeper. (*See page* 13.)

Reassembly.

15. Replace turbine-end housing (33), inserting bolts with spring washers and tighten up evenly.

16. Replace the governor-end housing (29), insert bolts with spring washers and tighten up evenly.

17. Replace the oil sleeve and deflector (41) and then fit the ball-bearing (1) on shaft, using the special tools provided in the kit to engage the inner ring of the ball race. Do not force the bearing and be careful not to damage the screw thread on the shaft.

    Pass the oil ring (39) over the bearing so that it rests on the sleeve (41).

18. Replace the bearing washer (3) and bearing nut (2), tightening it well with the peg spanner by means of a sharp blow. Tighten up the lock-screw on the bearing nut securely.

19. Replace housing cap (31) noting that the two projecting pins go at the top above the oil ring.

NOTE.—The pins are to prevent the accidental displacement of the oil ring from its position on the shaft.

20. Screw on the governor body (19), tightening it with the box spanner by a sharp clockwise blow on the "Tommy" bar. Tighten up locking-screws (20) in governor body securely.

21. Replace governor casing (11), insert bolts with spring washers and tighten up evenly.

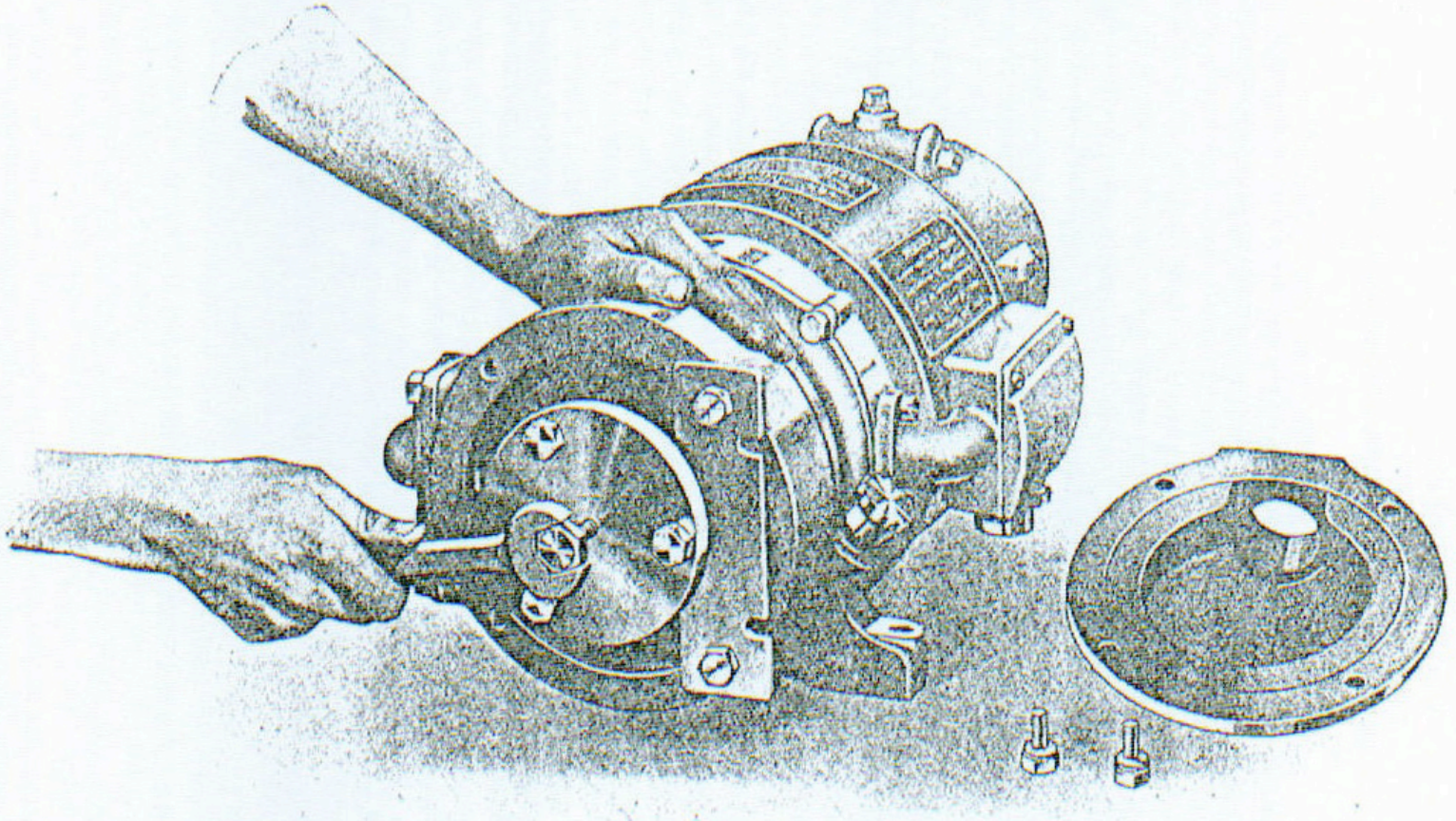

FIG. 5.
Removing bucket wheel from shaft—note use of locking strap.

22. Before re-assembling the steampipe, thoroughly clean the flange faces of old jointing, and fit new joints; we recommend the use of a special graphite jointing compound; apply this also to the bolts, it will ensure easy removal. This special compound will withstand a temperature of 600° F., and can be obtained from J. Stone & Co. Ltd.

23. Test the valve (53) to see that it works freely. (*See "Valve,"* p. 5.)

24. Replace inner thrust-plate (52), and ensure that the pin through the shaft engages with the slot. Swing the thrust block carrier (50) into position and replace outer thrust plate (51). Then replace and lock the governor stem lock nuts (27) and replace split-pin (when fitted).

(*See "Thrust-Blocks,"* p. 6, for proper clearances.)

Testing.—After re-assembly the turbo-generator should be tested for output and voltage, and the speed adjusted as found necessary (*see pages 7 and 8*).

NOTE.—Use only the special instrument referred to under "Speed Adjustment", page 7.

Dismantling of the Turbine End.—Should it be necessary to dismantle the turbine, say to renew the ball bearing (4), proceed as follows :—

1. Remove steam pipe and exhaust-end cover (13).

2. Remove split-pin (10) in bucket wheel nut (9) and attach the wheel-locking strap, using two of the bolts from the exhaust end cover, to prevent the wheel from turning. Then apply the plate

extractor by screwing the 3 bolts provided into the corresponding holes in the bucket wheel (7). Tighten the "Tommy" screw against the shaft centre, and give the head a sharp blow with a copper hammer. The bucket wheel may then be removed. (*See Fig.* 5.) Remove the key (8) from the shaft.

3. Remove the turbine-end casing (12) noting that flanges must be cleaned and joint renewed when replacing.

4. Remove the water-deflector (57) and the soft-steel pin (58) which locates it on the shaft.

5. Apply the extractor to the housing cap (35) and remove cap.

6. Slacken lock-screw and remove bearing-nut (5) and bearing washer (6) with the peg spanner.

7. Apply extractor to ball-bearing (4) and remove bearing, being careful not to damage oil ring.

8. When it is desired to remove the turbine-end housing (33) first remove the oil sleeve (42) from shaft. If tight, it may be removed with the housing.

Reassembly of Turbine End.

1. Replace turbine-end housing (33) and bolts with spring-washers, tightening up evenly.

   Replace oil sleeve (42) and oil ring (40) on the shaft, taking care that the ring rests on the sleeve.

2. Replace ball-bearing (4) using the special tool provided.

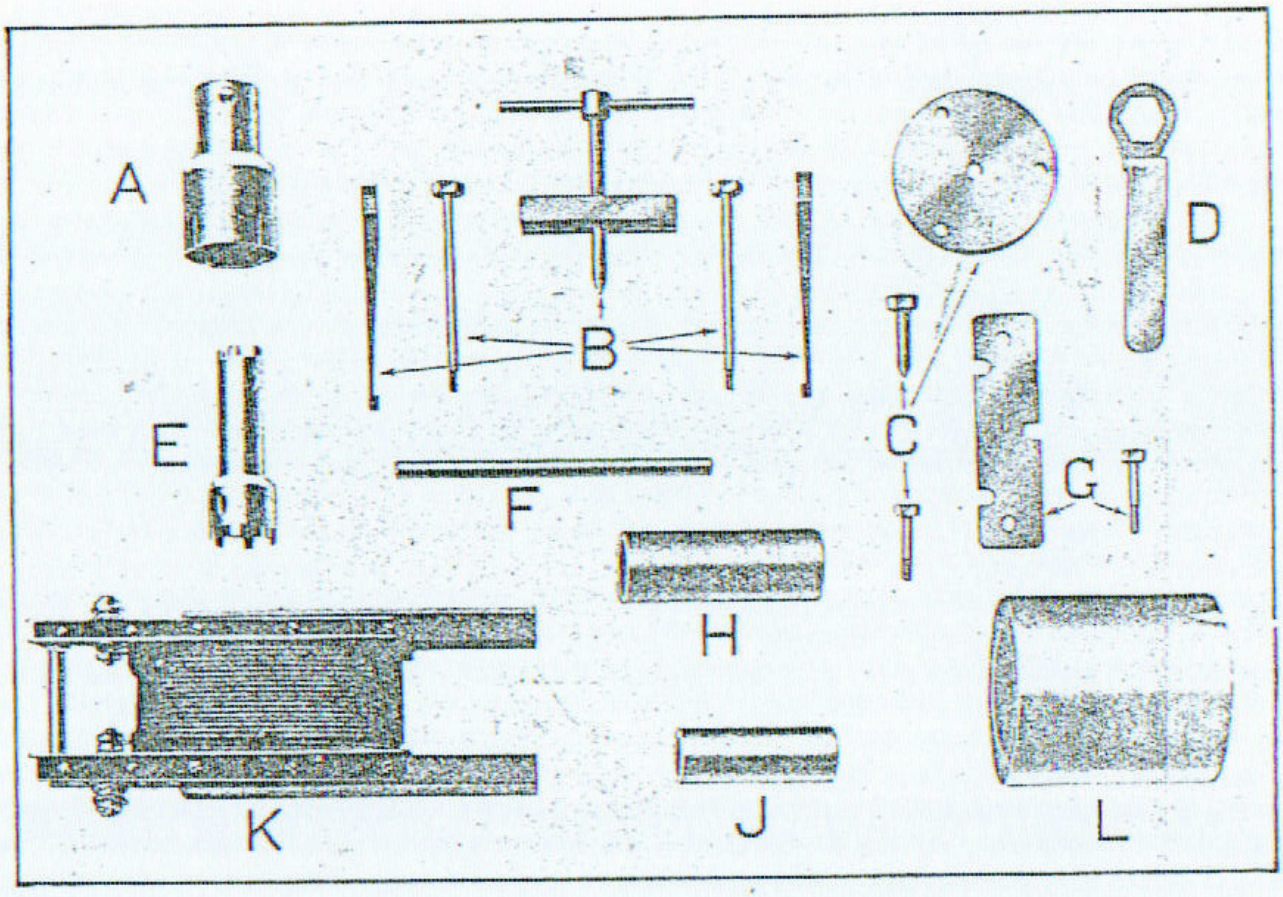

FIG. 6. **STONE'S L.B.B. TURBO-GENERATOR.**

Special Tools and Appliances, viz.:

A Box Spanner for Governor Body.
B Extractor for Ball Bearings.
C Extractor for Bucket Wheel.
D Ring Spanner for Bucket Wheel Nut.
E Peg Spanner for Ball-bearing Locking Nuts.
F Tommy Bar for A or E.
G Locking Strap for Bucket Wheel.
H & J Tools for fitting Ball-bearings.
K Charger. L Keeper.
(Ring Spanner not illustrated.)

Replace bearing washer (6) and bearing nut (5), and tighten the lock-screw.

3. Replace housing cap (35) and the bolts with spring washers, tightening up evenly.

4. Insert pin (58) in shaft and replace the water deflector (57).

5. Smear flanges with special graphite jointing compound to ensure steam-tight joints and replace the turbine-end casing (12) and the bolts with spring washers, tightening up evenly.

6. Attach wheel-locking strap and replace key (8) in shaft. Refit bucket-wheel (7). If a new key is fitted, see that all "burrs" are removed. Replace and tighten the bucket-wheel nut (9) securely, using the special ring-spanner.

   Insert a well-fitting split-pin through the bucket wheel nut, and splay out the ends.

NOTE.—When a new bucket-wheel has been fitted, the shaft must be set on knife-edges and the unit accurately balanced.

7. If the steam nozzle has been removed, clean the joint faces and refit with new joint ($\frac{1}{32}$" thick)

NOTE.—The thickness is important as it regulates the clearance between bucket-wheel and nozzle. The nozzle is adjusted in position and then dowelled before leaving the Works, there is therefore no difficulty in replacing it correctly. When fitting a new steam nozzle, it should be set so that the dimension from the extreme top edge to the periphery of the bucket-wheel is $\frac{1}{32}$" and a new dowel pin fitted if necessary.

8. Refit steam pipe, with new joints smeared with special graphite jointing compound to ensure steam-tight joints.

9. Refit exhaust end cover, cleaning all traces of old jointing from flanges and fitting new brown paper joint (37) coated with special graphite jointing compound. Replace bolts with spring washers.

Packing Rings.—As a precaution against oil creeping along the shaft, felt packing rings (30), (32), (34) and (36) are fitted in grooves in the housings and housing caps. When overhauling the generator it is well to take the precaution of renewing these. They need no attention while in service.

TONUM HEADLIGHT

The headlight requires little attention, apart from polishing of the reflector and front glass.

Polishing the Reflector.—To polish the reflector, open the front; blow off all dust or grit and remove the lamp, holding bulb in a clean cloth.

Use a clean and dry soft cloth, clean wash-leather or tissue paper free from all grit and polish lightly backwards and forwards from the centre to the rim—do not polish the reflector round and round.

Do not touch the glass with the fingers after polishing.

Care of Reflectors.—The reflector being of silvered glass must be handled with care if removed from the headlight. The back is protected by a metallic, damp-proof coating which must not be scratched or damaged at the edges.

Lamps.—The lamps used should be obtained from J. Stone & Co., as these are designed to give correct focus and to withstand shock and vibration.

The length of cap is arranged to take a special anti-vibration clip or locking nut which prevents the lamp

working loose in the socket. (Note. When the locking nut is fitted, this must be slackened back before removing the lamp.)

Polish the bulb with a soft dry cloth or tissue paper and hold in this when fitting.

Lamps should not be worked above their rated voltage.

Spare lamps should be carried on the locomotive in a suitable case.

Focussing.—The headlamp must be focussed before the locomotive goes into service and whenever a lamp is replaced.

To obtain a good light beam, suitable to the requirements of the driver, final adjustments must be made on the track, but a fair approximation may be obtained by setting the lamp so that the edges of the beam are as nearly parallel as possible. Make the adjustment by slackening the clamping screw and sliding the brass sleeve carrying the lamp holder in or out until correct; then tighten up the clamping screw and lock-nut securely.

SPARE PARTS AND ACCESSORIES

A fully illustrated catalogue of spare parts, tools and accessories will be furnished on request.

When ordering any part, quote the type from the nameplate, and give the name and part number from the spare parts catalogue. Do NOT use the index numbers from this text. These are only for reference to the sectional drawing at the end of book.

As a guide it is suggested that the following tools, accessories and parts should be available at each maintenance Depot :—

Tools and Accessories.

At least one each of the following :—

1. Tool kit containing special tools for L.B.B. Turbo-Generator.
2. Keeper.
3. Charger for 24 to 32 volt circuit.
4. Ammeter—D.C., complete with shunt, to read 5-0-150 amperes.
5. Voltmeter—A.C., calibrated for high frequency current, to read 0-40 volts.
6. Ammeter—A.C., calibrated for high frequency current, to read 0-25 amperes, complete with shunt.

   If current for re-charging the stator is to be taken from a constant voltage supply, the following will be required :
7. Variable Resistance, with multiple contacts, and a quick-break switch.

All these tools and accessories may be obtained from J. Stone & Co. Ltd.

Spare Parts.—On the basis of the first 10 equipments in service, the following spare parts are suggested against possible requirements :—

Turbo-Generator.

1—Steam Nozzle.
½ doz.—Gaskets for ditto.
1 doz.—Packings for Steam Elbows.
2—Asbestos Laggings for Steam Pipe.
1—Bucket Wheel.
3—Keys for ditto.
2—Nuts for ditto.
½ doz.—Split-pins for ditto.
3—Water Deflectors.
3—Brass Packing Rings for Deflector.

½ doz.—Pins for Deflector.
1 doz.—Assorted Felt Washers.
2—Ball-Bearings—Turbine End.
2—Ball-Bearings—Governor End.
2—Bearing Nuts with Lock-screws—Turbine End.
2—Bearing Nuts with Lock-screws—Governor End.
1 doz.—Lock-screws for above Nuts.
1—Bearing Washer—Turbine End.
1—Bearing Washer—Governor End.
2—Oil-sleeves and Deflectors—Turbine End.
2—Oil-sleeves and Deflectors—Governor End.
2—Oil Rings—Turbine End.
2—Oil Rings—Governor End.
1—Governor complete including weights, Spring, Locking Screw, etc., but without Thrust Plates.
1—Governor Spring.
½ doz.—Governor Body Locking-screws.
2 doz.—Governor Stem Lock-nuts.
1—Thrust Block Carrier.
3—Outer Thrust-plates.
3—Inner Thrust-plates.
2 doz.—Thrust-blocks.
1—Rocker complete.
1—Rocker Quadrant.
½ doz.—Rocker Quadrant Adjusting Pins.
3—Valves complete.
3—Valves only with Stems.
2 doz.—Valve Stop-rings.
1 doz.—Steam Strainers.
1 doz.—Stop-plugs for Strainer
2—Lubricator Caps, complete
1—Governor-end Cover.
1 doz.—Hinge-pins for ditto.
3—Oil Drain Plugs for Casings.

Generator.

1—Rotor, complete with Shaft.
2—Pairs of Stator Coils (*specify voltage*).
8—Coil Retaining Wedges.
4—Coil Connector Lugs.
2—Flexible Tubes for Coil Connections.
1—Terminal Box Cover.
1—Pair Magnets (not magnetised).
Assortment of screws (except those listed above) bolts, nuts, pins, spring pins, and spring washers, say 2 dozen each size and length also length of safety chain.

Headlight.

1—Main Door complete with Glass.
1—Retaining Ring for Front Glass.
2—Packings for Main Door.
3—Spare Window Glasses and Packings for ditto.
2—Glass Reflectors complete with Packings.
1—Reflector Retaining Ring and Packing.
1—Headlamp Holder complete.
1—Headlamp Holder Clamp complete.
1—Lamp Grip (Anti-vibration).
1 doz.—each. Assorted bolts, nuts, split-pins, hinge pins, etc.
36—250 watt Special "Focus" Lamps for Tonum Headlamps (*specify voltage*).
48—15 watt Vacuum Lamps for Cab fittings—(*specify voltage and if Bayonet (B.C.) or Screw Cap) (E.S.).*

The quantities given are the minimum advisable as a basis and some of the items—particularly parts subject to wear such as valves with stems, strainers, thrust blocks, lamps for headlamps and lamps for cab fittings, should be increased more than others when the number of equipments to be maintained at any depot is greater.

STONE'S L.B.B. TURBO-GENERATOR.

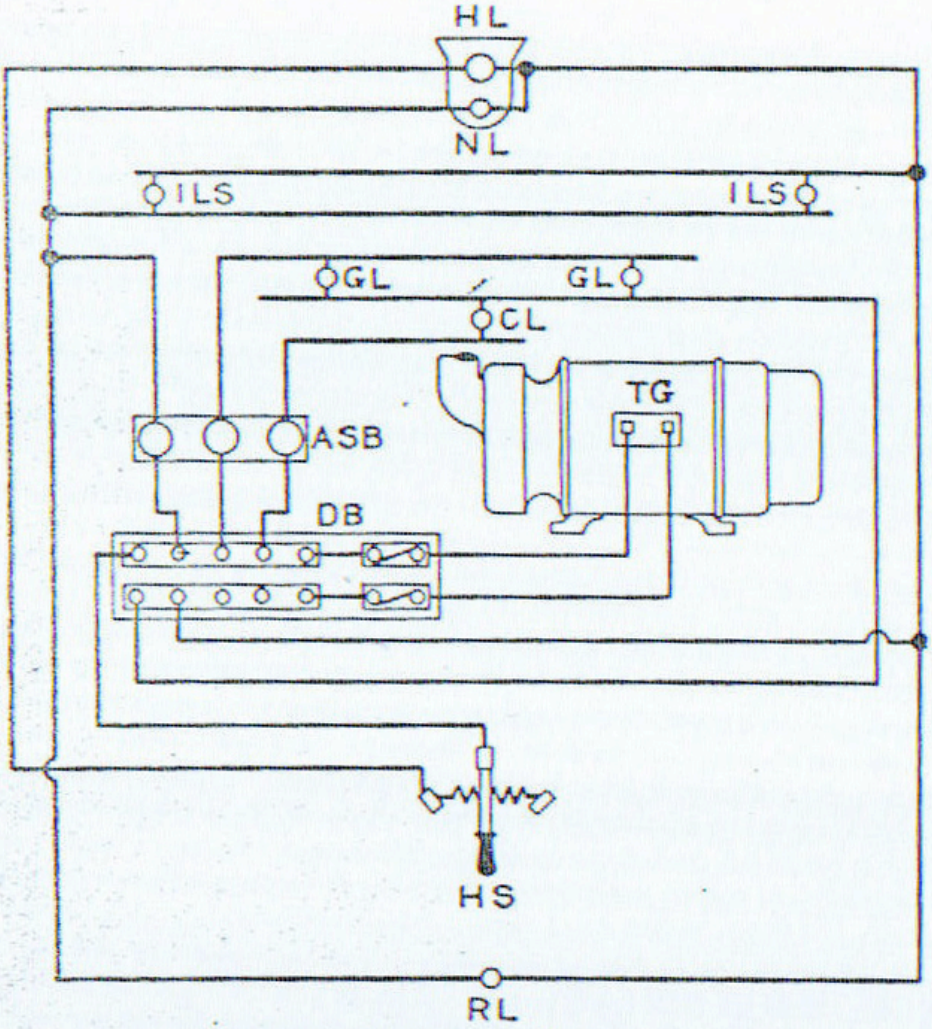

DIAGRAM A.

FIG. 7.—DIAGRAM OF CONNECTIONS FOR L.B.B. TURBO HEADLIGHT EQUIPMENT WITH SINGLE HEADLIGHT.

TG L.B.B. Turbo-Generator.
HS 3-way Headlight Switch with dimming resistance, for "full," "dim" or "off."
ASB Auxiliary Switch Box for controlling other lamp circuits.
DB Distribution Box with main fuses.
HL Headlamp with (NL) pilot or numeral light.
CL Cab light.
GL Gauge lights.
ILS Portable inspection lamp sockets
RL Tail light.

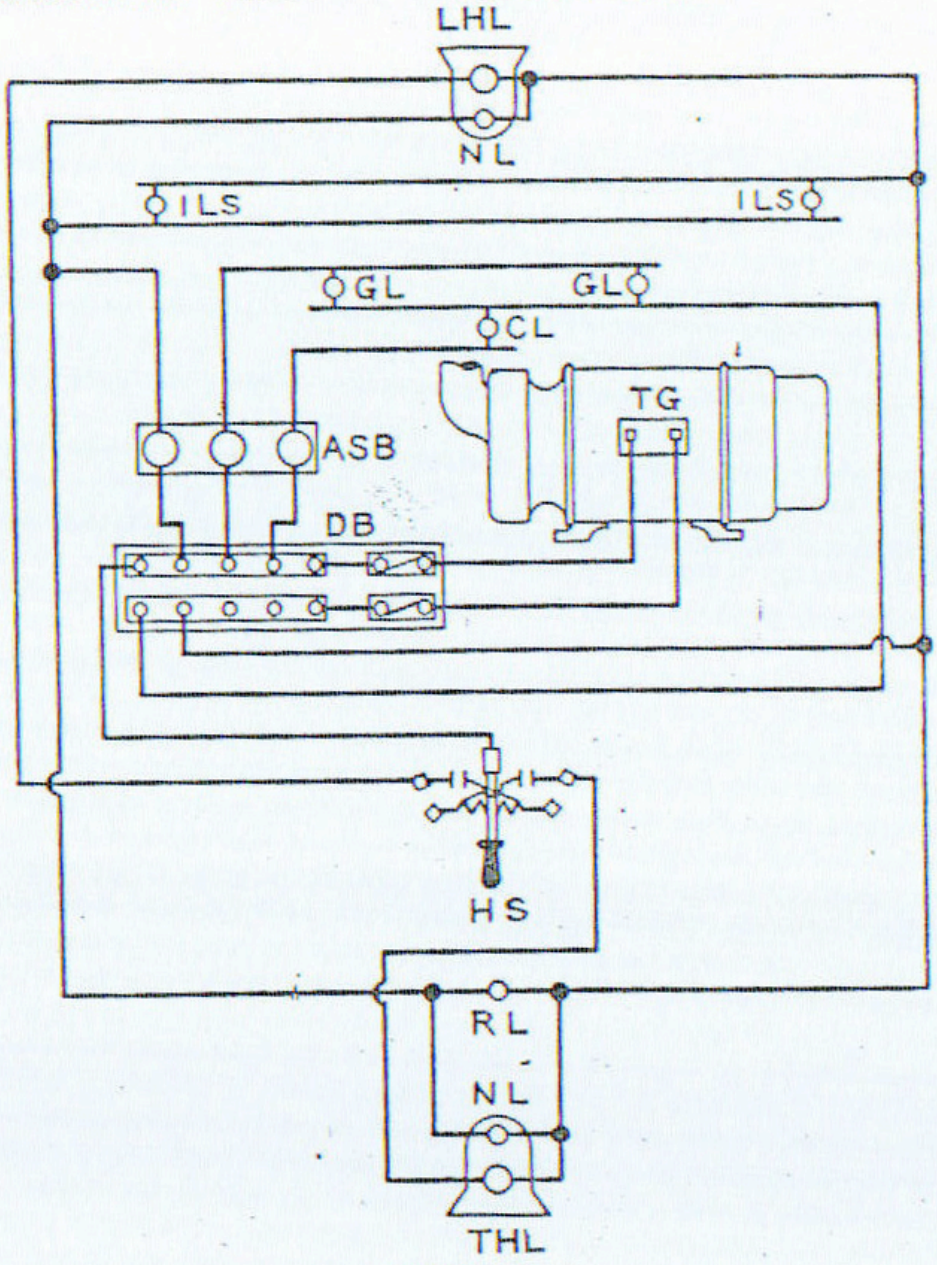

DIAGRAM B.

FIG. 8.—DIAGRAM OF CONNECTIONS FOR L.B.B. TURBO HEADLIGHT EQUIPMENT WITH HEADLIGHT AT EACH END OF LOCOMOTIVE.

TG L.B.B. Turbo-Generator.
HS 5-way Headlight Switch with dimming resistance to provide "full," "dim" or "off" to either front or rear headlight.
ASB Auxiliary Switch Box for controlling other lamp circuits.
DB Distribution Box with main fuses.
LHL Front Headlight with (NL) pilot or numeral light.
THL Rear Headlight with (NL) pilot or numeral light.
CL Cab light.
GL Gauge lights.
ILS Portable inspection lamp sockets.
RL Tail light.

Index Number to Drawing opposite.	PART OR LOCATION.
1	Ball Bearing, Governor End.
2	Ball Bearing Nut with Lock Screw, Governor End.
3	Ball Bearing Washer, Governor End.
4	Ball Bearing, Turbine End.
5	Ball Bearing Nut with Lock Screw, Turbine End.
6	Ball Bearing Washer, Turbine End.
7	Bucket-Wheel.
8	Bucket Wheel Key.
9	Bucket Wheel Nut.
10	Bucket Wheel Split-Pin.
11	Casing, Governor End.
12	Casing, Turbine End.
13	Cover, Exhaust End.
14	Drain-Plug for Oil, Governor End.
15	Drain-Plug for Oil, Turbine End.
16	Drain for Water (*location of*).
17	Frame of Generator.
18	Governor Adjusting Nut.
19	Governor Body.
20	Governor Body Locking Screw.
21	Governor End Cover.
22	Governor Nut-Lock.
23	Governor Spring.
24	Governor Spring Follower.
25	Governor Spring Follower Pin.
26	Governor Stem.
27	Governor Stem Lock Nut.
28	Governor Weight.
29	Housing, Governor End.
30	Housing, Governor End, Felt Packing.
31	Housing, Cap-Governor End.
32	Housing, Cap-Governor End, Felt Packing.
33	Housing, Turbine End.
34	Housing, Turbine End, Felt Packing.
35	Housing, Cap-Turbine End.
36	Housing, Cap-Turbine End, Felt Packing.

Index Number to Drawing opposite.	PART OR LOCATION.
37	Joint (brown paper) for Exhaust End Cover (*location of*).
38	Magnets.
39	Oil Ring, Governor End.
40	Oil Ring, Turbine End.
41	Oil Sleeve and Deflector, Governor End.
42	Oil Sleeve and Deflector, Turbine End.
43	Rocker.
44	Rocker Quadrant.
45	Rocker Quadrant Adjusting Pin.
46	Rotor (with shaft).
47	Steam Strainer.
48	Thrust-Block, Outer.
49	Thrust-Block, Inner.
50	Thrust-Block, Carrier.
51	Thrust-Plate, Outer.
52	Thrust-Plate, Inner.
53	Valve.
54	Valve Body.
55	Valve Stem.
56	Valve Stop-Ring.
57	Water Deflector.
58	Water Deflector Pin.
59	Exhaust Baffle.

IMPORTANT NOTE.—The index numbers above are given as a guide to the sectional drawing opposite and **MUST NOT** be referred to when ordering parts.

SPARE PARTS.—When ordering parts quote type from nameplate and part numbers as given in Spare Parts catalogue.

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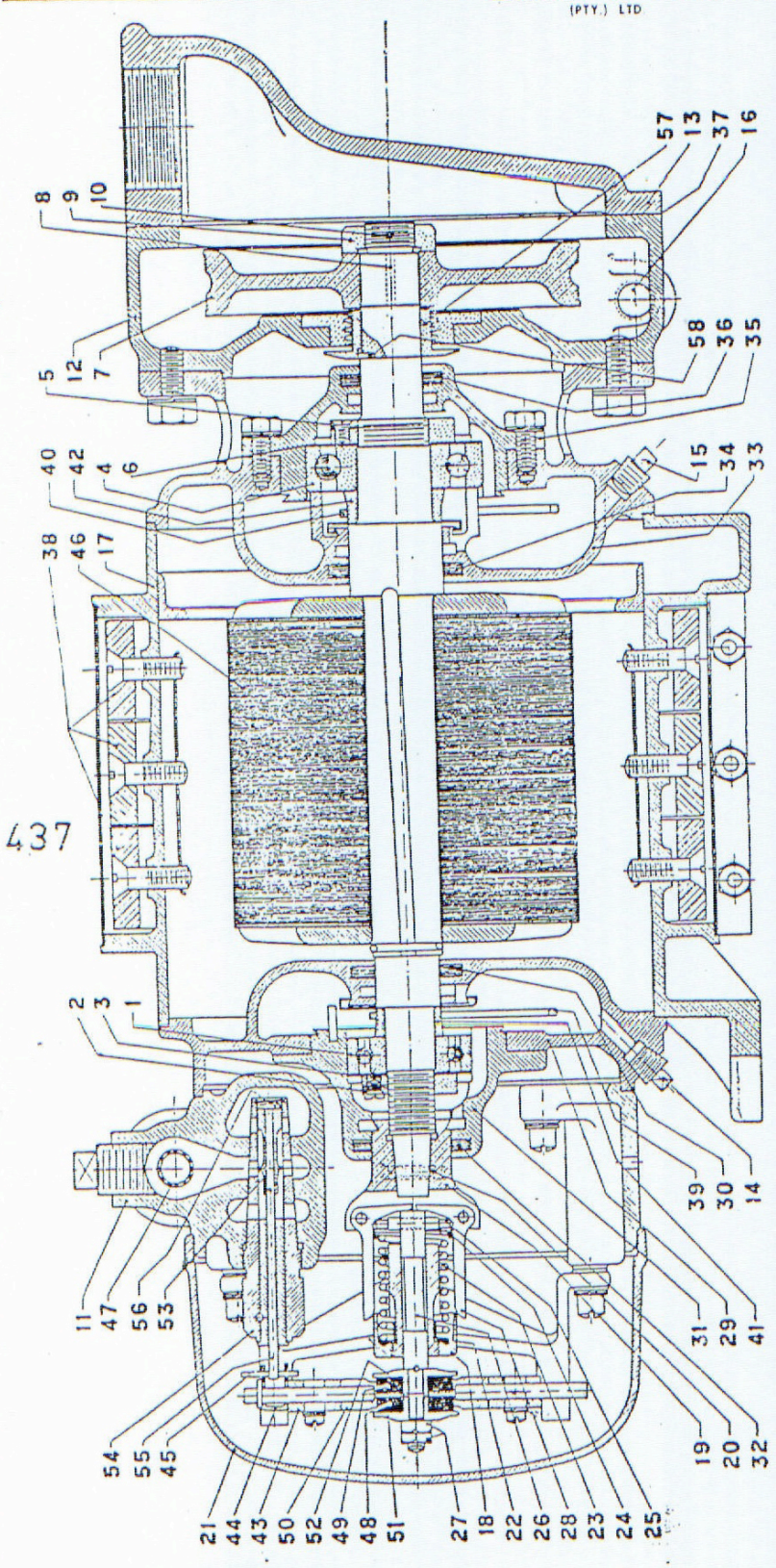

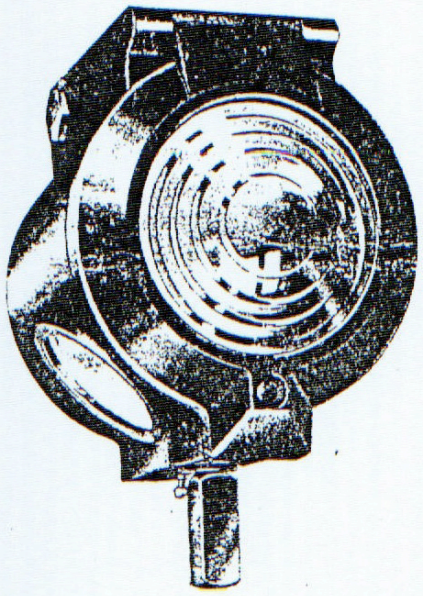
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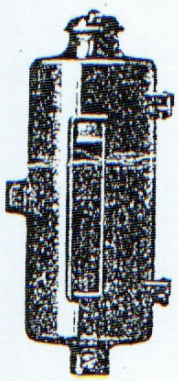
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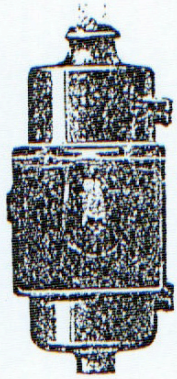
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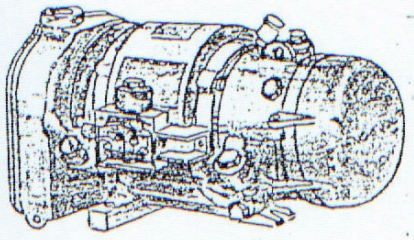
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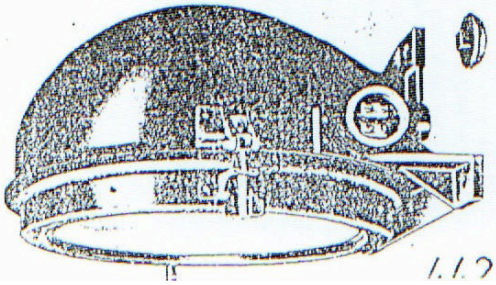
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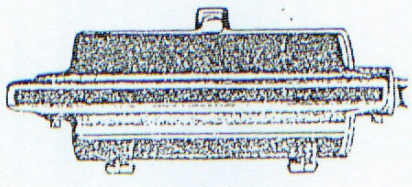
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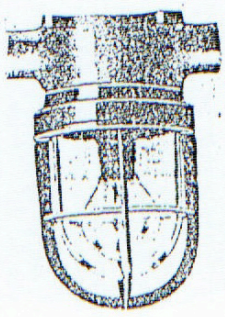
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