WORTHINGTON

MECHANICAL DRIVE STEAM TURBINES
SINGLE STAGE

INSTRUCTIONS AND PARTS LIST

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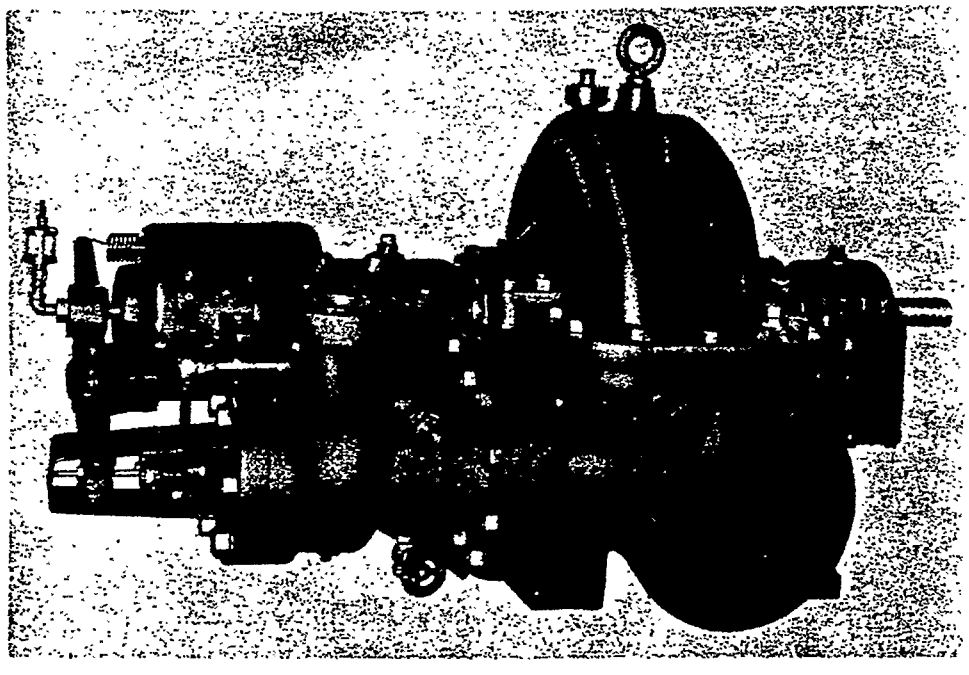

WORTHINGTON PUMP AND MACHINERY CORPORATION
MOORE STEAM TURBINE DIVISION, WELLSVILLE, N. Y.

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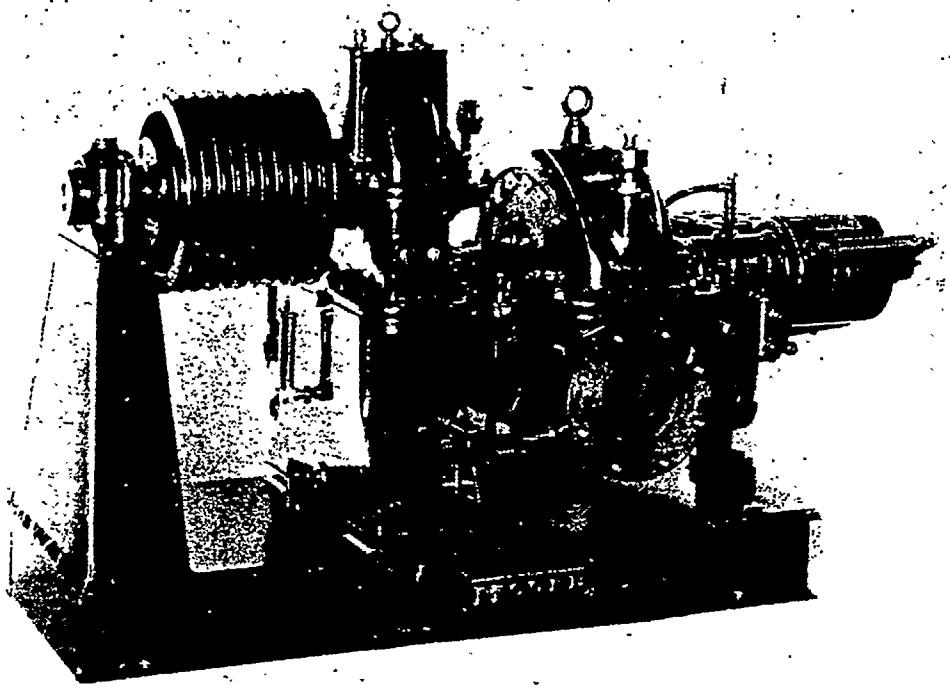
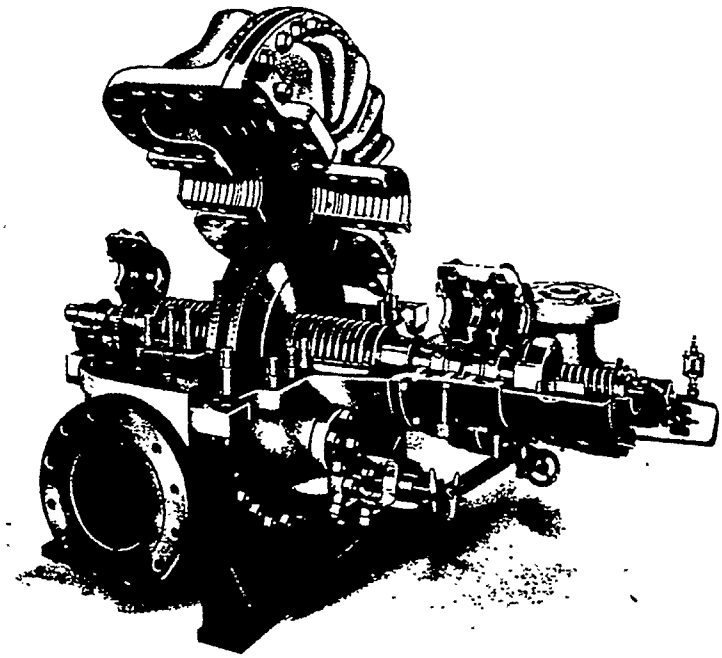




INTRODUCTION

The purpose of this Instruction Book is to describe the structural features of Worthington Single Stage Mechanical Drive Steam Turbines and to present this information in such form and detail as to enable the operating engineer to successfully install, operate, adjust and maintain his unit. We suggest that this Instruction Book be given careful consideration and study so that:

(a) The unit will be properly installed. Proper installation is the first requisite for satisfactory operation. The rugged construction of the Worthington Steam Turbine permits operation under adverse conditions, but it is to the user's advantage to provide the best possible conditions so that a maximum of service may be obtained with a minimum of wear and expense.

(b) The unit will be properly operated and adjusted. After a correct installation has been made, proper adjustment and operation will prevent many troubles from occurring. Any machine, however rugged, if neglected and abused, will in time become unsatisfactory in operation. These instructions, if carefully studied, should help the operators to become acquainted with the unit so that periodic inspections can be correctly interpreted and suitable action taken.

This Instruction Book and Parts List covers a turbine of "standard" construction. Select the drawings and description that fits the actual construction of your steam turbine. If the construction of some part of your steam turbine is different than shown in the drawings included in this book, it is due to some feature of your operating conditions requiring a construction deviating slightly from "standard". In such a case, use the closest corresponding part shown on the drawing for ordering parts.

ORDERING REPLACEMENTS AND SPARES

When ordering parts the following information must be given so that the machine and parts may be identified and the order filled without delay.

(a) The serial number which will be found on the nameplate.
(b) Name and description of parts. This should include part number and drawing number.
(c) State the quantity of parts of each type required.
(d) Give complete shipping instructions.

STORAGE

When the unit is received, it should be kept in a clean dry place and not subjected to abrupt or large temperature changes. Machined parts are slushed or painted to prevent rusting, but in case the unit is stored for any length of time before being placed in service, it is recommended that periodic inspections be made to see that rusting or corrosion has not started. Exposed machined parts should be slushed from time to time, if necessary, with a good grade of commercial slushing compound.

LOCATION

It is advisable that the unit should be placed in a location:

(a) Where it will not be subjected to abrupt or large temperature changes.
(b) Where it will be easily accessible for observation and attention.
(c) Free from dirt, dust, foreign materials and falling particles.

FOUNDATIONS

The foundation should be sufficiently heavy and rigid to make a permanently non-warping support.

All conditions surrounding the foundation should be uniform, as far as possible. The foundation should rest entirely on natural rock or firm soil. A foundation resting partly on solid rock and partly on firm soil may warp due to settling of part of the foundation, or due to unequal pressure of ground water level. A foundation supported by piling should have a heavy continuous cap over the piling on which the foundation rests. The foundation should be sufficiently massive so that it will absorb, to a large extent, vibration of the units installed on it. Likewise, it should be arranged so that outside vibrations are not transmitted to it.

INLET STEAM PIPING

Water in steam increases turbine steam rates and also causes erosion of governor valves, blading, etc. Pipes should be well insulated and drained. A separator should be provided close to the turbine when there is a possibility of wet steam. The steam line to the turbine should be taken off of the top of the header, rather than the bottom, as there is likely to be water at the bottom of the pipe, even with superheated steam.

Impurities coming from the boiler may cause incrustations within the turbine, wear of valves and blading and damaged packing glands. Clean dry steam will result in less maintenance.

The steam pipe should be blown out before connecting to the turbine flange. Scale, chips, pieces of gasket, welding beads etc. clog valves and nozzles and damage turbine blading. A steam strainer close to the turbine is desirable.

The inlet steam piping must be so arranged and supported that no more than one hundred pounds of thrust can be transmitted to the turbine due to the weight of the pipe and its expansion or contraction.

The inlet steam pipe size given on the certified outline drawing is for a short direct run of pipe. The pressure for which the turbine is designed is stamped on the nameplate. The steam piping must be adequate to give this pressure at the turbine throttle at maximum steam flow. When the steam pipe line is long or contains many fittings, a pipe size larger than called for on the outline drawing may be necessary.

Keep all parts clean, especially the governor and bearings. Watch the oil and change it often enough to prevent the formation of sludge. If any water accumulates in the bearing reservoirs, drain it off from time to time.

Test the overspeed governor once a week if possible.

Check the alignment frequently while the unit is new and occasionally thereafter.

For best economy keep as many hand valves closed as the load will permit. Hand valves are not to be used as throttling valves; therefore, a valve should be either wide open or completely closed. A hand valve partly open will soon have a damaged seat due to steam erosion.

Hand valve stems are of a non-rusting material with a greater heat expansion than the turbine casing. For this reason they should not be closed tight until the turbine has reached operating temperature, otherwise expansion of valve stems will lock the valves so tightly that it may be difficult to open them.

On normal service the turbine may be started up immediately by turning the throttle valve fully open, provided the turbine casing and the steam line ahead of the throttle valve are well drained.

NORMAL SPEED GOVERNOR

The speed governor is a mechanically constructed self-contained unit mounted on the steam end of the turbine shaft. It functions by operating the governor valve through a lever.

The governor weights pivot on hardened steel knife edges in the governor cup. Movement of the weights is transmitted to the governor spindle by a second set of knife edges. The centrifugal force of the weights is opposed by the compression of the governor spring.

A decrease in load will tend to raise the turbine speed which increases the centrifugal force of the governor weights, moving them outward, away from the shaft. This movement of the weights causes the spindle to move against the lever and to close the governor valve, and will tend to maintain the operating speed.

Similarly when the speed tends to decrease due to an increase of the load, the compression of the governor spring will cause the opposite action to take place.

The thrust of the governor spindle against the governor lever is carried by a ball thrust bearing. A spring holds the lever against the governor spindle so that the movement of the spindle is followed exactly by the governor lever and the governor valve.

Most governor troubles are caused by dirt and lack of oil, rather than actual wear. The governor is covered as much as is practical to protect it from dust. Inspection and cleaning is advisable at regular intervals to keep operating parts in good working order for satisfactory governor operation.

The governor is properly adjusted by the manufacturer at the factory and except to meet special conditions, should need no further adjustment. It is a good plan to become thoroughly familiar with the governor parts and their function.

The speed of the turbine may be changed within small limits by changing the compression of the governor spring by means of the adjusting nut. Increasing the compression raises the speed; decreasing the compression lowers the speed.

If it becomes necessary to disassemble the governor, always measure the distance from the lock nut to the end of the shaft so that the governor spring may be assembled again with the same amount of compression. It is important that all knife edges are seated properly and that the governor lever pin is placed in the proper hole.

GOVERNOR VALVE

The governor valve is a balanced double-seated type. It operates in a removable bushing having two valve seats. The governor valve bushing with its seats is inserted in the turbine steam chest. The inner fit of the bushing in the steam chest is a metal to metal ground joint. A steam tight joint between the outer end of the governor valve bushing and the steam chest cover is obtained by using 3/16" diameter braided asbestos packing. Be sure that the steam chest cover nuts are drawn up so that clearance between the steam chest and the steam chest cover is even around the entire circumference (measured by feeler gauge); this clearance is determined by the thickness and compressibility of the packing used between the valve bushing and the steam chest cover. Whenever the governor valve bushing is removed for any reason be certain that the inner metal ground joint is steam tight. Check with prussian blue and regrind for proper seating if necessary.

The governor valve is held on its stem by a collar which allows practically no end play, but provides sufficient clearance radially to permit the valve and stem to align themselves. The governor valve stem is packed, where it passes through the steam chest cover, with suitable packing for the initial steam conditions. This packing should be drawn up evenly and only tight enough to prevent leakage. After any adjustment of the governor valve stem packing be certain that the valve can be moved freely and easily by hand. Some turbines are built with metallic valve stem packing, which requires no adjustment.

The governor valve stem stuffing box, in the steam chest cover, is provided with a tapped leak-off opening near its outer end. This packing leak-off should not be plugged, but should be left open to the atmosphere or piped separately to an open drain.

A leaking governor valve should be corrected quickly because steam leaking through a small opening produces an effect called "wire drawing", which will damage the governor valve and seats. The governor valve should be inspected frequently and reground if necessary. This will prolong its usefulness and prevent faulty or unsatisfactory operation.

Be certain that the governor valve and governor valve bushing are clean and free from scale before inserting in the steam chest.

EMERGENCY GOVERNOR AND TRIP MECHANISM

The purpose of the emergency governor is to stop the turbine when its speed reaches a predetermined value. This speed is known as the tripping speed and is approximately 15% higher than the maximum full load speed. The emergency governor and emergency governor valve act independently of the speed governor and the speed governor valve.

The emergency governor is located in the speed governor cup which is mounted on the turbine shaft. It consists of a weight which is held in place by spring #27. At tripping speed the centrifugal force of the weight overcomes the force of the spring and the weight is thrown out, striking the trip lever and releasing the valve lever. The trip spring supplies the force for closing the emergency valve.

ADJUSTMENT AND CARE

The emergency governor is set and tested at the factory and should require no further adjustment. The tripping speed may be raised or lowered within small limits by increasing or decreasing the compression in the overspeed spring #27. Increasing the compression will raise the tripping speed, and decreasing the compression will lower the tripping speed.

When the turbine is equipped with a "pivot" type of emergency weight the compression in trip spring #27 is changed by removing lock screw #747 and moving adjusting screw #746 "in" to raise the tripping speed and "out" to lower the tripping speed. Replace and securely tighten lock screw #747 before operating the turbine.

When the turbine is equipped with a "pin" type of emergency weight, the tripping speed is changed by increasing or decreasing the length of the spring.

If steam leakage occurs at trip valve spindle #201, tighten the packing evenly, but only enough to stop the leak. If tightened too much, binding will interfere with correct operation of the emergency valve.

The turbine should be stopped at least once a week, if possible, by tripping the emergency by hand. This serves as an inspection and as a safety measure to insure correct functioning. To trip the emergency by hand, push down on trip lever #233.

When the steam chest is opened or removed for any reason, always inspect the emergency valve to be certain that it is steam tight and is in proper working order.

The emergency valve seat in the steam chest should be checked with prussian blue and the seat reground if necessary. The travel of the emergency valve is limited by lock nut #756 on valve pilot pin #755. Be certain that this lock nut is replaced and securely locked in the same position on the pilot pin from which it was removed. Observe the emergency valve travel in the guides to insure that the valve is well within the guides when fully open.

The emergency valve, when open and latched in the normal operating position, should not interfere with the proper functioning of the speed governor valve.

To reset the emergency governor, first let the turbine slow down to permit the emergency trip weight to return to its original position, then release latch spring #189 so that trip lever #233 can move to a position where it can latch with and hold valve lever #231. Next, release the pressure in back of the emergency valve by opening the drain valve at the bottom of the steam chest. Valve lever #231 may then be raised so that it will latch with trip lever #233.

SPEED CHANGER

The purpose of the speed changer is to provide a convenient method of altering the speed of the turbine when the turbine is in operation. As usually supplied, it is suitable for changing the speed of the turbine within a small range above or below the normal operating speed for which the speed governor is designed.

The speed changer consists of a spring attached to one end of the governor lever. The tension of this spring can be varied by turning the adjusting wheel on the stem to which the other end of the spring is attached.

The speed of the turbine depends on the force opposing the centrifugal force of the governor weights. When the force opposing the movement of the weights is increased, the turbine speed is increased. Similarly when the force opposing the movement of the governor weights is decreased, the turbine speed is lowered. Therefore, turning the speed changer adjusting wheel to increase the speed changer spring tension increases the turbine speed. Decreasing the tension in the spring lowers the turbine speed.

In actual practice, a normal speed governor equipped with a hand speed changer should be adjusted for minimum operating speed with minimum tension on the speed changer spring; increasing the speed changer spring tension will increase the turbine speed.

MAIN BEARINGS

The turbine is equipped with a steam end and an exhaust end sleeve bearing. These babbitt lined bearings are horizontally split to permit their removal and replacement with the turbine shaft in place. Shoulders on the ends of the bearings keep them in place axially. The bearings are held from rotating with the shaft by a stop in the lower half.

The bearings are made to precision limits on a production basis. No adjustment is necessary. For this reason, it is generally more economical to buy new bearings than to re-babbitt the old ones. Spare bearings may be carried for an emergency and can be installed with a minimum of fitting.

LUBRICATION

Each main bearing is equipped with an oil ring.

The lubricating oil should be periodically drained, and the bearing cases flushed with kerosene or some other suitable solvent; carefully remove all of the solvent and fill with fresh oil. The frequency of oil changes will depend upon operating conditions.

OIL COOLING

The turbine may be equipped with water cooled bearing cases having sufficient jacket surface to obtain proper oil cooling. The water inlet may be at the side or bottom of the bearing case. The water outlet is at the side of the bearing case. These water connections are shown on the certified outline drawing. No valves or other restrictions should be placed in the cooling water outlet line. Drain the water jackets when there is danger of freezing.

THRUST BEARING (Collar Type)

The thrust bearing is located in the steam end bearing case. It consists of two steel collars which are fixed to the shaft and take thrust in either direction against the ends of the sleeve bearing. Each collar has a series of tapped holes on its periphery, which are placed axially .010" apart. There are also four holes (two for each collar) drilled on opposite sides of the shaft and spaced axially .055" apart. These holes are used for adjustment.

ADJUSTMENT (Collar Type)

To adjust the position of the turbine rotor using a collar type thrust bearing, remove screws #196 and #197 from the thrust collars. The rotor can then be moved the full limit of the axial clearance. Next, set the rotor back to the middle of its clearance. Adjust

each thrust collar to have .005" on each end of the sleeve bearing, making a total of .010". With the proper clearance, one of the tapped holes in the collars will line up with one of the holes in the shaft. Insert screw #196 until it bottoms in the hole in the shaft. Then back the screw out approximately one-half turn and lock it in place with lock screw #197.

Before replacing the bearing cap, check the clearance again to make sure that there is a total clearance of approximately .010" (approximately .005" on each side).

THRUST BEARING (Ball Type)

A ball thrust bearing is sometimes used instead of a collar thrust bearing, and is located in the steam end bearing case. The inner race is held against a shoulder on the shaft by thrust sleeve #349 which is locked in place by thrust sleeve nuts #351. The outer race is held by the upper and lower halves of the sleeve bearing. Thrust sleeve lock nuts #351 turn on thrust collar sleeve #34. This threaded thrust collar sleeve is split to permit insertion in the groove provided in the shaft. The rotor position is set and the thrust bearing locked in place at the factory and should require no further adjustment.

Thrust sleeve lock nuts #351 will have right-hand threads if the turbine rotates counter-clockwise when viewed from the governor end, and will have left-hand threads when the turbine rotates clockwise when viewed from the governor end.

ADJUSTMENT (Ball Type)

Adjustment of the axial position of the turbine rotor using a ball thrust bearing is by shims #350 provided between the inner race of the ball thrust bearing and the shoulder on the shaft. To adjust the position of the turbine rotor first determine the total endwise clearance and move it back halfway. The distance from the shoulder on the shaft to the edge of the main bearing shell will be the thickness of the shims required. Be certain when placing the shims on the shaft that they rest against the flat surface of the shaft shoulder and not on the radius.

The ball thrust bearing and the thrust sleeve should then be placed on the shaft and the ball thrust bearing moved up tightly against the shims. Any force necessary to move the bearing against the shims should be exerted against the inner race only. When the bearing and the thrust sleeve are in place, the threaded halves of thrust collar sleeve #34 can be put in the shaft groove and nut and lock nut #351 screwed on and securely tightened.

CARBON PACKING GLANDS

The packing cases are usually an integral part of the turbine casing. The carbon packing rings are individually separated in

compartments formed by non-corrosive spacers. The spacers are located in annular grooves in the packing cases. On high back pressure turbines the packing cases may not be an integral part of the turbine casing. These separate packing cases are horizontally split, bolted together and doweled and are then bolted to the turbine case and located concentric with it by means of a rabbeted fit. When this construction is used the upper halves of the packing cases may be removed to inspect the carbon packing rings and springs located in the separate packing cases, without lifting the top half of the turbine casing. Any remaining carbon rings are accessible when the top half of the turbine casing is lifted for periodic inspections.

The carbon packing rings are made in three segments, held together by garter springs and kept from turning by suitable stops.

GLAND OPERATION

The carbon rings seal by being forced against the spacers and by being a sliding fit around the shaft. When the glands appear to be leaking excessively, it may be caused by the rings not seating properly on the spacers. A sudden increase in back pressure, or lightly tapping the packing case with a lead hammer should result in moving the rings against the spacers.

ASSEMBLY AND MAINTENANCE

When removing the carbon rings be sure to keep each ring by itself. Note that the ring segments are marked; these marks should be placed together when fitting or replacing the rings in the turbine. Do not stretch the spring more than necessary.

In order that the carbon rings may function properly, it is necessary that they are properly fitted and clean. When carbon packing rings are removed, clean any deposit that may be on the rings or in the compartments. When gland leakage indicates the necessity of carbon ring maintenance, it is recommended that new rings be installed. It is very difficult to refit rings. When it is necessary to refit rings (due to an emergency condition), remove a small amount from the ends of each segment, maintaining flat square ends. The diametral clearance between the carbon ring and the shaft should be approximately .001"to .006" at operating temperature. The diametral clearance at room temperature should not be less than .001" per inch of shaft diameter. New carbon rings furnished by Worthington Pump and Machinery Corporation will be made with correct diametral clearance, based on the original contract steam conditions.

PREPARING THE CASING JOINT

To reassemble after the top half of the turbine casing has been removed, the surfaces of the horizontal joint should be carefully cleaned and any burrs and projections scraped or filed flush with joint surface.

Light fluffy asbestos tape approximately .020" thick or 1/32" dia. soft asbestos string should be used for making up the steam joints. If tape is used it should be of such a consistency that it can be compressed to about .010" in thickness. It can be prepared by unstranding Johns-Manville No. 4202 asbestos rope packing, removing the cotton cord reinforcements, and opening up the strand into a ribbon.

Paint the surface of the lower half of the casing joint on which asbestos tape or string is to be laid with a suitable high temperature joint compound such as "Key-Paste", "Namco", "Copaltite", "Permatex", etc.

The tape or string should be laid all around the bottom half of the casing, just inside and almost touching the studs and bolt holes. On one side of the packing cases are recesses for the carbon packing stops. The tape or string should not cover these recesses but there should be short cross pieces run into the packing spacers to prevent steam leakage at this point.

Care must be taken that the carbon packing rings are not damaged when removing or replacing the upper half of the turbine casing or the upper half of a packing case.

LUBRICATING OIL

Correct lubrication is essential to satisfactory operation of this equipment. We recommend that you deal with a reputable oil company, obtaining oil recommended by them for steam turbine service.

The chief requirements of the lubricating oil to be used are as follows:

(a) Properly refined highly filtered mineral oil.
(b) Maximum metal-wetting ability, and ability to prevent the formation of rust on metal parts bathed in oil.
High stability toward oxidation and corrosion resistance may be accomplished by the use of rust and oxidation inhibitors, or as a result of a particular refining process.
(c) Free from acid or alkali.
(d) Best possible ability to separate rapidly from water.
(e) Minimum tendency to oxidize or form a sludge when agitated at actual operating temperatures when mixed with air and water.
(f) Minimum tendency to emulsify or foam when agitated with water and/or air.
(g) Viscosity as low as commensurate with operating and structural features involved in order to reduce bearing friction and temperatures and still maintain proper lubrication.

The viscosity of the lubricating oil used with units equipped with a flood lubrication system and not equipped with speed reducing or speed increasing gears should be from 130 to 225 seconds Saybolt at 100 degrees F; for geared units the viscosity of the lubricating oil should be from 280 to 400 seconds Saybolt at 100 degrees F.

For ring oiled units not equipped with a flood lubrication system, the viscosity of the lubricating oil should be from 400 to 600 seconds Saybolt at 100 degrees F.

The viscosity-temperature characteristics of the oil should be such that the viscosity changes as little as possible with a change in temperature.

For ring oiled units not equipped with a flood lubrication system, be sure that the oil rings turn when starting the unit after circulating cooling water at low temperatures.

For operation in ambient temperatures below 32° F. or above 125° F. refer to us for specific recommendations.

EXHAUST STEAM PIPING

The exhaust steam piping must be so arranged and supported that no more than one hundred pounds of thrust can be transmitted to the turbine due to the weight of the pipe and its expansion or contraction.

The exhaust steam pipe size given on the certified outline drawing is for a short direct run of pipe. The exhaust pressure for which the turbine is designed is stamped on the nameplate. The exhaust piping must be adequate so that this exhaust pressure will not be exceeded at the turbine exhaust flange at maximum steam flow. When the exhaust pipe line is long or contains many fittings, a pipe size larger than called for on the outline drawing may be necessary.

ATMOSPHERIC RELIEF VALVES

An atmospheric relief valve should invariably be provided between the turbine and any shut-off valve in the exhaust line.

DRAIN PIPING

Necessary tapped openings are provided for draining the turbine. These should be piped to a drain, having a valve in each line, suitable for the pressure carried.

GLAND PIPING

All single stage turbine shaft packing glands are provided with a drain opening near the outer end. The drain connections may be left open to the atmosphere near the turbine or piped away with liberal lines free from valves, and arranged so that no back pressure is put on the glands. It is desirable to keep each shaft packing drain line separate and arranged so that it slopes away from the gland.

For turbines operating with an exhaust pressure below atmosphere, steam seal piping is provided instead of gland drain piping. Sealing steam should be piped to the sealing steam lines through globe valves which should be adjusted so that the quantity of sealing steam prevents air from being drawn into the turbine, and so that no steam blows past the outer carbon packing ring.

COOLING WATER PIPING

When operating conditions require the use of cooling water, the bearing cases should be connected in series having a header in the outlet pipe from each bearing case at least six inches higher than the outlet pipe tap to insure that the water jackets are kept full of water. Most steam turbine installations require cooling water.

COUPLING ALIGNMENT

Coupling alignment must be correct for successful operation.

Flexible couplings will not compensate for any appreciable misalignment, and rapid wear, noise, vibration and actual damage may be caused by misalignment. Alignment of flexible couplings should be as accurate as that necessary for solid couplings.

Baseplates will spring to some extent, even if very rigid, and should be depended on for correct alignment. For convenience of alignment, place a few shims under the turbine supports; these shims may be removed if it is necessary to lower the turbine at a later time. Coupling alignment may be made by adjustment of shims under the turbine supports or under the driven machine supports, or by "springing" the baseplate or soleplate.

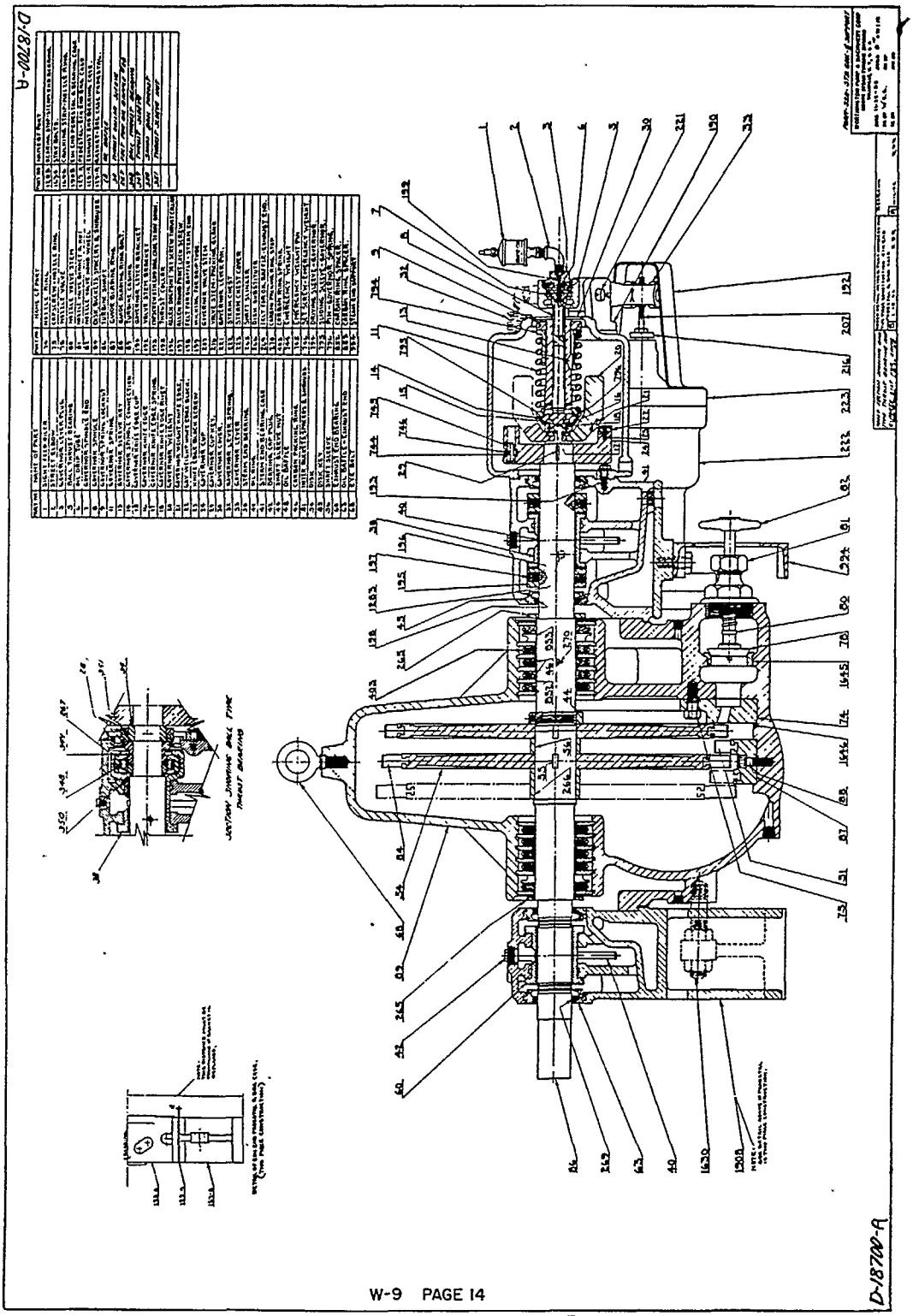
In the actual alignment of couplings, allowance must be made for expected changes in operating temperature of the driving unit and also the driven unit. For example, cast iron and steel expand or contract approximately .000006 inch per inch per degree F. change in temperature; a unit having a 20 inch distance between the shaft center and the supporting base when aligned at 80° F. will rise approximately .006 inch when operated at 130°F. Turbines having centerline support rise less than turbines having foot support. Condensing turbines rise very little. The steam end of a turbine is hotter than the exhaust end, thus causing the turbine to tip slightly toward the driven machine. An allowance for this tilting effect may be made in "cold" coupling alignment. The final coupling alignment check should be made with the unit at operating temperature. Coupling alignment at operating temperature should be checked periodically.

OPERATION

Make sure that there are no broken or missing parts and that the rotor turns freely. Operate the governor lever and valve by hand. Trip the emergency valve by hand and see that it operates freely. Clean the turbine thoroughly.

Fill the oil reservoirs with the correct grade of oil as shown on the oil tag attached to the turbine, or as described on Page 12 of this book.

Open the exhaust valve and all drain valves. Then start the turbine very slowly by opening the throttle valve a small amount. Make sure that each oil ring turns and carries oil. Close the drains when certain that all water is out of the system and gradually bring the turbine up to speed, watching the bearings carefully. When near full speed, observe the governor carefully and make sure that it operates the governor valve and controls the speed. Test the overspeed governor by the methods described under "Overspeed Governor". Observe operation carefully and frequently during the first few days of operation.



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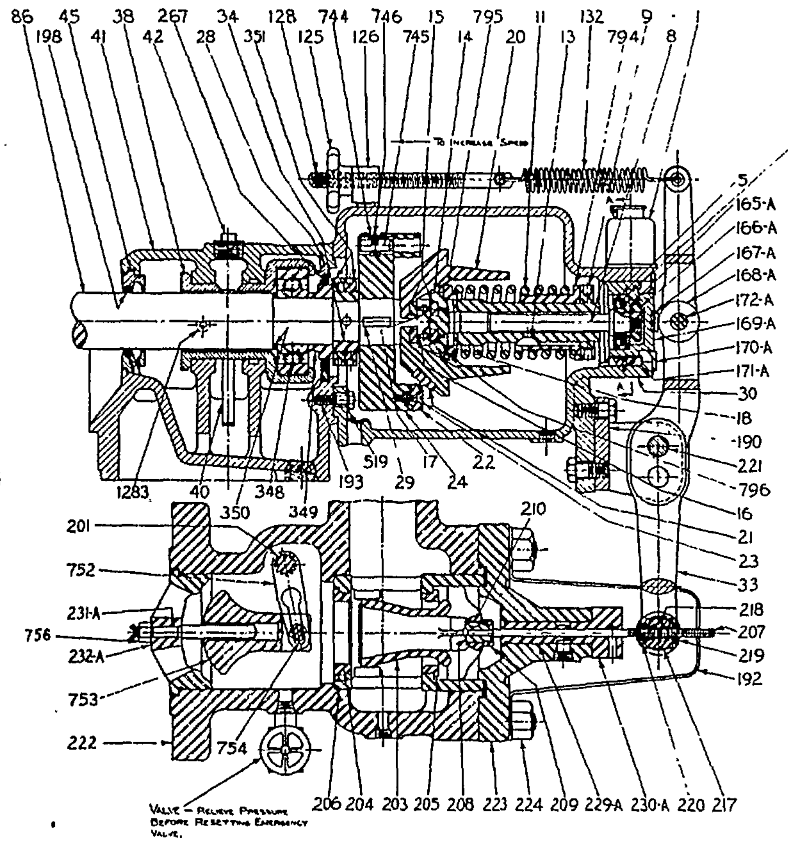

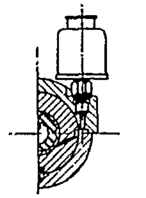

Partial Section "AA"

Note: When Part 169 A Is Required Parts 169-A And 167-A Are Furnished Assembled. When Part 14 Is Required Parts 14, 15, 16, 17 And 18 Are Furnished Assembled. When Part 20 Is Required Parts 15, 20 And 21 Are Furnished Assembled. When Part 24 Is Required Parts 22, 23 And 24 Are Furnished Assembled. When Part 45 Is Required Parts 45 And 198 Are Furnished Assembled. When Parts 203 Or 206 Are Required 203, 204, 205 And 206 Are Usually Furnished With Valve Ground In. When Part 207 Is Required 207, 208, 209 And 210 Are Furnished Assembled.

Part No	Name Of Part
1	Oiler
5	Ball Thrust Bearing
8	Governor Spindle
9	Governor Spring Locknut
11	Governor Spring
13	Key
14	Governor Spindle Connection (See Note)
15	Governor Knife Edge Cup
16	Governor Knife Edge
17	Governor Knife Edge Spring
18	Governor Knife Edge Rivet
20	Governor Weight (See Note)
21	Governor Weight Knife Edge
22	Governor Weight Knife Edge Block
23	Knife Edge Block Screw
24	Governor Cup (See Note)
28	Oil Baffle
29	Governor Cup Key
30	Governor Cover
33	Governor Lever
34	Thrust Collar Sleeve
38	Steam End Bearing
40	Oil Ring
41	Steam End Bearing Case
42	Bearing Cap Plug
45	Oil Baffle (See Note)
86	Turbine Shaft
125	Speed Changer Adjusting Wheel
126	Speed Changer Bracket
128	Speed Changer Adjusting Stem
132	Speed Changer Spring
165-A	Lock Washer
166-A	Locknut
167-A	Button
168-A	Roller
169-A	Bearing Housing
170-A	Dust Guard
171-A	Bearing Housing Key
172-A	Pin-Roller Governor Lever
190	Governor Lever Bracket
192	Valve Stem Bracket
193	Governor Cover Cap Screws
198	Felt Ring-Oil Baffle
201	Valve Spindle
203	Governor Valve (See Note)
204	Lower Governor Valve Seat
205	Upper Governor Valve Seat
206	Governor Valve Bushing (See Note)
207	Governor Valve Stem (See Note)
208	Valve Stem Collar
209	Valve Stem Collar Nut
210	Valve Stem Collar Key
217	Governor Lever Connection
218	Governor Lever Block (Two Required)
219	Valve Stem Adjusting Nut
220	Valve Stem Adjusting Nut
221	Governor Lever Pin
222	Steam Chest
223	Steam Chest Cover
224	Steam Chest Cover Stud And Nut
229-A	Valve Stem Bushing
230-A	Valve Stem Follower
231-A	Guide Pin
232-A	Valve Seat
267	Felt For Oil Baffle "28"
348	Ball Thrust Bearing
349	Thrust Sleeve
350	Shims – Ball Thrust
351	Thrust Sleeve Nut
519	Lock Washer – Gov. Cover Cap Screw
744	Emergency Weight
745	Emergency Weight Pin
746	Emergency Weight Set Screw
752	Valve Link
753	Emergency Valve
754	Emergency Valve Pin
794	Governor Sleeve – Driving
795	Governor Sleeve – Sliding
796	Governor Sleeve Pin
1283	Bearing Stop – Steam End
756	Locknut

Standard Gov. #3428

Changed Guide Pin to Type Using Nut and Split End — A

WORTHINGTON PUMP & MACHINERY CORP.
MOORE STEAM TURBINE DIVISION
WELLSVILLE N. Y. U. S. A.

Date 7-12-43 Scale 6"

Assembly Of Steam Chest, Governor Head With Speed Changer And Steam End Bearing Case

C-35254-A

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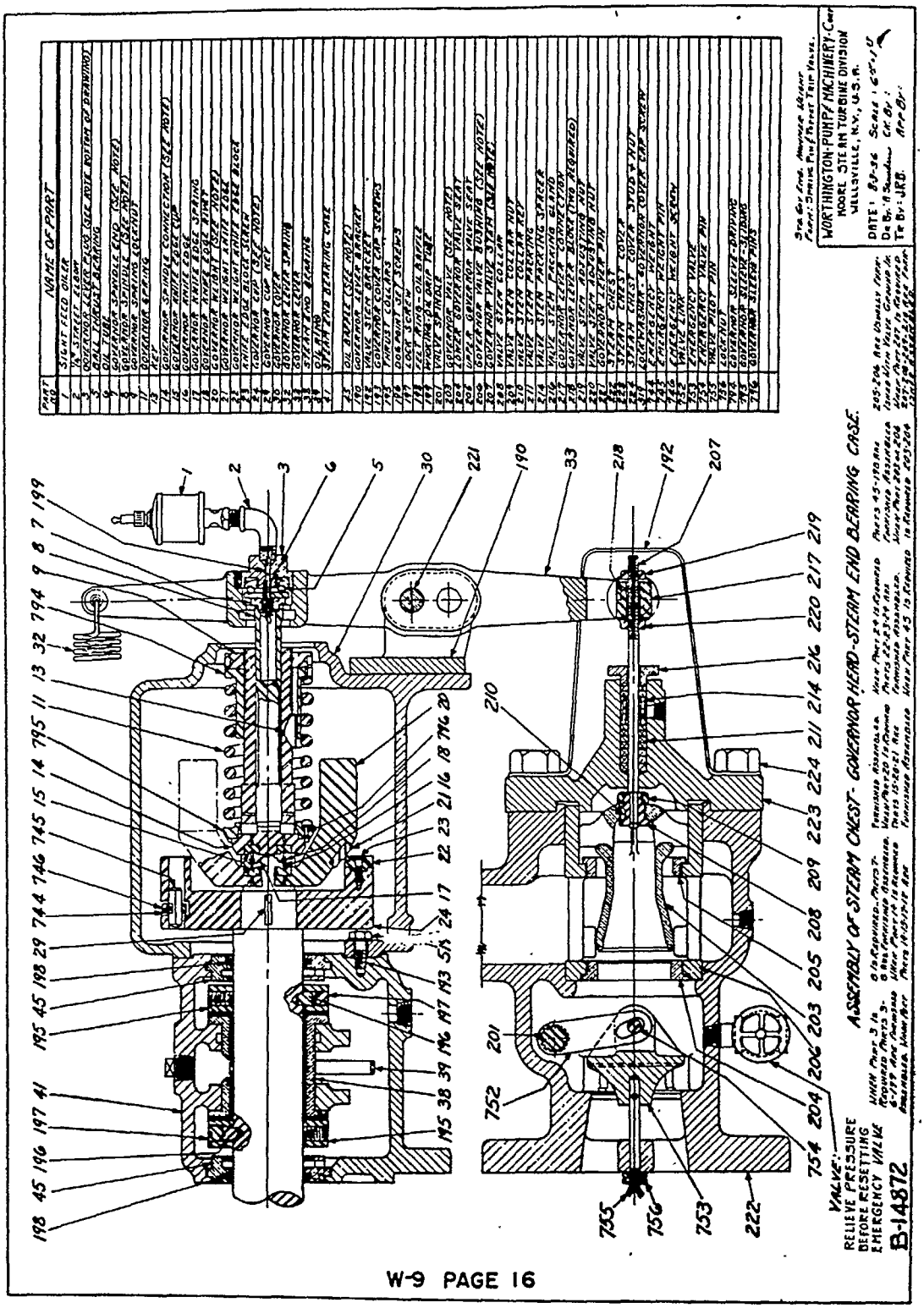

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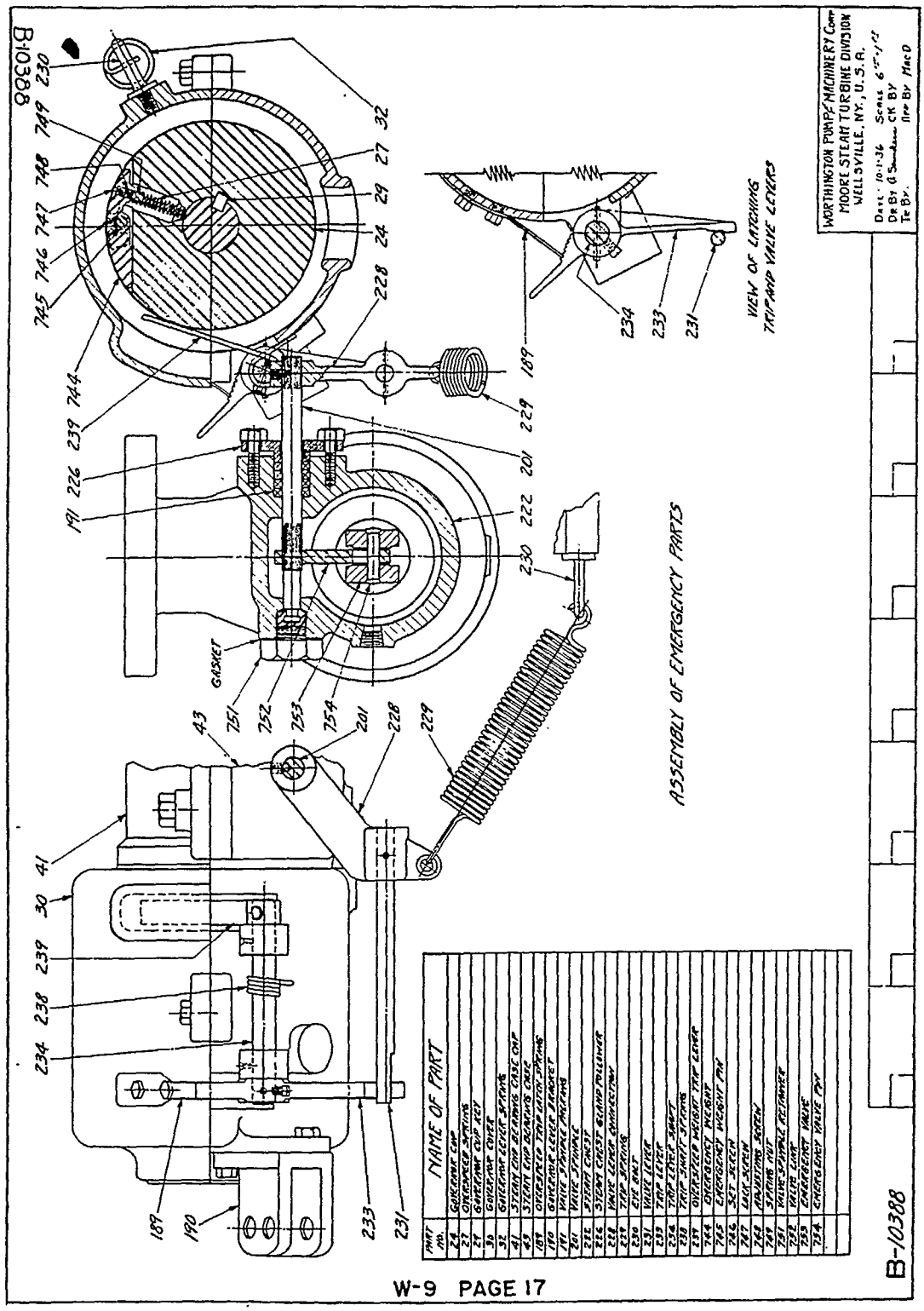

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