WESTINGHOUSE TURBINES

Types C-14 & C-20

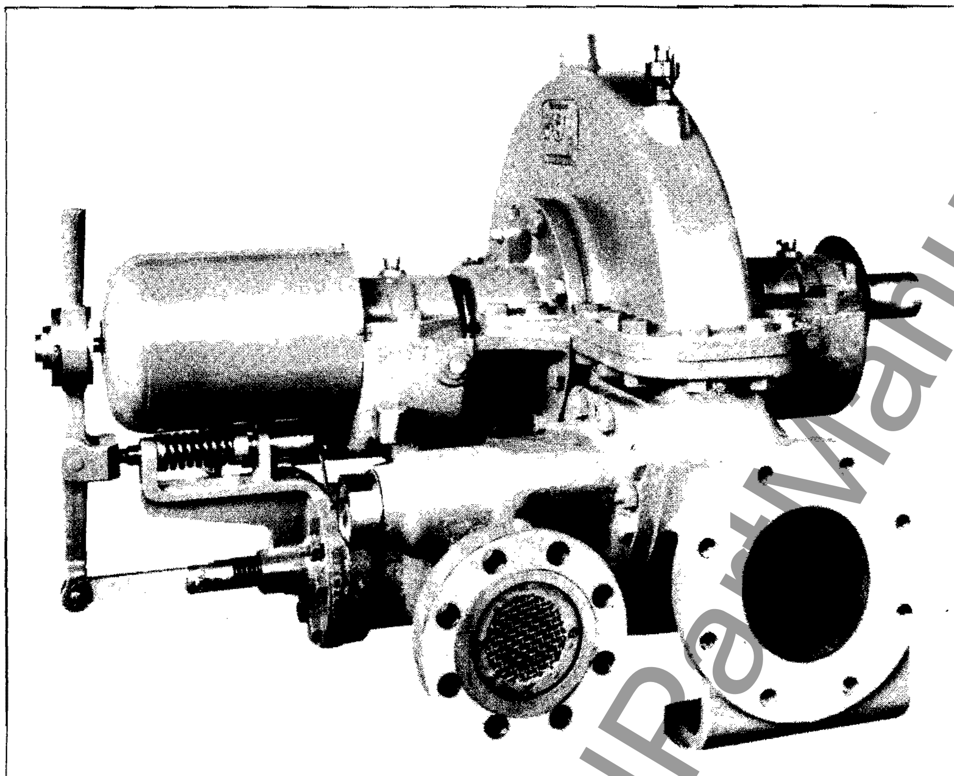

Fig. 1 - C-20 Turbine

INSTRUCTION BOOK 6104

In the event that it becomes necessary to return any part of this equipment to the South Philadelphia Works, it should be tagged with the Sender's name and address and the serial number of the unit. Shipments by freight, express or parcel post should be addressed to: Westinghouse E. & M. Co. Essington, Pa.

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY

So. Philadelphia Works Philadelphia, Pa.

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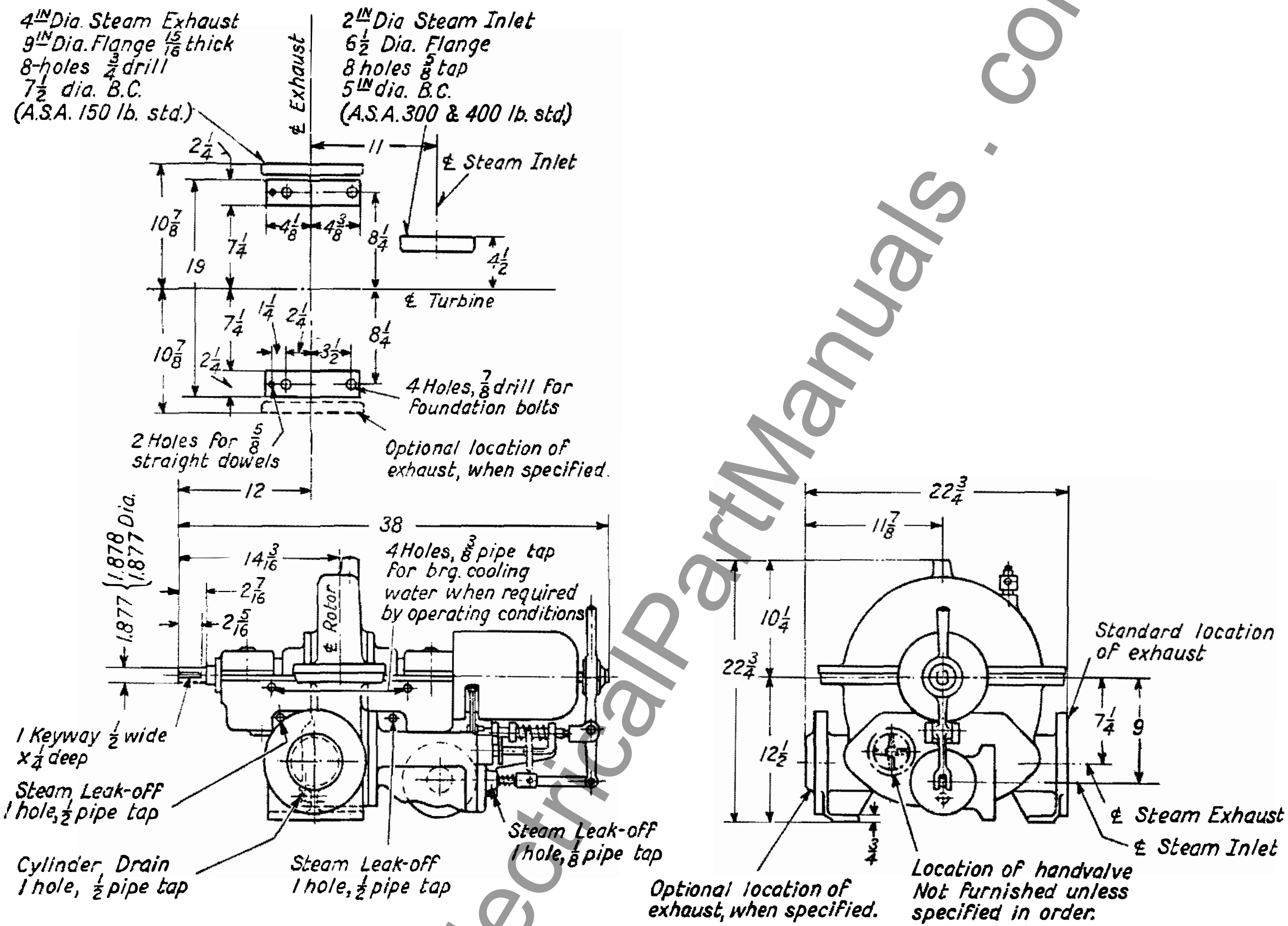

Fig. 2a - Outline of C-14 Turbine

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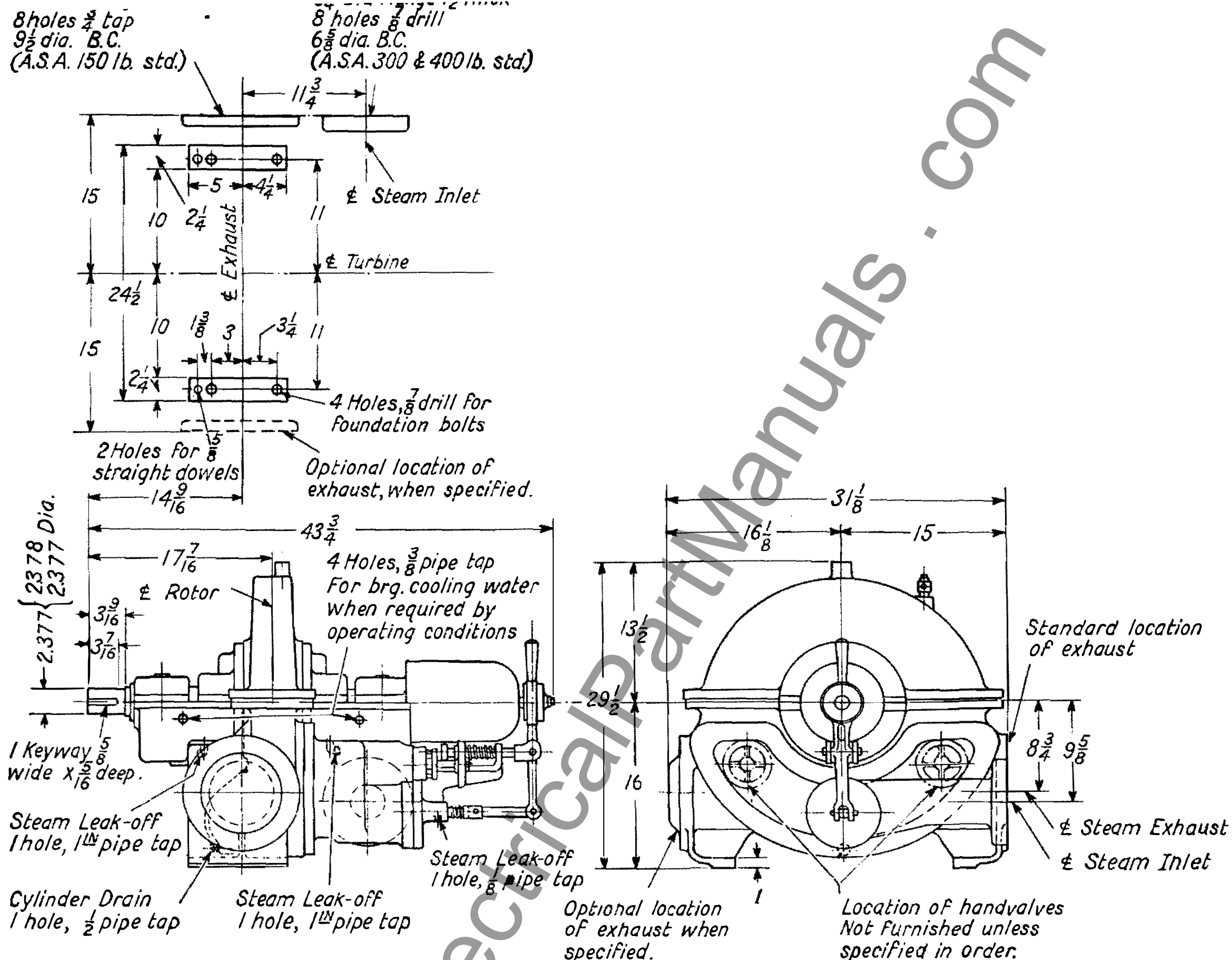

Fig. 2b - Outline of C-20 Turbine

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WESTINGHOUSE TURBINES

Types C-14 & C-20

General Description

The turbine described herein is of the impulse type, consisting of a single Curtis stage with two rows of rotating blades and one row of stationary blades. Its field of application is that of either mechanical or generator drive, and it can be connected to the driven apparatus either directly or through a reduction gear. A longitudinal section through the turbine is shown in Figure 3.

Steam enters the turbine through a single governing valve which, in addition to being under control of the main governor, is also under control of an overspeed trip mechanism in such a manner that it will close instantaneously if the turbine overspeeds a predetermined amount. From the governing valve, the steam passes into the nozzle chamber from which it expands through the nozzles, thus transforming the heat energy into velocity energy. Having reached its maximum velocity at the mount of the nozzle, it impinges against the blades, causing them to move forward, thus rotating the turbine rotor. By this rotation of the rotor, the heat energy of the steam is transformed into work at the turbine coupling. After passing through the first row of rotating blades, the steam is re-directed by the stationary blades into the second row of rotating blades and then passes out into the exhaust line.

Turbine Casing

The casing consists of a base and cover, bolted together at the horizontal joint. Steam inlet and exhaust connections are made to the base, so that the cover can readily be removed for a complete inspection of the internal parts. When removing the casing cover, it must be lifted straight up sufficiently to clear the rotor blades. Before replacing the cover, scrape the joints clean and make up with shellac. Be sure to pull the joint down tightly before the shellac hardens.

The entire turbine is supported by two feet cast integrally with the casing base. These feet should be bolted and dowelled to the foundation, soleplate or bedplate.

Rotor

The rotating element, consisting of a shaft, a disc and the governor, is carried in two ring oiled bearings. The disc is pressed on and keyed to the shaft. The inlet end of the shaft carries the main governor and the overspeed trip mechanism, and the exhaust end is machined to suit the coupling used to connect the driven apparatus.

Nozzles and Stationary Blade Holder

The nozzle block "14" (Figure 3) and the stationary blade holder "15" are located in the casing base. The nozzle block is bolted to the steam chest body and the stationary blade holder, in turn, is bolted to the nozzle block. When assembling the turbine or checking the adjustments, the axial position of the rotor should be adjusted, by means of the thrust bearing, so that the stationary blades are central between the first and second rotating rows.

Bearings

The bearings are of the cast shell, horizontally split type, lined with tin base babbitt. Lubrication is provided by the conventional type of revolving rings. These rings (item 22 in Figure 3) dip in oil in

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the bearing brackets and carry it to the top of the journals. Both bearings are of the same general type, the only difference being that the inlet end bearing has the ends babbitted and grooved for oil passage, thus forming a combined journal and thrust bearing. Thrust collars "40", which are attached to the shaft, ride against the babbitted ends of the thrust bearing and thus hold the rotor in its correct axial position.

The clearance in these bearings, between the journal and the babbitt, should be between .003 and .006 inch.

The total clearance between the thrust collars "40" and the ends of the bearing, that is the axial clearance (or end play), should be between .005 and .010 inch. This clearance can be varied by adjusting the shims "38" which are placed back of the thrust collars. Increasing the thickness of the shims decreases the thrust clearance. Decreasing the thickness of the shims increases the thrust clearance. Shifting shims from one collar to the other changes the axial clearance between the stationary and rotating blades.

Glands

Leakage of steam at the points where the rotor shaft passes through the cylinder is reduced to a minimum by glands of the conventional carbon ring type. The gland cases are split horizontally to facilitate dismantling and assembling.

The carbon rings are made in three segments to insure a good fit on the shaft, and the ends are fitted so that a radial clearance of .002 to .005 inch on the diameter exists between the carbon and the shaft when cold. It is essential that the joints at the end of the segments be perfectly square and radial to prevent leakage at these points. Each ring is carried in a separate groove and is held around the shaft by a garter spring which holds the ends of the segments together. Each ring is prevented from rotating by a key in the casing which engages a slot in the carbon ring. If the gland is dismantled, it is important to re-assemble the segments in the same grooves and in the same relative positions as found originally.

When fitting the packing rings, every precaution must be taken to see that they are free to move radially in their individual grooves. If the rings are tight in the grooves, they will wear rapidly and in extreme cases may injure the shaft. The axial clearance necessary to insure this freedom of movement should be from .013 to .025 inch.

A leak-off is provided between the two outer rings to prevent the leakage of steam past the outer ring to the atmosphere. A supplementary leak-off opening from the chamber between the second and third carbon rings is provided at the top of the gland case. This is for use only when operating against high exhaust pressures. If the turbine exhausts to a vacuum, this same opening serves as an inlet for gland sealing steam. (See section entitled "Pipe Connections").

GOVERNOR

The governor is of the horizontal weight, centrifugal type, in which the centrifugal force of the weights is opposed by the compression force of the governor springs. This same principle has been used for many years but the detail construction of this governor differs materially from older types.

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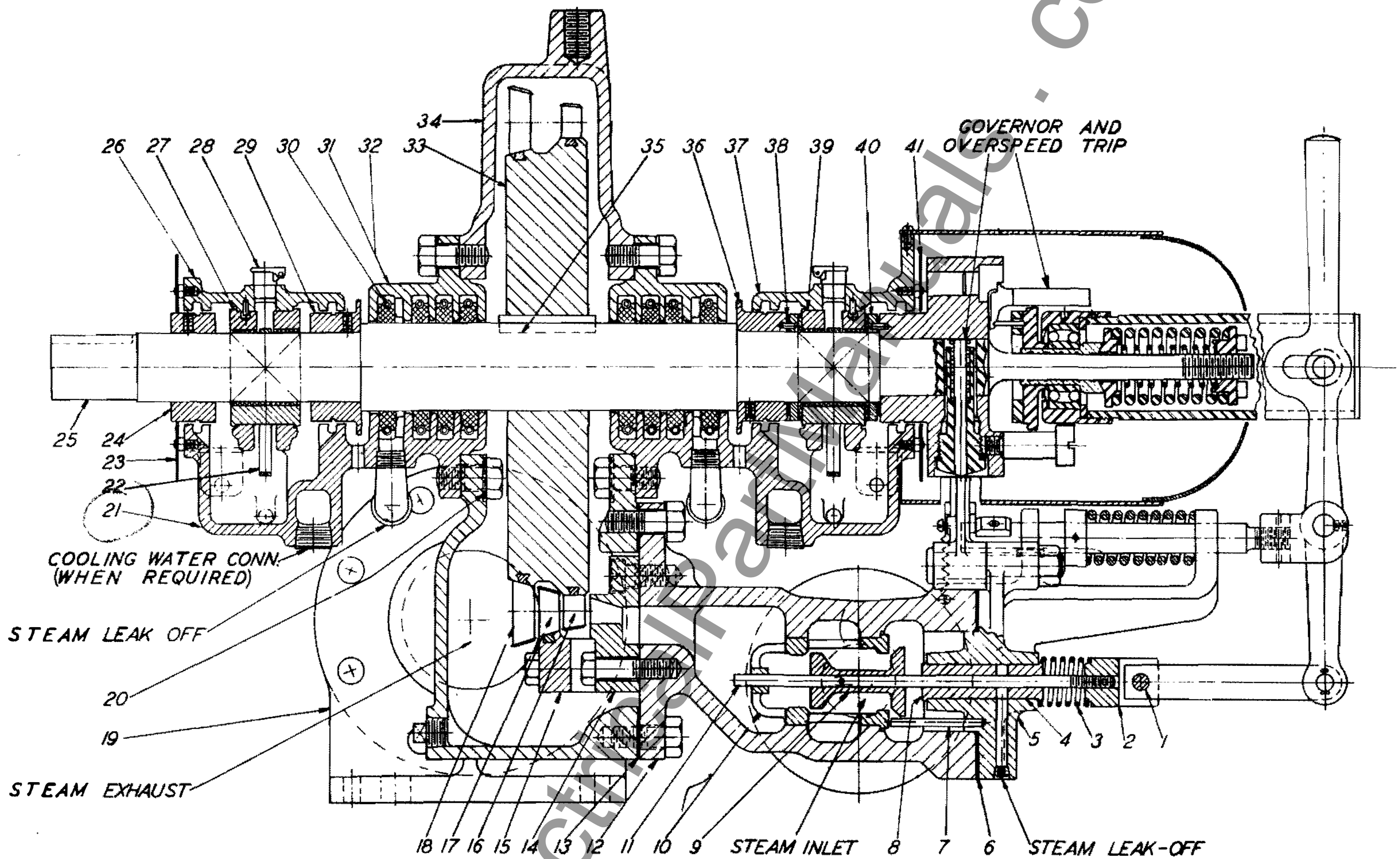

Fig. 3 - Longitudinal Section

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Referring to Figure 4, the governor hub "60" is a tight fit on the otor shaft and is further secured to the shaft by the auto stop governor eight retainer. This hub carries the weight fulcrum blocks "61" which suport the governor weights "64". Each weight is made in a single piece and as machined on it the knife edge about which it pivots and a knife edge eat which works against the knife edge on the strut "62". The other knife dge on the strut works against the strut seat "63". All of these knife dges and seats are properly hardened to withstand the service to which they re subjected.

With the machine at rest, the governor weights are held in their nner position by the force exerted by the compression springs "68". These prings are secured to the shaft at the outer end and exert a force which s transmitted to the toe of each governor weight through the spring seat 57", the bearing retainer sleeve "66", the inner race of the ball bearing 55", the strut seat "63" and the struts "62".

As the speed of the turbine increases, the governor weights move utward due to the increased centrifugal force and, being fulcrumed on the locks "61", this movement compresses the governor springs and moves the ball earing "65" outward. As the speed decreases, the spring force moves the leeve "66" and adjacent parts inward with the weights moving inward a corresonding amount. Therefore, the axial position of the ball bearing "65" aries with the speed. In order to transmit this governor movement to the overnor valve, which controls the steam inlet, the sleeve "69" is threaded n the bearing housing so as to clamp the outer race of the ball bearing. he outer end of the sleeve is connected to the governor lever by the pin 72", thus completing the linkage. The ball bearing carries any thrust hich may be exerted by the steam valve and transmits the governor movement ith a minimum of friction. The governor lever is fulcrumed so that outward ovement of the governor weights closes the steam valve while inward movement of the weights opens them.

ubrication

The governor ball bearing is lubricated by oil placed in the sleeve 59". The end cap "71" should be removed and the housing filled up to the evel at which it overflows past the inner ring which holds the end cap snap pring. A good grade of turbine oil should be used. Periodically (say once week or once a month, depending on the nature of the service) the oil level hould be checked and more oil added if the level is not up to the overflow oint.

o Dismantle Governor

1. Remove the governor lever "74" by removing the pins "77", "80" and "72".

2. Remove the guard "75".

3. Loosen the set screw and unscrew the sleeve "69".

4. Mark the nut "70" and the shaft, and count the number of threads exposed so the nut can be tightened to the same point when reassembled.

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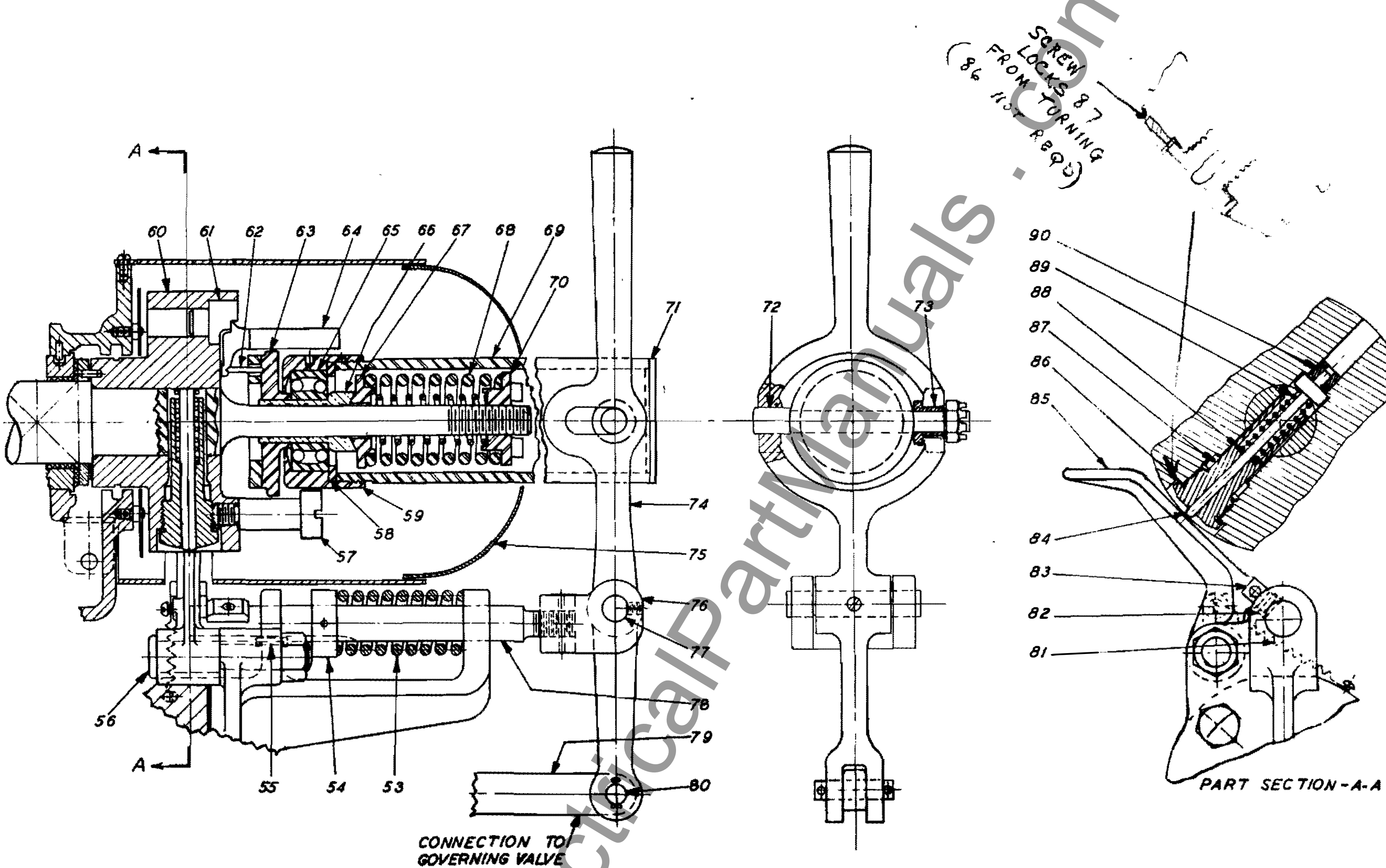

Fig. 4 - Main Governor and Auto Stop Governor

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5. Loosen the nut "70" until all compression of springs "68" is relieved. Note: In some cases the inner spring is omitted.

6. As the springs become loose, lift out the governor weights "64". As soon as the weights are removed the struts "62" must be removed to insure their not being lost. These weights, struts and the hub "60" should be marked so they can always be assembled in their original positions.

7. Take the nut "70" all the way off. Then the springs "68", sleeve "66" and bearing parts can easily be taken off the end of the shaft. Note: In rare instances it may be necessary to remove the strut retainer "63". In order to do this, the stop screws "57" must first be removed.

<u>o Assemble Governor</u>

1. If the strut retainer "63" has been removed install it together with the stop screws "57".

2. Assemble on the end of the shaft in the following order: The bearing housing "59", the bearing "65", the sleeve "66", the ring "58" and the spring seat "67".

3. Then assemble the springs "68" and start the nut "70".

4. Install the struts "62", place the weights "64" in position and push inward on the spring to hold them. Note: To see if these parts operate properly, press inward on the governor spring and at the same time pull one weight outward. Release the weight suddenly, still maintaining pressure on the spring. If the weight snaps back freely, it is correct. If a rub occurs, it can be felt. Repeat this test for the other weight, and then for both weights.

5. Tighten the nut "70 the same amount as originally found.

6. Install the sleeve "69" and lock it with the set screw.

7. Install the governor lever "74".

<u>justment</u>

Before making any change in the governor setting, be sure that the vernor valve is set correctly according to instructions under "Governing lve".

The normal speed maintained by the governor is determined by the mpression of the springs "68" and can be adjusted by means of the nut "70".

To increase the speed, tighten the nut "70".

To decrease the speed, loosen the nut "70".

One complete turn of the nut "70" will change the speed approxitely 70 rpm.

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Governing Valve

The steam chest "12" which encloses the governing valve is located below the governor, and is bolted and doweled to the casing base, as shown in Figure 3.

The governing valve "9" is of the double seated, balanced, poppet type and operates within the cage "10". The valve is pinned to the stem "11" which is guided by the cage at the inner end, and by the bushings "4" and "8" at the outer end. The coupling "2" on the end of the stem is connected to the governor lever by the link "79" (Figure 4) so that the valve "9" opens and closes in response to movements of the governor. The valve stem spring "3" eliminates lost motion between the valve and lever by constantly exerting a force in one direction.

The bushings "4" and "8" serve also to reduce to a minimum the leakage of steam along the stem. A leak-off connection is provided between the two bushings so any steam which does leak past the inner one can be led to a point where it will not be objectionable. No other form of stem packing is used and excessive leakage should be corrected by installing new bushings. When installing these bushings, they should be pressed into the cover and reamed in place. The surface of the stem must be kept smooth and free of galled spots, paint, rust and dirt. Any binding or sticking of this stem will cause unstable governor action.

Valve Adjustment

The valve travel (or lift) is very important and is set accurately at the factory when the turbine is tested. Therefore, <u>it is recommended that the travel (or lift) be checked on each new machine when first received, and this travel recorded in a permanent record</u>. Then at any future time, the travel can be checked against the original setting.

In order to check the setting, proceed as follows:

1. With the turbine at rest, trip the auto stop governor by hand, which will cause the spring to close the governing valve "9".

2. Measure the distance between the cover "5" and the coupling "2".

3. Re-set the automatic stop by pulling outward on the handle of the governor lever until the trip mechanism latch plates are engaged. This will open the governing valve wide.

4. Again measure the distance between the cover "5" and the coupling "2". The difference between the two measurements taken is the valve travel which should be recorded for future reference. It is advisable to go through the above checking process a second time to insure the correctness of the record.

It will be noted that the valve and seats form line contacts and not surface contacts. Therefore, this valve cannot be "ground-in" to stop leakage. A test to determine whether or not the valve is leaking too badly for use may be applied as follows:-

(a) Shut down the turbine by tripping the overspeed trip mechanism.

(b) If the valve permits enough steam to enter the turbine to prevent its coming to rest, without load, it is evident that the valve is leaking too badly for practical use.

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If it should be necessary to re-seat the valve, the inner disc ıst be faced off maintaining a 90° angle, and the bevel on the outer disc aced off the same amount. The seats in the cage must be bored in the same anner, maintaining a 90° angle on the outer seat and a bevel on the inner eat. If this is not done accurately, the areas of the valve discs will be nanged, thus throwing the valve out of balance which will undoubtedly cause nunting" of the governor. It is difficult to do this work without proper acilities and, since the parts are relatively inexpensive, it is recommended nat new parts be obtained from the factory when such repairs are necessary. rom the above it will be obvious that the cage and valve should be ordered nd replaced together because these parts are made in sets and are not furıshed separately.

When removing the cage, the steam chest should be heated by turnng steam into it, and the cage cooled by ice or water (preferably ice). The age can then be pulled out of the steam chest. Likewise, the steam chest nould be heated when installing the cage in order to avoid galling the press it.

Overspeed Trip Mechanism

The function of the overspeed trip mechanism is to automatically nut down the turbine if the speed increases to approximately 10% above ormal full load speed. The mechanism is shown in Figure 4. It consists a plunger (or weight) "84" which is set in the governor hub, perpendicuarly to the rotor axis. This weight is placed with its center of gravity ff-set so that the centrifugal force exerts an unbalanced force tending to nrow it outward. Normally, it is held in its inner position by the comression spring "89" and retainer "87".

If the speed increases to the tripping point (approximately 10% oove normal), the centrifugal force of the weight overcomes the compression the spring and the weight flies outward and strikes the trip lever "85". ovement of this lever disengages the latch plates "82" and "83". When the od latch plate "82" is released by the trip lever latch plate "83", the ompression spring "53" slides the rod "78" inward, which, acting through e pin "77" and governor lever "74", closes the governing valve (item 9, igure 3), thus shutting off the flow of steam to the turbine.

It can be re-set by pulling outward on the handle of the governor ver "74" until the trip lever plate "83" again engages the latch plate 2" on the rod "78" so as to hold this rod in its running position. Retting, of course, cannot take place until the turbine speed has decreased fficiently to allow the weight "84" to return to its normal position.

The turbine should be overspeeded occasionally to check the speed which the weight flies out and disengages the trip rod. When the driven paratus, to which the turbine is connected, is such that the load cannot removed, it may be found difficult (or even impossible) to increase the eed to 10% above normal. In such cases, it is advisable to disconnect e driven apparatus when running the overspeed test. <u>In order to increase e speed, gradually push inward on the handle of the lever "74"</u>. The speed ould be watched carefully so that it does not go much over 10% overspeed.

The trip lever "85" projects outward through the housing and forms convenient hand trip. By merely striking this lever, the trip rod latch released and the governing valve closes instantly, thus shutting down e turbine.

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Adjustment

In order to increase the tripping speed, insert thin liners or washers "88" (.005 to .010 inch thick) between the spring retainer "87" and the end of the spring "89", so as to increase the spring compression.

In order to decrease the tripping speed, remove liners from between the retainer and the spring. In case there are no liners, grind the end of the spring squarely just enough to obtain the desired decrease in compression.

When making these adjustments, it is important to place the liners between the retainer "87" and the spring and not between the spring and the collar on the end of the weight "84". Before making any change in the liners, the weight should be examined to see that it works freely in the hub and is not stuck by dirt or excessive wear. The linkage should be inspected to see that all parts work freely.

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INSTALLATION

It is very important that the machine be installed properly. Misalignment, distortion of the bedplate or soleplate or other errors of this kind will later bring about serious operating troubles even though the unit appears to run satisfactorily at first. While it is desirable to have the bedplate or soleplate as nearly level as possible, it is absolutely necessary to have the rotating shafts in proper alignment as determined by the couplings, regardless of the levels. In order to emphasize this point, on machines which are shipped assembled with the driven apparatus on a continuous bedplate, the coupling bolts are purposely removed before shipment. It is of utmost importance that the machine be installed to give the correct alignment at the coupling faces before installing these bolts or attempting to operate the turbine.

The foundation may be either concrete or fabricated steel. In some cases, the turbine and driven apparatus are mounted on a continuous bedplate, and in other cases they are mounted separately on the foundation. If the foundation is concrete, while not necessary, it is advisable to provide some sort of soleplate beneath the turbine feet. This provides a means of correcting alignment by shims and also makes it possible to remove and replace the turbine without difficulty if such an occasion should arise. In either case, the procedure of installation is the same. The official outline dimension leaflet (copy of which is furnished when the machine is sold and a copy of which is shipped with the machine) shows the space required and the location of the foundation bolts. If the foundation bolts are set in concrete, it is advisable (especially for the larger machines) to place them in pipe sleeves to provide clearance so the bolts can be bent, if necessary, to match the holes in the supporting feet or bedplate. This precautionary measure compensates for any slight shifting of the bolts when pouring the concrete and may save considerable expense and trouble when installing the turbine.

To install on concrete, set the machine in position with the bedplate or supporting feet supported on steel wedges. Do not depend upon the stiffness of a bedplate to give or maintain alignment.

Adjust the wedges to bring the machine as nearly level as possible and place it at the correct height and on the correct centerlines. At this point, be sure that the driven apparatus is in its correct position with relation to pipes or other apparatus to which it connects.

If the driven apparatus is a generator, be sure that the air gap between its rotor and stator is equalized at the top, bottom and both sides. Any inequality in this gap will cause unnecessary friction and heating of the bearings, and unequal heating of the armature iron.

Next, check the alignment by means of the coupling faces and adjust the wedges under the turbine to make this alignment correct. There are several methods of checking the alignment at the coupling. The following is believed to be the most reliable and is given here as a convenient guide.

COUPLING ALIGNMENT

Aligning for Parallelism of Rotor Axes

This is done by paralleling the faces of the coupling flanges. However, the flange faces may not be perfectly true with respect to the rotor axes. Therefore, the following rules should be followed which compensate for discrepancies in the faces and give accurate results.

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Separate the flanges a convenient distance and measure the gap at the top, bottom and both sides. Then rotate both shafts 180° and take another set of readings.

Rule 1 - If the opening between coupling faces, as indicated by two sets of readings taken 180° apart remains on the same side of the axes, the amounts of the openings should be added and the sum divided by two. The result is the amount that the coupling faces would be open if they were machined perfectly true with the axes.

Rule 2 - If the opening between coupling faces, as indicated by two sets of readings taken 180° apart, changes from one side of the axes to the other, the amounts of the openings should be subtracted and the difference divided by two. The result is the amount the coupling faces would be open if they were machined perfectly true with the axes.

The following examples explain these rules. (The discrepancies are, of course, greatly exaggerated to add clearness to the examples):

Example I (Refer to Figure 6)

In the 0° position:

Top reading........................ .024
Bottom reading..................... .012
Therefore faces show............... .012 opening at top.

With both coupling halves turned 180°:

Top reading........................ .036
Bottom reading..................... .012
Therefore faces show............... .024 opening at top.

Since the opening is at the top in both positions, Rule I applies. Therefore: $\frac{.012 + .024}{2}$ = .018 actual opening across the diameter (or .009 across the radius) if the faces were perfectly true.

To put the coupling in correct alignment, raise the outboard end of one shaft so as to bring the faces .009 closer together at the top.

To check the accuracy of this work, take a set of readings in the 0° position and one in the 180° position. If the work is correct, the coupling faces will be open a certain amount at the top in one position and the same amount, but at the bottom, in the other position.

Example II (Refer to Figure 6)

In the 0° position:

Top reading........................ .024
Bottom reading..................... .030
Therefore faces show............... .006 opening at bottom.

With both coupling halves turned 180°:

Top reading........................ .054
Bottom reading..................... .008
Therefore faces show............... .046 opening at top.

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Example-1

Top

Example-2

Top

Westinghouse Turbines

At the point where the steam line connects to the turbine, make ure that the flange faces are parallel and that no force is necessary to ring them together or to match the bolt holes. In order to reduce to a inimum the force exerted on the turbine by the expansion and contraction the pipe, the alignment of the flanges should be made with full steam ressure and temperature up to the throttle valve. The final alignment is hen made at the joint between the throttle valve and the turbine.

Before finally connecting the steam line to the turbine, it hould be blown out thoroughly with high pressure steam to remove any oreign matter such as dirt, scale, pipe joint compound, etc., which, if arried into the turbine, might prevent the closing of the governing valves nd cause overspeeding, or plug part of the nozzle area, thus reducing the apacity and efficiency of the unit.

It is of utmost importance to install a drain in the steam line its lowest point between the header and the turbine.

<u>haust Line</u>

The exhaust line should have a flexible copper expansion joint laced close to the turbine, preferably at the turbine exhaust flange. The xhaust pipe should be anchored just beyond the expansion joint to prevent ts weight damaging the expansion joint or the turbine. Even though an exansion joint is used, the same care should be exercised in aligning the ipe flange to the turbine exhaust flange as described for the main steam ine. Be sure that the expansion joint is made of material sufficiently ight to provide flexibility. Some expansion joints are so stiff that heir use is of little value.

Whenever the turbine coupling is to be aligned or the alignment hecked, be sure to disconnect the main steam line and the exhaust line order to eliminate the possibility of these pipes exerting excessive trains on the turbine. When reconnecting them, be sure that the faces an be made parallel and the bolt holes matched without using force.

GLAND PIPING, DRAINS AND STEAM LEAK-OFFS

The outline dimension leaflet (a copy of which is shipped with he turbine) shows the various pipe connections with notes indicating the urposes which they serve. These notes should be followed very careally and, if any are not understood, consult a Westinghouse representative efore proceeding with the work.

The openings marked "Steam Leak-Off" include the leak-offs from he rotor shaft glands and from the governing valve and throttle valve tem glands. These must be open to atmospheric pressure at all times and hould be connected by piping to a nearby point where a small amount of scaping steam is not objectionable.

On machines which exhaust into a vacuum, a supply of low presure steam is required to seal the glands. The openings marked "Steam eal" should be connected to a source of steam supply and throttled to ive approximately 2 or 3 lbs. pressure and the steam admitted should be ontrolled by hand valves so as to maintain just enough pressure to preent air leakage through the glands.

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WATER CONNECTIONS FOR OIL COOLING

On those machines which have water cooling chambers for the bearings, the openings shown on the outline dimension leaflet for water inlet and outlet should be connected to provide a circulation of water when the operating temperatures are sufficiently high to warrant the use of water cooling. While these can be connected either in parallel or series, it is suggested that they be connected in series. That is, pass the water through one bearing, then through the other and then to drain. The flow may be in either direction. A valve must be placed in the inlet line and water should be circulated only when required to maintain the desired oil temperature.

When an external oil cooler is used, these water connections need not be made unless special instructions are given.

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OPERATION

Before starting the turbine, clean off any dirt which might have ccumulated during the installation work and be sure that dirt has not gotten nto the bearing cavities or other internal parts. Be sure that the working rts of the governing mechanism are clean and in good working condition.

Be sure to place the proper amount of lubricating oil in the bear- g oil ring cavities and in the oil reservoir (when a separate reservoir is ed).

Check the overspeed trip mechanism by means of the hand tripping vice, and be sure it is working properly. Then reset it.

Note: This tests only the trip mechanism and does not check the speed at which the overspeed trip weight actually functions.

To operate the unit, proceed as follows:

Start

1. Open the drains from the steam inlet and exhaust lines, and be sure these lines are free of water.

2. Be sure all casing drains and steam inlet pipe drains are open.

3. Open the exhaust valve.

4. Open the throttle valve sufficiently to start the turbine rolling immediately.

5. Close the hand controlled drains when it becomes certain that the parts which they drain are free of water and the turbine is heated sufficiently to prevent additional accumulation of water.

6. Open the throttle valve gradually to increase the speed. As the speed approaches normal, see that the governing valves close partly and properly control the speed. This can be seen by movement of the governing valve stems.

7. When the governor has taken control of the speed, open the throttle valve wide.

t Overspeed Trip

When the turbine is first started after installation, it is very ortant to test the overspeed trip by actually overspeeding the machine. n the driven apparatus to which the turbine is connected is such that the d cannot be removed, it may be found difficult (or even impossible) to rease the speed to 10% above normal. In such cases, it is advisable to connect the driven apparatus when running the overspeed test.

To overspeed the turbine, proceed as follows:

With the turbine operating under control of the governor, increase speed by gradually pulling the governing valve stem in the opening di- tion, until the tripping point is reached.

The overspeed trip should operate at approximately 10% above nor- full speed. A direct reading, hand tachometer is preferred for reading

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the speed, but in case the end of the shaft is not accessible, a vibrating tachometer is satisfactory, provided it has been checked recently for accuracy.

During these tests, the speed should be increased slowly and the tachometer watched very carefully. An operator should stand by, ready to trip the mechanism by hand instantly if it does not trip automatically at about 15% overspeed.

If the mechanism does not trip at the proper speed, it should be inspected and adjusted as described in the section under the subject of "Overspeed Trip".

This same overspeed test should be made periodically, throughout the life of the machine, to insure that this important safety device is kept in good working condition.

To Shut Down

1. Trip the overspeed trip by hand. This is the easiest way to stop the turbine and will test the trip mechanism. However, this tests only the trip linkage and quick closing valve and does not check the speed at which the overspeed trip weight functions.

2. Close the throttle valve.

3. Reset the overspeed trip mechanism, thus putting it in the correct position for the next starting period.

4. When the turbine comes to rest, close the exhaust valve and open all drains between the throttle valve and exhaust valve.

   Precaution - Keep the exhaust valve closed and all casing drains open while the turbine is shut down. This is of utmost importance to prevent the accumulation of water in the casing which might cause corrosion and impair the future operation.

Care of Turbine

1. Keep the machine clean.

2. Clean the governing valve stem and throttle valve stem as often as necessary to prevent the accumulation of boiler compound or other foreign matter. These parts must be kept working freely.

3. Keep the throttle valve in good condition and steam tight, in order to prevent leakage of steam into the turbine during shut-down periods. All drains must be kept open whenever the unit is shut down.

4. Trip the overspeed trip occasionally to see that it is in good working order.

Inspection

About once each year, depending upon the nature of the service, the unit should be dismantled and thoroughly cleaned and inspected. All parts should be examined for wear. In this way, the cause of excessive wear can frequently be found and corrected before any damage is done. All oil chambers should be cleaned thoroughly to insure removal of all foreign matter and sludge deposits.

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REPAIR PARTS

The following list has been compiled to facilitate ordering spare or renewal parts. When ordering parts, give the serial number of the turbine and the item number and name of each part desired.

In the event that it becomes necessary to return any part of this equipment to the South Philadelphia Works, it should be tagged with the sender's name and address and the serial number of the unit. Shipments by freight, express or parcel post should be addressed to:

Westinghouse Electric & Manufacturing Company
South Philadelphia Works
Essington, Pa.

PART LIST

Figure 3

Item No.	Name
1	Valve Stem Coupling Pin
2	Valve Stem Coupling
3	Valve Stem Spring
4	Valve Stem Bushing (Outer)
5	Steam Chest Cover
6	Gasket
7	Valve Cage Stop Rod
8	Valve Stem Bushing (Inner)
9	Valve
10	Valve Cage
11	Valve Stem
12	Steam Chest
13	Gasket
14	Nozzle Block
15	Stationary Blade Holder
16	Blades (First Rotating Row)
17	Blades (Stationary)
18	Blades (Second Rotating Row)
19	Casing Base
20	Gland Case Bolt & Washer
21	Bearing Bracket (Exh. End)
22	Bearing Oil Ring
23	Bearing Bracket Baffle (Exh. End)
24	Shaft Thrower (Exh. End) (Outer)
25	Turbine Rotor Shaft
26	Bearing Cover (Exh. End)
27	Bearing (Exh. End)
28	Oil Cup
29	Shaft Thrower (Exh. End) (Inner)
30	Gland Packing Ring (Complete with Spring)
31	Gland Case (Upper Half)
32	Gland Case (Lower Half)
33	Rotor Disc
34	Casing Cover
35	Rotor Disc Key
36	Shaft Thrower (Inlet End)
37	Bearing Cover (Inlet End)

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Figure 3 - Continued

Item No.	Name
38	Thrust Bearing Shims
39	Bearing (Inlet End)
40	Thrust Collar
41	Bearing Bracket Baffle (Inlet End)

Figure 4

Item No.	Name
53	Overspeed Trip Rod Spring
54	Overspeed Trip Rod Collar
55	Overspeed Trip Rod Key
56	Overspeed Trip Lever Pin
57	Governor Stop Screw
58	Governor Thrust Bearing Retainer Ring
59	Governor Thrust Bearing Housing
60	Governor Hub
2 61	Governor Weight Fulcrum Block
2 62	Governor Weight Strut
63	Governor Weight Strut Seat & Retainer (Complete)
2 64	Governor Weight
65	Governor Thrust Bearing
66	Governor Thrust Bearing Retainer Sleeve
67	Governor Spring Seat
2 68	Governor Springs Inner & outer
69	Governor Sleeve
70	Governor Spring Adjusting Nut
71	Governor Sleeve End Cap
72	Governor Lever Fulcrum Pin
73	Governor Lever Fulcrum Pin Spacer
74	Governor Lever
75	Governor Guard
76	Overspeed Trip Rod Clevis
77	Overspeed Trip Rod Clevis Pin
78	Overspeed Trip Rod
79	Governor Lever Connecting Link
80	Governor Lever Connecting Link Pin
81	Overspeed Trip Lever Spring
82	Overspeed Trip Rod Latch Plate
83	Overspeed Trip Lever Latch Plate
84	Overspeed Trip Weight
85	Overspeed Trip Lever
86	Overspeed Trip Weight Retainer Lockwasher
87	Overspeed Trip Weight Retainer
88	Overspeed Trip Spring Shims (1 Set)
89	Overspeed Trip Spring
90	Overspeed Trip Weight Bushing

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