Governor
(Transformer Type)

In order to simplify the description, this type of governor can conveniently be divided into three parts, each of which has a definite function. These parts are:

(1) Governing impeller which is mounted on the turbine shaft and when supplied with oil discharges at a pressure which varies as the square of the speed, thus giving a positive governing medium.

(2) The governor transformer which magnifies the relatively small pressure changes delivered by the impeller into larger pressure changes which are utilized to actuate the relays of the servo-motor.

(3) The servo-motor which operates the governing (steam inlet) valves.

The governing impeller and also the main oil pump impeller, are shown in Figure 1. The governor transformer and the servo-motor are combined in a single housing as shown in Figure 2. The transformer is shown in Section B-B-B-B-B, while the servo-motor is shown in Section A-A. Figures 3, 4, and 5 are added to show more clearly the detail construction of the various parts.

Oil Impellers

Figure 1 shows the arrangement of the two impellers which are secured on the turbine shaft between the thrust bearing and the overspeed trip mechanism. The impeller on the left, item "3", serves as the main oil pump and supplies all the oil requirements while the turbine is operating at normal speed. It is of the conventional centrifugal type with efficient characteristics and discharges at a pressure of approximately 100 lbs/in^2 gauge at normal operating speed. This impeller is not self-priming. While operating at normal speed, its suction is supplied by an ejector which utilizes a part of the high pressure oil from the impeller discharge as the operating medium. During the starting period, this impeller suction is supplied by the auxiliary oil pump.

The ejector is designed to handle all oil required for lubrication and the normal leakage. The servo-motor operating piston discharges directly into the impeller suction line and, therefore, does not add load to the ejector. The size of the ejector nozzle and the quantity of oil handled by it are the factors which determine its discharge pressure. Consequently, after the turbine is installed and running under normal operating conditions, this pressure should remain constant. Any decrease in the discharge pressure indicates an increase in leakage in the system and if it should drop to 4 lbs. gauge or less, the impeller oil seal rings should be inspected and replaced if worn.

The governing impeller is made integrally with the overspeed trip body. It consists merely of an inclined hole drilled in the body "9". As shown in the illustration, this hole is placed so that one end opens into the chamber "X" between the two oil seal rings "10", while the other end opens into the drain chamber.

An orifice plug admits a small quantity of high pressure oil from the main pump discharge into the annular chamber "X" and maintains a small flow through the impeller hole to the drain chamber. With the impeller "9" rotating, the centrifugal force of the oil in that half of the hole between the chamber "X" and the axis of the impeller, opposes the flow through the hole and maintains in the chamber "X" a pressure which varies as the square of the turbine speed (at normal speed this pressure is about 40 lbs/in^2). In other words, this impeller acts as a relief valve, maintaining a pressure corresponding to the centrifugal force of the column of oil in the impeller hole and by-passing to the drain any excess oil supplied through the orifice above that required to maintain the pressure in chamber "X".

The chamber "X" is connected to the governor transformer and the pressure changes in this chamber produced by speed changes constitute the governing forces which control the valve servo-motor. <u>If the turbine speed increases, this pressure in chamber "X" increases, and if it decreases, this pressure decreases.</u>

It is important to check the pressure in chamber "X" when testing the overspeed trip mechanism by overspeeding the turbine. If a gradual drop in this pressure is noticed at subsequent tests (at identical speeds) it is an indication of either excessive wear in the seal rings "10" or gradual plugging of the supply orifice.

<u>Governor Transformer</u>

As stated above, this mechanism (shown in Fig. 2, Section B-B-B-B), is in reality a pressure transformer which magnifies the relatively weak pressure changes which are received from the governing impeller into pressure changes sufficiently strong to actuate the relay of the valve servo-motor.

Its principal parts are: The flexible metal bellows "75", the load spring "79", and the relay "94". Oil at the pressure delivered by the governing impeller enters the chamber around and below the bellows "75", thus exerting an upward force on the annular area of the plate which forms its lower support. This force is opposed by the tension spring "79", which exerts a downward force on the bellows. The relay "94" operates within the ported housing and is kept revolving at all times by a jet of oil directed against the spinner "102" so as to reduce the friction to a minimum and make the mechanism highly sensitive.

The upper "land" on the relay controls ports which admit high pressure oil to the central annulus around the relay, while the lower "land" controls ports which connect this central annulus to the drain. The central annulus between the two relay "lands" is connected to the annular area at the top of the relay and also is connected to the inner chamber of the servo-motor relay bellows "72". This central annulus contains oil under the regulating (or transformed) pressure, denoted by "Z", which pressure varies with movements of the relay and exerts a downward force on the relay.

From the above, it can readily be seen that upward movement of the relay "94" closes the drain ports and opens the high pressure ports, thus increasing the regulating pressure "Z". Conversely, downward movement of the relay closes the high pressure ports and opens the drain ports, thus decreasing the regulating pressure "Z". In following the operation of this mechanism, it is important to bear in mind that whatever pressure "Z" exists in the annular chamber between the two relay "lands" is transmitted also to the chamber above the relay, and any change in this pressure results in a change in the force acting downward on the top of the relay.

As shown in the illustration, the spinner which forms the lower end of the relay merely rests upon the upper spring seat bolt. If the governing oil pressure under the bellows decreases, the spring moves the bellows plate downward and the relay follows downward due to the pressure "Z" acting above it. If the governing oil pressure under the bellows becomes great enough to overcome the spring, the bellows plate and relay move upward. With the relay "94" in its neutral position, the upward force of the governing oil below the bellows "75" must balance the downward force of the spring "79", plus the downward force "Z" of the oil acting above the relay, and any movement of the relay changes the oil pressure "Z" above it so as to re-establish this balance and thereby return the relay to its neutral position.

It should be noted that the change in regulating pressure "Z" is dependent upon the ratio of the effective areas of the annulus at the bottom of the bellows and that at the top of the relay. For example, if the annular area at the bellows is taken as 10 sq.in. and the annular area at the top of the relay as 1 sq.in. an increase of 1 lb. oil pressure below the bellows will produce a 10 lb. increase in regulating pressure "Z" in order to maintain the relay in a balanced state. This is the principle by means of which the comparatively small pressure changes produced by the governing impeller are magnified so as to obtain large pressure changes to actuate the servo-motor.

In normal operation, this governor will have the customary regulation (or frequency change) between no load and full load. However, by opening the piston type valve "109" (which is shown in Section E-E, view "U", Figure 4), this regulation can be reduced to a small figure and the governor made practically isochronous. As described above, the regulating pressure "Z", which is controlled by movement of the relay "94", acts on the top of the relay to return it to its neutral position. By connecting the top of this relay "94" to the bottom, the effect of the regulating pressure on top of the relay is eliminated and the relay does not return to its neutral position until the oil pressure below the bellows "75", and hence the speed of the turbine, return to their respective normal values.

In order to maintain stability of operation, the change in pressure "Z" cannot be applied below the relay immediately, a certain time lag being essential. This time lag is obtained by means of the constant orifice "114", adjustable needle valve "112" and air bell "95" which are placed in the passage between the chambers above and below the relay. The function of this time lag is to allow the normal speed change, due to load change, to move the governing valves to their proper positions first, and then by slowly applying the change in pressure "Z" below the relay, the motion of the governing valves is further increased until the same speed which existed before the load change is re-established.

The top of the relay is connected to the chamber at the bottom by the drilled passage shown in the upper portion of Section L-L, view "W", Figure 4, and this passage is opened or closed manually, as desired, by means of the handwheel "105" (shown in Section E-E, view "U", Figure 4) which moves the piston type valve "109". Opening this valve, renders the governor isochronous. Closing the valve, causes the governor to operate with its normal regulation characteristics. When changing over from one type of operation to the other, the handwheel "105" should be turned slowly a part of its travel, and then, to compensate for the change in speed, correct it with the speed changer. Repeat this operation, in relatively small steps, until valve "109" is fully open or closed as the case may be.

When this isochronous feature is not furnished the drilled passage connecting the top of the relay with the chamber at the bottom of the relay, is closed by means of a plug "92" (shown in view "S", Figure 4).

An oil filter is used in the H.P. oil supply to the transformer relay (shown in Figure 2, section B-B-B-B). The filter body is an integral part of the transformer relay body "99". The filter element complete "97" consists of a stack of round, thin, perforated discs, each one separated from the other by a very thin metal spacer, the thickness of the spacer determining the fineness of filtration. Oil enters the cartridge from the outside, passes through the spaces, goes up through the interior of the discs and out to the discharge. These discs are assembled with stationary cleaning fingers so that revolving the handle "34" scrapes the cartridge clean. The solid matter drops and settles to the bottom of the body. The spinner nozzle "116" (shown in view Y, Figure 4) is supplied through a passage leading from the bottom of the filter body and therefore the fine solid matter is carried from the body by the spinner jet and discharged to drain. A relief valve is incorporated in the filter unit to prevent failure of the oil supply due to fouling of the filter cartridge. To keep the filter clean the handle should be turned frequently, when the unit is first put in service and following any major overhaul. Thereafter, once a week should be sufficient.

Governing Valve Servo-Motor

The governing valve servo-motor (shown most clearly in Section A-A, Figure 2) consists of the operating piston "3" which is controlled by a double relay mechanism. The upper end of the operating piston rod is connected to the governing valves by means of a lever which is fulcrumed so that downward movement of the piston opens the valves and upward movement closes them.

The principal parts of the relay mechanism are: the main relay "27", the cup valve "60", the flexible metal bellows "72", and the spring "24". As shown in Figure 2, a small hole drilled in the top of the main relay connects the high pressure oil inlet to the chamber above the relay. Also, the central hole through the entire length of the main relay connects this chamber above it to the drain. The cup valve seats on top of the relay around the hole which leads to the drain. The small orifice from the high pressure oil supply builds up a pressure in the chamber above the relay. The cup valve controls the flow of oil from this chamber to the drain, thereby controlling the pressure so as to just balance the upward force of the spring "28", and causes the main relay to move instantly as the cup valve is moved by the regulating pressure changes on the bellows. Since there is a continuous flow of oil through the orifice in the relay bushing to the chamber above the relay, there will be also a continuous flow through the cup valve to the drain in order to maintain a balanced relay. Therefore, it is evident that upward movement of the cup valve increases the flow through it to the drain, thereby decreasing the pressure above the relay. Conversely, downward movement of the cup valve decreases the flow through it to drain, thereby increasing the pressure above the relay. These pressure changes above the relay, together with the spring force below it, cause the relay to follow all movements of the cup valve (within a few thousandths of an inch), thus giving practically the same results as though they were connected to each other.

The cup valve "60" is secured to the bellows cover and also the spring "24" by suitable linkage. The regulating oil pressure "Z" delivered by the transformer relay is admitted to the inner chamber of the bellows "72" and exerts a force tending to move the bellows downward. This force is opposed by the tension spring which tends to move the bellows and cup valve upward. Therefore, any change in the regulating pressure above the bellows results in movement of the bellows cover which is transmitted to the cup valve which, in turn, controls the pressure above the main relay.

The spring "24" connects the cup valve to the operating piston follow-up lever "15", which is fulcrumed so that following any change in speed and pressure "Z", the resulting operating piston movement increases or decreases the spring tension until it balances the change in pressure "Z" thereby returning the cup valve and hence the relay to its neutral position.

With the turbine carrying a constant load, the relay will be in a neutral position. In this position, the downward force of the oil pressure acting above the bellows "72" is just balanced by the upward force of the spring "24", and there will be no movement of the cup valve. Likewise, the main relay "27" will be just balanced by the downward force of the oil on top of it and the upward force of the compression spring "28" at the bottom.

Assuming that the mechanism is in operation and with both the transformer relay "94" and the servo-motor relay "27" in their respective neutral position, the following outlines a complete cycle of control.

If the load increases, the turbine speed decreases and the governing oil pressure below the transformer bellows "75" decreases, thus allowing the tension spring "79" to move the transformer relay "94" downward. Downward movement of this relay opens the lower relay ports to the drain chamber, thus decreasing the regulating pressure "Z". With the pressure "Z" (which also acts against the annular area at the top of the relay) decreased, the existing force of the oil pressure below the bellows returns the relay to its neutral position.

The decreased regulating pressure "Z" thus established by the transformer relay, has, at the same time, decreased the downward force on the servo-motor relay bellows "72", thus allowing the spring "24" to move the cup valve "60" upward. This upward movement of the cup valve increases the flow of oil from the chamber above the main relay to the drain. This decreases the pressure above the relay "27", thereby allowing the spring "28" to move it upward. Upward movement of this relay admits high pressure oil above the operating piston and connects the space below to drain. The operating piston, therefore, moves downward, thus opening the governing valves. This downward movement of the piston, acting through the follow-up lever "15", decreases the tension of spring "24" until this decreased spring tension balances the decrease in regulating oil pressure, thereby returning the relay to its neutral position.

If the load decreases, the turbine speed increases and the governing oil pressure acting below the transformer bellows "75" increases, thus compressing the bellows and moving the relay "94" upward. Upward movement of this relay opens the upper ports, thus admitting high pressure oil which increases the regulating pressure "Z" until its force at the top of the relay again balances the increased force due to the change of oil pressure below the bellows and again returns the relay to its neutral position. At the same time, this increased regulating pressure "Z" acting above the servo-motor relay bellows "72" moves the cup valve "60" downward, thus decreasing the flow of oil from the chamber above the main relay "27" to the drain. This increases the pressure above the relay, thereby moving it downward. Downward movement of this relay admits high pressure oil below the operating piston and connects the space above to the drain. The piston, therefore, moves upward, thus closing the governing valves. This upward movement of the piston, acting through the follow-up lever "15", increases the tension of spring "24" until the increased spring tension balances the increase in regulating oil pressure, thereby returning the main relay to its neutral position.

From the above, it is seen that following any movement of the relay, the operating piston moves in the opposite direction. The follow-up lever, item "15", which connects the piston rod and the relay spring, is fulcrumed on the bracket "23" so that, following any relay movement, the resulting piston movement changes the tension in spring "24" so as to return the relay to its neutral position until another change in speed (or load) occurs.

Speed Changer

The hand or motor operated speed changer, by means of which the speed (or load) can be varied, is shown in Figure 2, Section B-B-B-B, and in detail in Figure 5. The desired changes are accomplished by changing the tension of the transformer spring "79". From the description given above, it is obvious that increasing the tension of this spring increases the turbine speed (or load) and decreasing the tension of this spring decreases the turbine speed (or load). Referring to Figure "5", the principal parts of the speed changer are: The hand wheel "18", sleeve "15", worm wheel "14" and stem "4". The stem "4" is threaded in the sleeve "15". The sleeve, however, is held against axial movement by the housing and the stem is held against rotation by the key "5". Therefore, when the handwheel "18", which is attached to the sleeve, is rotated, the sleeve rotates, thereby moving the stem axially. When the mechanism is motor operated, the worm wheel "14" drives the sleeve "15" through a friction clutch formed by the plate "13" and compression spring "10".

The end of the stem "4" carries a roller which rides against the rocker arm "85" (shown in view "M" of Figure 3.) This rocker arm is fulcrumed in the housing and carries two fingers "86" which ride upon shoulders on the transformer spring adjusting screw "81". Therefore, movement of the speed changer stem to the left (as viewed in the illustration) lowers the spring adjusting screw, thereby increasing the tension of the spring and hence the speed of the turbine. Conversely, movement of the speed changer stem to the right allows the adjusting screw to rise, thereby decreasing the tension in the spring and decreasing the turbine speed.

For comparatively large speed range adjustments, a supplementary mechanism can be provided as shown in view "N" Figure 3. The shaft "58" forms a worn gear which meshes with a similar gear "59" carried on the lower end of the transformer spring adjusting screw. Therefore, rotating the shaft "58", which can be done manually by means of handwheel "55", rotates the adjusting screw within the spring nut "82", thereby increasing or decreasing the tension of the spring "79" as desired. On the large machines, this mechanism is used as a convenient means of overspeeding the turbine for the purpose of checking the adjustment of the overspeed trip mechanism. On those machines which require only a normal speed changer range and on which this supplementary speed changer is not required for the overspeed tests, the parts shown in view "N" are omitted.

Adjustments:

The governor is thoroughly tested and adjusted at the factory and should operate satisfactorily as received. However, when reassembling the parts after an inspection or if it should become necessary to check the accuracy of the adjustments, the following points should be noted.

Before starting these adjustments, the supplementary speed changer stops (items "80" and "84") should be assembled at the top and bottom of the screw "81" as shown in full lines.

Follow-Up Lever Mechanism (Refer to Figure 2).

1. - If the follow-up lever "15" is dismantled, it is important to reassemble the fulcrum pin "17" in the same hole as found originally, in order to maintain the same regulation. Moving this fulcrum pin to the right gives a closer regulation, and moving it to the left gives a wider regulation.

2. - Adjust the tension of the relay spring "24" so that the differential pressure acting downward on the bellows "72" is not less than 5 lbs. gauge at any time. This can be done as follows:

   On turbines without exhaust pressure or extraction pressure regulators, hold the turbine speed at normal by means of the throttle valve and adjust the speed changer until all valves are wide open. This gives a minimum governor regulating pressure above the bellows. Then adjust spring "24" to make this minimum not less than 5 lbs., adjusting the speed changer if necessary to keep all valves wide open.

   When an exhaust or an extraction pressure regulator is used, the regulator must be blocked in its position calling for wide open steam valves. This gives a maximum regulating pressure below the bellows "72". Then proceed as above to adjust spring "24" to give a minimum differential pressure of 5 lbs. acting downward on the bellows.

3. - If an exhaust or extraction pressure regulator is used, cut it out of service before making additional adjustments

Main Speed Changer (Refer to Fig. 5)

4. - Turn the speed changer handwheel in the "Decrease" direction until it strikes its stop.

5. - Adjust the supplementary speed changer handwheel "55" (Fig. 3) to maintain a speed 8% below normal.

6. - Turn the main speed changer handwheel in the "Increase" direction and (holding the speed at normal rpm by means of the throttle valve) continue movement of the speed changer until all valves are wide open.

7. - This is the full load position of the speed changer. Set the stop "19" (Fig. 5) against the handwheel hub and lock it in place.

8. - Shut down the unit.

Supplementary Speed Changer (Refer to Fig. 3)

9. - The low speed limit of the supplementary speed changer is now established by setting the stop "80" against the top of nut "82".

   The only method of determining the distance stop "80", must be moved down is to count the number of turns required to bring it against the nut in its present location. Therefore, turn the supplementary handwheel "55" in the "Decrease" direction, counting the turns, until stop "80" strikes the nut.

   Then the number of handwheel turns multiplied by 3/8 gives the number of turns stop "80" must be moved downward on the screw "81". Dismantle the mechanism and make this change. Then re-assemble.

10. - Put the unit in operation with no load.

    Adjust the supplementary speed changer to its low speed limit.

Adjust the main speed changer to maintain normal speed.

11. - By means of the supplementary speed changer, increase the speed to 12% above normal. (It is necessary to hold the overspeed trip valve shut in order to reach 12% above). Then shut down, and set the high speed limit stop "84" against the bottom of nut "82".

Note: If these adjustments do not give the desired range, change stops "80" and "84" accordingly.

One turn of the stop on screw "81" changes the speed range approximately 2%.

One turn of handwheel "55" changes the speed approximately 3/4 of 1%.

The above adjustments give a 12% overspeed on the supplementary speed changer plus an additional 6 or 7% on the main speed changer. Since 12% is the maximum overspeed that should be used, it is of utmost importance to have the main speed changer in its mid (or no load) position whenever using the supplementary changer for checking overspeed.

Likewise, it is necessary to have the supplementary speed changer in its low speed limit of travel whenever the unit is in normal operation. Otherwise, the main speed changer will not give its normal range of load control.

If it is necessary to govern at speeds less than 8% below normal, the stop "80" should be moved upward on the screw "81", bearing in mind that one turn changes the speed range approximately 2%.

If the governor is not equipped with a supplementary speed changer, the adjustment under step 5 is obtained by turning the screw "81" directly. Then steps 9 to 11 inclusive do not apply.

The following list has been compiled to facilitate ordering spare or renewal parts by item number and name, together with the serial number of the turbine:

Item No.	Name
	Figure 1
1	Main Pump Impeller Discharge Guide (Upper Half)
2	Main Pump Impeller Suction Guide (In Halves)
3	Main Pump Impeller
3-A	Main Pump Impeller Wearing Ring
4	Oil Seal Ring (Large)
5	Main Pump Impeller Discharge Guide (Lower Half)
6	Oil Seal Packing Ring
7	Governing Impeller Casing (Lower Half)
8	Governing Impeller Casing Baffle (Lower Half)
9	Governing Impeller and Overspeed Trip Body
10	Oil Seal Ring (Small)
11	Governing Impeller Casing (Upper Half)
12	Governing Impeller Casing Baffle (Upper Half)
13	Main Pump Impeller Suction Guide Bolt
14	Governing Impeller Casing Bolt

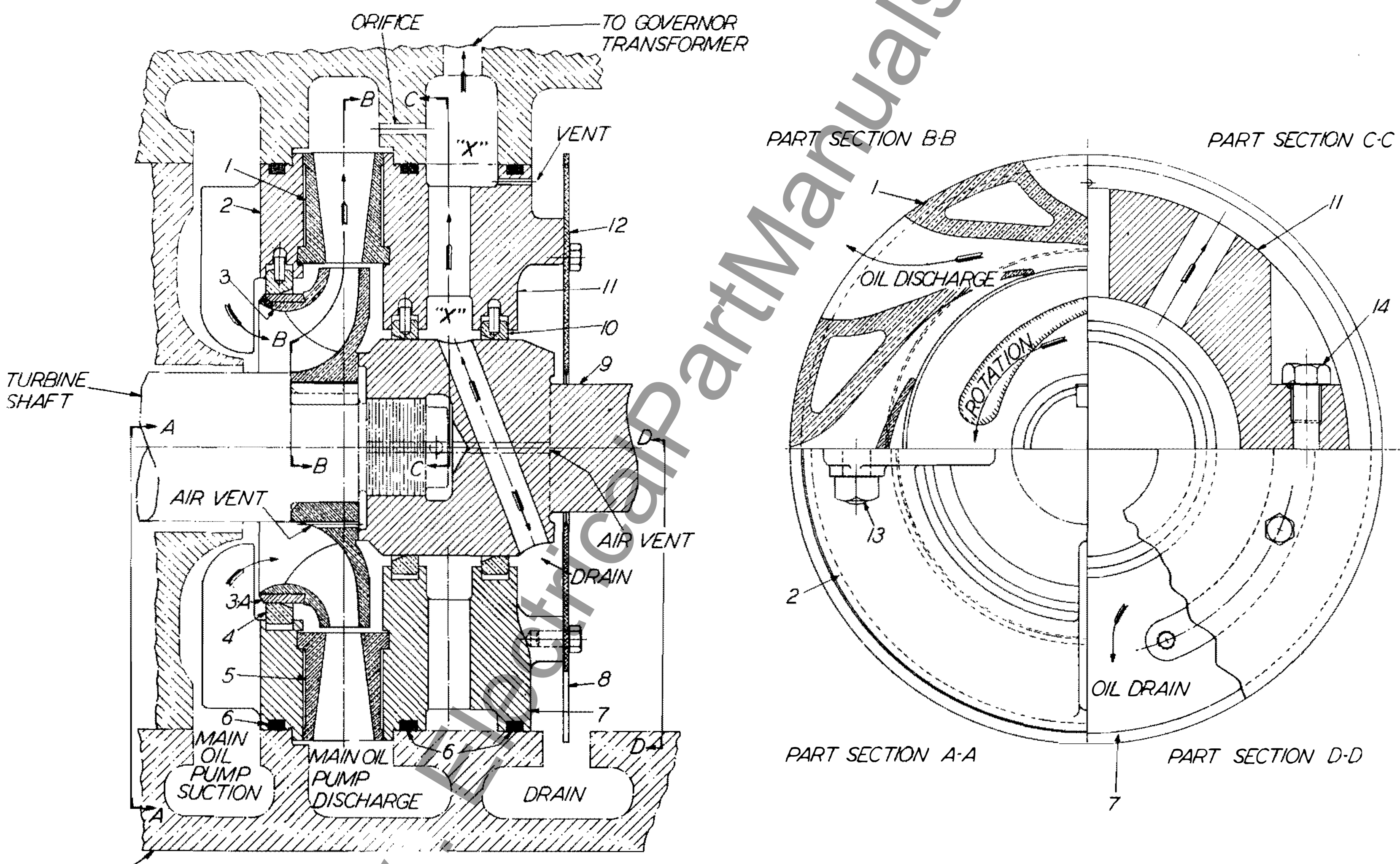

ORIFICE
TO GOVERNOR TRANSFORMER
VENT
"X"
"X"
TURBINE SHAFT
AIR VENT
AIR VENT
DRAIN
MAIN OIL PUMP SUCTION
MAIN OIL PUMP DISCHARGE
DRAIN
PART SECTION B-B
PART SECTION C-C
OIL DISCHARGE
ROTATION
OIL DRAIN
PART SECTION A-A
PART SECTION D-D
1
2
3
3-A
4
5
6
7
8
9
10
11
12
13
14

Fig. 1

Item No.	Name

Figure 2

1	Servo-Motor Piston Rod Nut
2	Servo-Motor Piston Ring
3	Servo-Motor Piston
4	Servo-Motor Piston Stop (Lower)
5	Servo-Motor Piston Rod
6	Servo-Motor Piston Rod Bushing (Lower)
7	Servo-Motor Piston Stop (Upper)
8	Governor Cylinder
9	Gasket
10	Governor Cylinder Cover
11	Servo-Motor Piston Rod Bushing (Upper)
12	Servo-Motor Piston Rod Oilite Bushing
13	Governor Cylinder Cover Dowel
14	Governor Cylinder Cover Tap Bolt
15	Servo-Motor Relay Follow-up Lever (In Pairs)
16	Servo-Motor Relay Follow-up Lever Spacer Bolt
17	Servo-Motor Relay Follow-up Lever Fulcrum Pin
18	Oil Tube and Connection
19	Servo-Motor Relay Spring Adjusting Bolt Nut
20	Servo-Motor Relay Spring Adjusting Bolt Lock Nut
21	Servo-Motor Relay Spring Adjusting Bolt
23	Servo-Motor Relay Follow-up Lever Bracket
24	Servo-Motor Relay Spring (Upper)
25	Servo-Motor Relay Cup Valve Seat
26	Servo-Motor Relay Bushing
27	Servo-Motor Relay
28	Servo-Motor Relay Spring (Lower)
29	Servo-Motor Relay Spring Seat
30	Oil Cleaner Extension Spring Washer
31	Oil Cleaner Extension Spring
32	Oil Cleaner Extension Felt Washer
33	Oil Cleaner Extension
34	Oil Cleaner Extension Pin
35	Servo-Motor Relay Follow-up Lever Crosshead
36	Servo-Motor Relay Follow-up Lever Ball Bearing
37	Servo-Motor Relay Follow-up Lever Link Spacer
38	Servo-Motor Relay Follow-up Lever Link Pin
39	Servo-Motor Relay Follow-up Lever Link
40	Servo-Motor Relay Follow-up Lever Pin
41	Oil Tube
42	Oil Tube Connection
43	Gasket (1/32 Thick)
44	Gasket (1/32 Thick)
45	Gasket (1/32 Thick)

Figure 3

55	Auxiliary Speed Changer Bevel Gear Knob
56	Auxiliary Speed Changer Bevel Gear Lock Nut
57	Auxiliary Speed Changer Bevel Gear Sleeve
58	Auxiliary Speed Changer Bevel Gear (Driver)
59	Auxiliary Speed Changer Bevel Gear (Driven)
60	Servo-Motor Cup Valve
61	Servo-Motor Cup Valve Ball End
62	Servo-Motor Relay Stop
63	Servo-Motor Cup Valve Ball Seat
64	Servo-Motor Cup Valve Ball Seat Nut

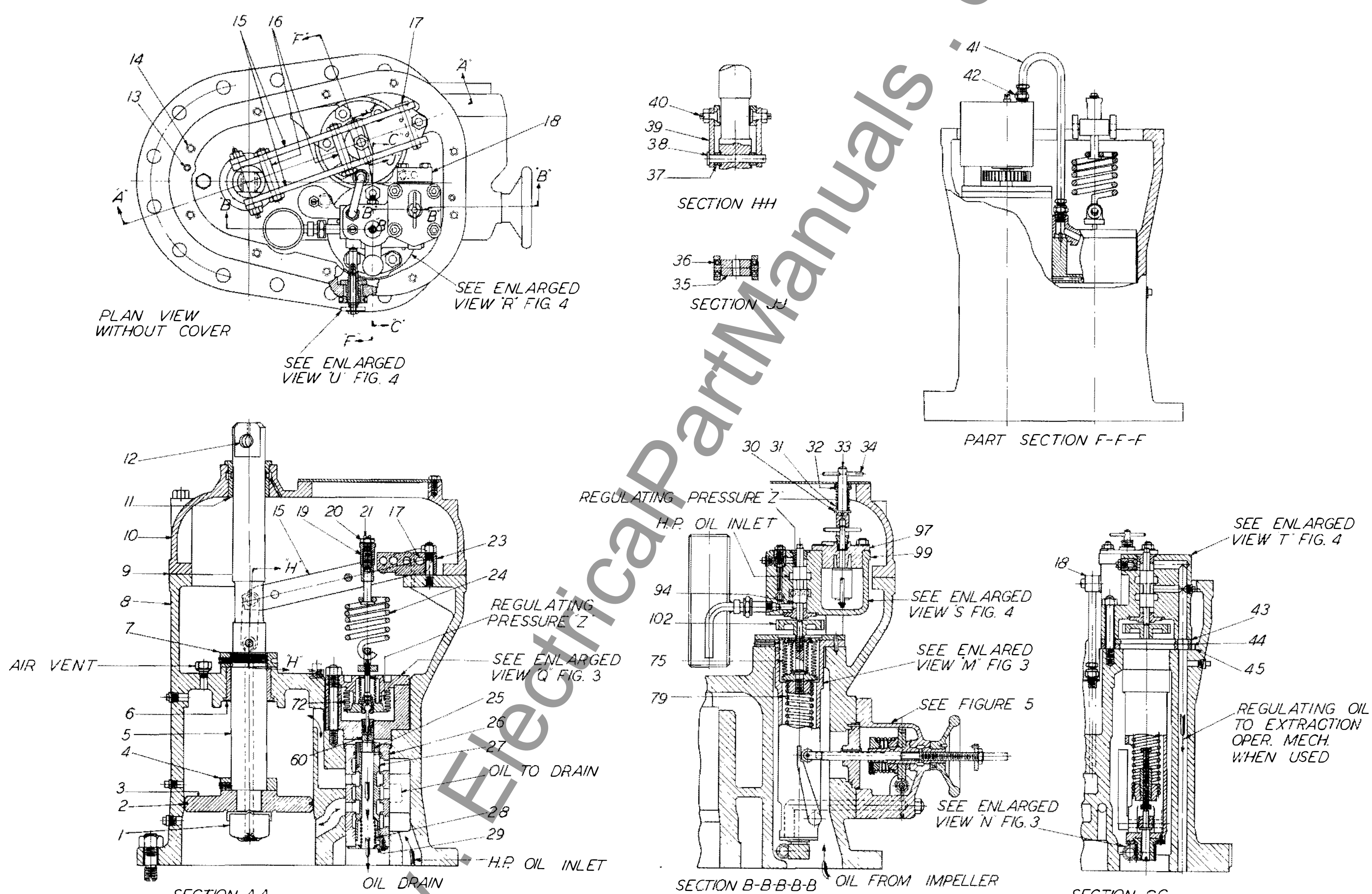
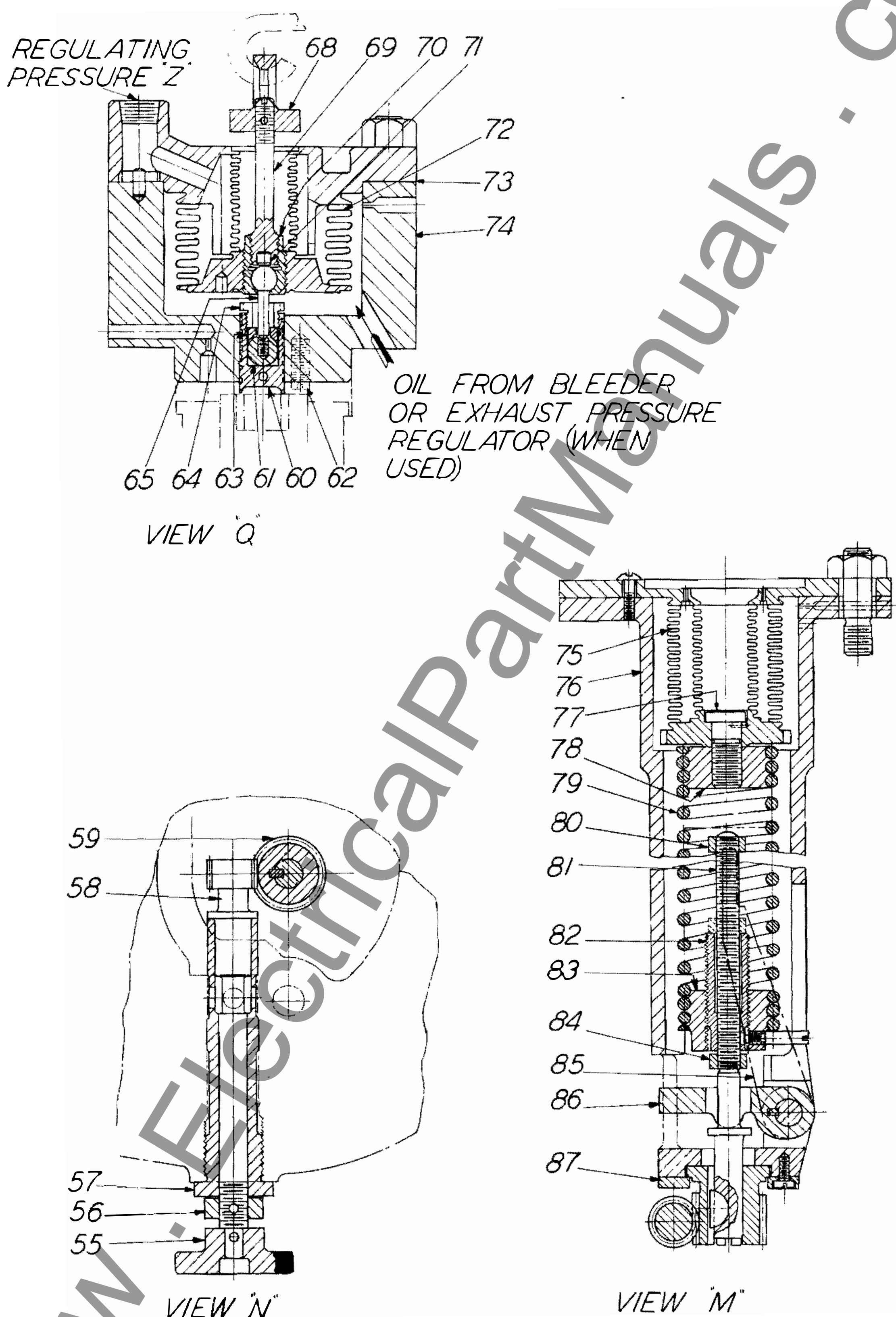

PLAN VIEW WITHOUT COVER
SEE ENLARGED VIEW "R" FIG. 4
SEE ENLARGED VIEW "U" FIG. 4
SECTION HH
SECTION JJ
PART SECTION F-F-F
SECTION A-A
AIR VENT
REGULATING PRESSURE "Z"
SEE ENLARGED VIEW "Q" FIG. 3
OIL TO DRAIN
OIL DRAIN
H.P. OIL INLET
REGULATING PRESSURE "Z"
H.P. OIL INLET
SEE ENLARGED VIEW "S" FIG. 4
SEE ENLARED VIEW "M" FIG 3
SEE FIGURE 5
SEE ENLARGED VIEW "N" FIG. 3
SECTION B-B-B-B-B
OIL FROM IMPELLER
SEE ENLARGED VIEW "T" FIG. 4
REGULATING OIL TO EXTRACTION OPER. MECH. WHEN USED
SECTION C-C

Fig. 2

Item No.	Name
	Figure 3 - Continued
65	Servo-Motor Cup Valve Ball Rod
68	Servo-Motor Cup Valve Rod Coupling
69	Servo-Motor Cup Valve Rod
70	Servo-Motor Cup Valve Rod Adjusting Nut
71	Servo-Motor Cup Valve Rod Insert
72	Servo-Motor Bellows
73	Gasket (1/32" Thick)
74	Servo-Motor Bellows Housing
75	Transformer Bellows
76	Transformer Bellows Housing
77	Transformer Bellows Spring Nut Bolt
78	Transformer Bellows Spring Nut (Upper)
79	Transformer Bellows Spring
80	Auxiliary Speed Changer Adjusting Screw Stop (Upper)
81	Transformer Bellows Spring Adjusting Screw
82	Auxiliary Speed Changer Adjusting Screw Bushing
83	Transformer Bellows Spring Nut (Lower)
84	Auxiliary Speed Changer Adjusting Screw Stop (Lower)
85	Speed Changer Rocker Arm
86	Speed Changer Rocker Arm Fingers
87	Auxiliary Speed Changer Bevel Gear Retainer
	Figure 4
90	Transformer Relay Needle Valve Bushing
91	Transformer Relay Needle Valve
92	Transformer Relay Body Plug
93	Transformer Relay Bushing (Upper)
94	Transformer Relay
95	Air Bell
96	Air Bell
97	Cuno Filter (Complete)
98	Gasket (1/32" Thick)
99	Transformer Relay Body
100	Transformer Relay Extension
101	Transformer Relay Extension Spacer
102	Transformer Relay Spinner
103	Transformer Relay Bushing (Lower)
104	Transformer Isochronous Adjustment Handwheel Screw
105	Transformer Isochronous Adjustment Valve Handwheel
106	Transformer Isochronous Adjustment Valve Screw Bushing Nut
107	Gasket (1/32" Thick)
108	Transformer Isochronous Adjustment Valve Screw Bushing
109	Transformer Isochronous Adjustment Valve
110	Transformer Relay Needle Valve Bushing
111	Transformer Relay Needle Valve
112	Transformer Relay Needle Valve
113	Transformer Relay Needle Valve Bushing
114	Transformer Relay Needle Valve Orifice Plug
115	Transformer Relay Spinner Nozzle Washer
116	Transformer Relay Spinner Nozzle
	Figure 5
1	Speed Changer Stem Roller
2	Speed Changer Stem Roller Pin
3	Speed Changer Stem Clevis


REGULATING PRESSURE "Z"
68 69 70 71
72
73
74
OIL FROM BLEEDER OR EXHAUST PRESSURE REGULATOR (WHEN USED)
65 64 63 61 60 62
VIEW "Q"
59
58
57
56
55
VIEW "N"
75
76
77
78
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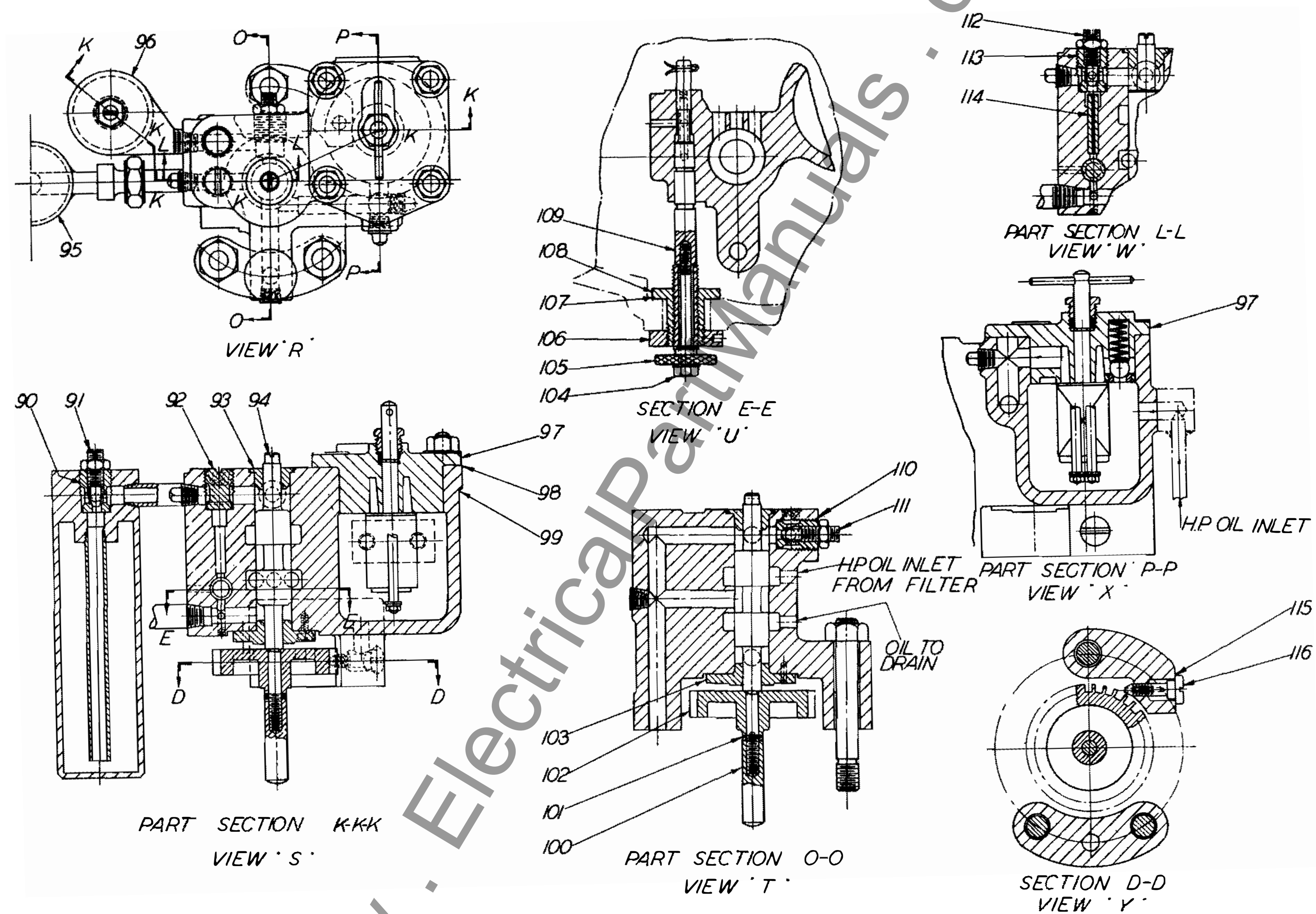
VIEW "M"

Fig. 3

Item No.	Name
	Figure 5 - Continued
4	Speed Changer Stem
5	Speed Changer Stem Key
6	Speed Changer Body Guide Flange
7	Gasket
8	Gasket
9	Speed Changer Friction Clutch Adjusting Nut
10	Speed Changer Friction Clutch Spring
11	Speed Changer Friction Clutch Spring Nut Set Screw
12	Speed Changer Friction Clutch Spring Plate Key
13	Speed Changer Friction Clutch Spring Plate
14	Speed Changer Worm Wheel
15	Speed Changer Stem Sleeve
16	Speed Changer Body
17	Speed Changer Handwheel Set Screw
18	Speed Changer Handwheel
19	Speed Changer Handwheel Stop Plate
20	Speed Changer Worm Set Screw
21	Speed Changer Worm Bushing (Outer)
22	Speed Changer Worm
23	Speed Changer Worm Bushing (Inner)
24	Speed Changer Motor
25	Pipe Plug
26	Pipe Plug



VIEW 'R'
PART SECTION K-K-K
VIEW 'S'
SECTION E-E
VIEW 'U'
PART SECTION O-O
VIEW 'T'
PART SECTION L-L
VIEW 'W'
PART SECTION P-P
VIEW 'X'
SECTION D-D
VIEW 'Y'
H.P. OIL INLET FROM FILTER
OIL TO DRAIN
H.P. OIL INLET
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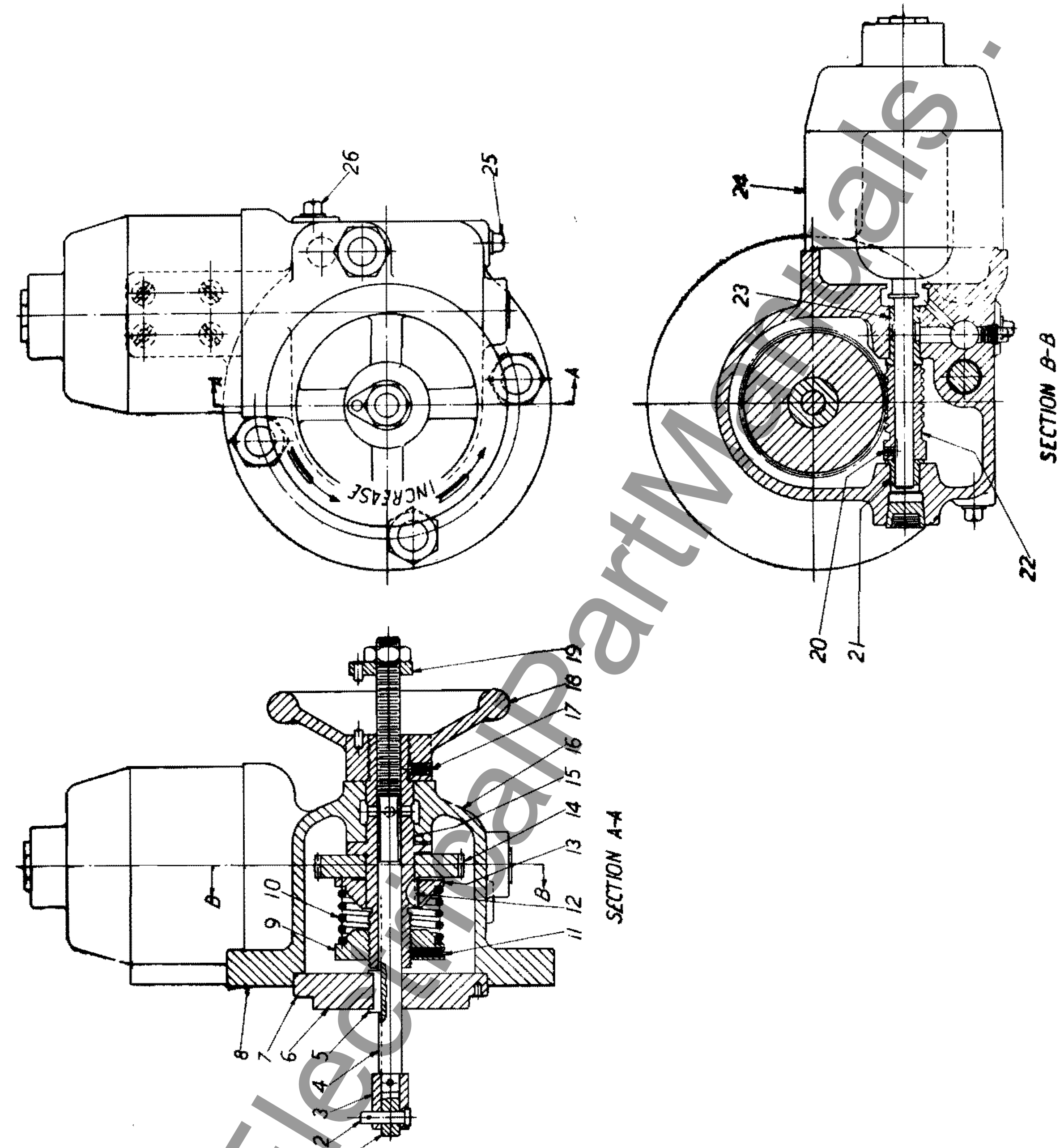
Fig. 4



SECTION A-A
SECTION B-B
INCREASE
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Fig. 5.