

AMERICAN MULTIPLE-VALVE THROTTLES

AMERICAN THROTTLE COMPANY, INC.

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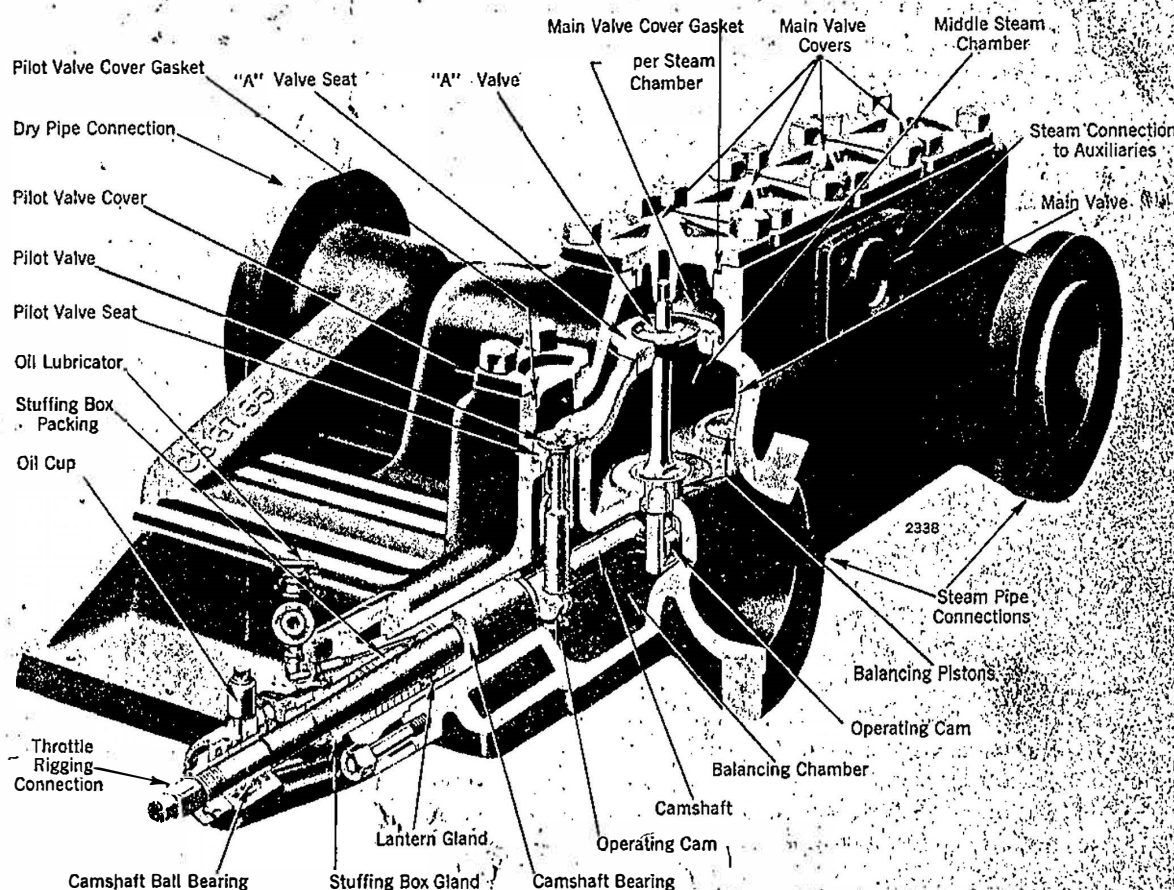


Fig. 1. Perspective View of American Multiple-valve Throttle and Superheater Header

Maintenance Instructions

for

MULTIPLE-VALVE THROTTLES

equipped with spindle-top disc valves and stirrup pulldown ($3\frac{1}{16}$ " "A" valves, $4\frac{1}{8}$ " and $4\frac{1}{2}$ " main valves), outboard bearing and compensating lever in throttle rigging.

Instructions are also available on other designs of multiple-valve throttles.

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MAINTENANCE INSTRUCTIONS

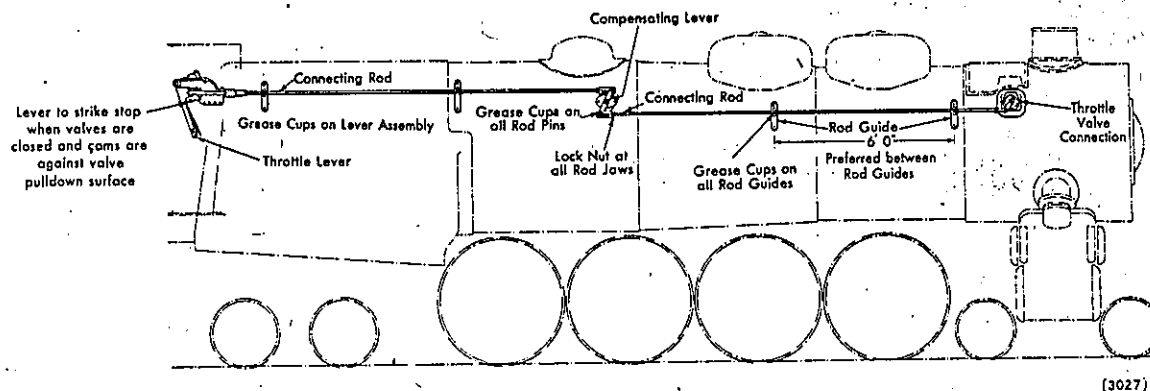
OPERATION

The valves of the American throttle open in sequence. The sequence and the intervals between valve movements are established by the graduated contours of the cams on the camshaft. The main valves, other than the "A" valve, are all identical in construction, but are assigned designations "B", "C", "D", etc. which relate to the position of each valve in the throttle and the sequence in which each valve is set in motion in opening the throttle, see Fig. 31. The number of main valves varies with the size of the boiler and range from three to seven.

The first movement of the throttle operating lever, from the closed position to the open position, raises the pilot valve and permits steam to pass from the upper chamber of the throttle to the balancing chamber at the bottom. The main valves are then in balance. Further movement of the throttle lever opens the "A" valve, followed at the established intervals, by valves, "B", "C", "D", etc. The flow of steam from the upper chamber to the middle chamber and thence to the steam pipes and cylinders begins at the moment the "A" valve is opened, and increases in volume as the other valves are subsequently set in motion until full throttle opening is attained.

When the throttle lever is moved from the open position to the closed position, the valves will close in reverse order, the pilot valve closing last. As the throttle lever approaches the closed position, the lower side of each cam exerts force upon the bottom portion of the valves and closes each valve tightly. Leakage past the balancing pistons permits escape of the steam from the balancing chamber.

Additional information regarding the sequence and intervals of valve movements will be found elsewhere in this bulletin, where camshafts and their contours are discussed.



(3027)

Fig. 2. Rigging of American Multiple-valve Throttle.

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ADJUSTMENT OF THROTTLE RIGGING

Careful adjustment of the throttle rigging is very important and should be made while the locomotive is cold. The following procedure is to be used in the adjustment of the throttle rigging, Fig. 2.

(1) Remove camshaft crank arm pin and rotate crank arm on the outer end of the camshaft until the bottoms of the cams are in contact with stirrups of the valves.

(2) Then, with the cab lever in the closed position, adjust length of the rods so as not to spring the camshaft. The adjustment should assure that the compensating lever will move an equal distance each side of its vertical center line. All lost motion should be removed from the rigging.

(3) After the adjustment has been properly made, see that the lock nuts are securely tightened.

Sloping throttle rods are not recommended. An offset in the rod is preferred, when necessary. A maximum pull of approximately 40 lb. on the lever handle is preferred, although conditions may necessitate a pull slightly above or below this figure. The minimum recommended movement of the lever handle in opening and closing the throttle is 16 in.

CAUSES FOR A HARD WORKING THROTTLE

(1) Binding in throttle rigging, due to a misalignment. Throttle connecting rods tight in guides or moving parts of rigging not free to move readily. These faults are corrected by proper adjustment of rigging.

(2) Lack of lubrication in the rigging.

(3) Packing gland on camshaft drawn up too tight or packing dried out.

(4) Excessive end play of camshaft, causing the cams to bind against the valve spindles or stirrups.

(5) Incorrect intervals caused by wear of the cams or valves.

(6) Excessive clearance between balancing piston and balancing piston guide in throttle.

The means for correcting excessive end play, incorrect valve intervals and excessive balancing piston clearance will be found elsewhere in this bulletin.

WASHING OF THROTTLE HEADERS

Throttle headers should be washed periodically with hot water to remove mud, scale and other accumulations. The frequency of washing will depend upon the territory and the service in which the header is used.

Throttle headers of recent manufacture are provided with two washout connections, located as nearly as possible at the opposite ends of the balancing chamber. It is recommended that these connections be piped to a point convenient to hand-holes arranged in the smokebox. When this arrangement is used, the removal of the hand-hole covers and the pipe plugs will permit convenient washout of the header balancing chamber without the

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necessity of opening up the front end of the locomotive. Alternate proposals of this arrangement are illustrated by Fig. 3 and 4.

The upper and middle chambers of the throttle header and the superheater units can be washed by connecting the washout hose to the auxiliary steam connection. In this case remove boiler washout plugs and block the drivers. During the time the header and superheater units are filled with water, the throttle is alternately opened and closed. It is recommended that this washing be done when the locomotive valves are pulled.

HYDROSTATIC TEST OF THE THROTTLE

Routine hydrostatic test in roundhouse, etc., generally includes steam pipes and exhaust stands, as well as the superheater, throttle and boiler. The exhaust tip is removed and a blank flange substituted. The entire system is filled with water through a boiler connection, and the boiler working pressure is used. On locomotives equipped with feedwater heaters, the heater body and pipes leading to it must not be subjected to test pressure. The pipes should be disconnected and cylinder outlets blanked. When this test is used, the dryer need not be removed. To prevent this test pressure being extended to auxiliaries, which use superheated or saturated steam, the master valves in these lines should be closed.

When extensive repairs have been made to the locomotive, an additional test can be applied to the throttle valves as well as to the superheater, by applying a blank flange to the dry pipe in the dome. In this test, the water enters through the auxiliary superheated steam outlet and leakage of the throttle valves can be quickly detected by looking through the steam pipe openings on the header. On locomotives equipped with the vertical dryer in the dome, it is necessary to apply a blank flange on the end of the dry pipe elbow with the dryer removed, as it is not designed to withstand boiler pressure. The pressure used with this test is at least 25% in excess of the maximum allowable working pressure of the boiler.

AIR AND STEAM LEAKS

Frequent inspections should be made for steam and air leaks in the throttle, superheater and the smokebox joints. Leaks should be corrected.

REMOVAL OF THROTTLE VALVES

Remove the smokebox cover plate and disconnect throttle rod end from the camshaft crank arm. After the throttle has cooled, wash off the top of the throttle box with hot water to remove soot and cinders. Remove the valve covers and gaskets, rotate the camshaft in the direction for opening the valves and lift out the valves. The valve covers should then be replaced temporarily to prevent dirt or other foreign substances from dropping into the throttle.

Before replacing the valves, all scale and accumulation should be cleaned from the throttle box. The valve parts should be thoroughly cleaned and the valves ground to their seats. To replace the valves, rotate the camshaft to the position it occupied when the valves were removed.

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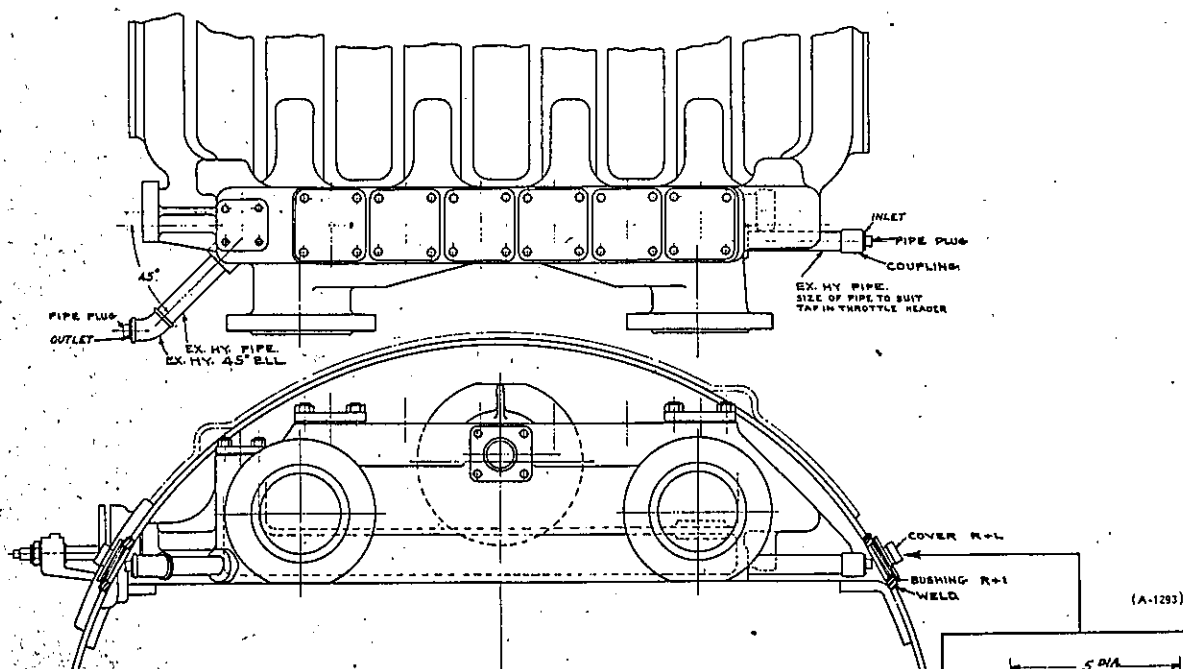


Fig. 3. Throttle Washout Arrangement with Side Connections

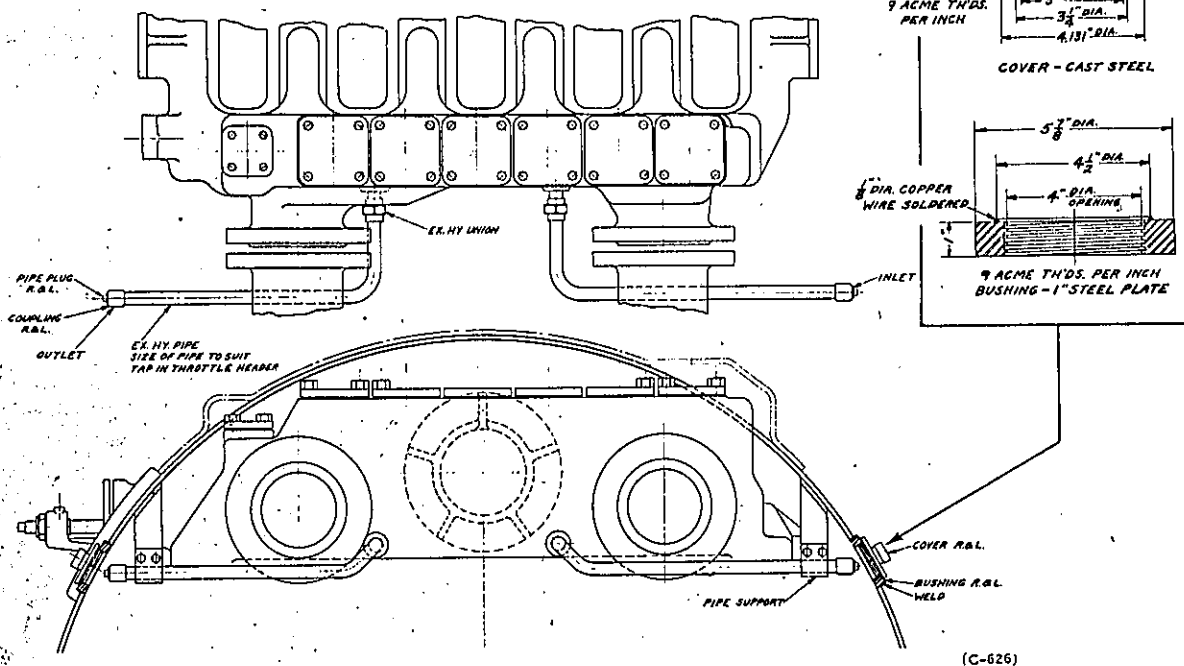


Fig. 4. Throttle Washout Arrangement with Front Connections

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First apply the pilot valve, then rotate the camshaft sufficiently to permit the application of the "A" valve, which is the nearest main valve to the pilot valve. The remaining valves may now be applied. Before applying the gaskets and covers, operate the camshaft and see that the valves are lifted properly.

REMOVAL OF CAMSHAFT BEARING AND CAMSHAFT

If the camshaft is to be removed, first take out all throttle valves; then take off the camshaft nut and crank arm; and then remove the gas joint packing gland and flange, the steam packing gland and the bearing stud nuts. The exposed portion of the camshaft should be thoroughly cleaned and the bearing removed with the bearing puller, illustrated by Fig. 5.

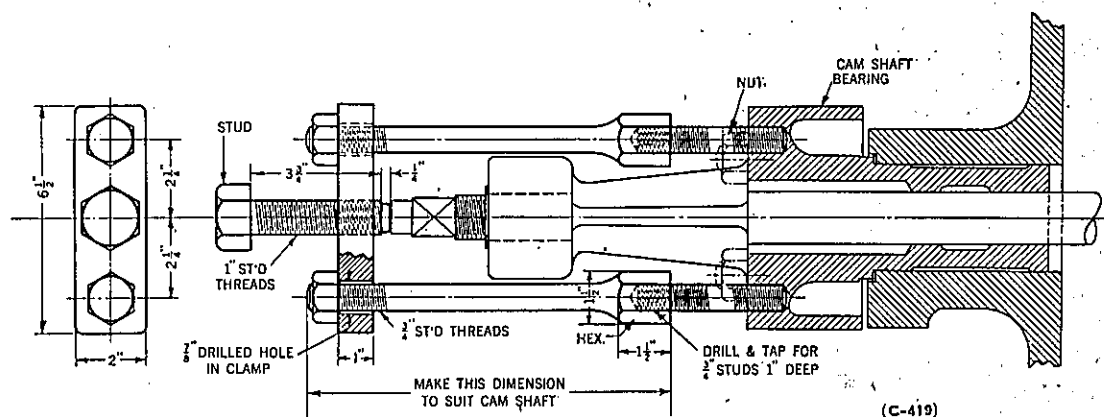


Fig. 5. Jack for Pulling the Camshaft Bearing.

The camshaft may now be removed through the hole in the neck of the throttle casting.

RE-APPLYING CAMSHAFT AND BEARING

Before re-applying a camshaft it should be thoroughly cleaned. The ball bearing and adjusting sleeve should likewise be thoroughly cleaned. When the camshaft is inserted, care must be taken that it does not strike and dislodge the camshaft plug bearings in the balancing chamber, and the end of the camshaft must enter the camshaft bushing at the opposite end of the header. The gasket recess in the throttle neck should be clean and, if necessary, should be given a light grinding with a suitable ring grinder. The old gasket should be replaced with a new one, annealed immediately before application.

Camshaft bearing gaskets are furnished with a suitable inside diameter, so that the gasket can be placed on the shoulder of the bearing, after which the bearing and gasket may be brought into position against the throttle neck at the same time. This procedure is recommended.

The camshaft bearing may now be secured in place and the inner camshaft sleeve applied, followed by the ball bearing ring and the outer sleeve, etc. The camshaft nut is then applied and tightened and the glands and gland

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nuts replaced. Ball bearing rings of recent manufacture are reversible; however, bearings of earlier manufacture bear the words "Thrust Here" on one side. Where this is found to be the case, the bearing should be applied with the side showing these words facing outward. Check oil or grease supply for ball bearings and replenish if necessary.

REPACKING STUFFING BOX

If stuffing box gland packing is leaking and leak cannot be eliminated by tightening the gland just enough to allow camshaft to turn freely, apply a new set of packing, preferably semi-metallic.

Before applying packing, clean box of old packing, dirt or scale, be sure camshaft packing zone is in good condition and oil hole to lantern gland is free of any obstruction.

The first packing ring should be firmly seated with convex side of ring toward inner end of box and pressure. Each following ring should then be separately compressed into place with the joints staggered. Apply lantern gland after second ring. Seat packing rings with a split metal bushing with inner end beveled to fit back face of packing ring; or a packing tool can be used, with leading edge having proper shape to conform to back face of packing ring. Tighten gland to seat rings firmly and then loosen slightly.

A suitable high temperature lubricant, preferably valve oil, should be provided to the lantern gland. This is important as it helps to prevent leakage and provides easy throttle operation.

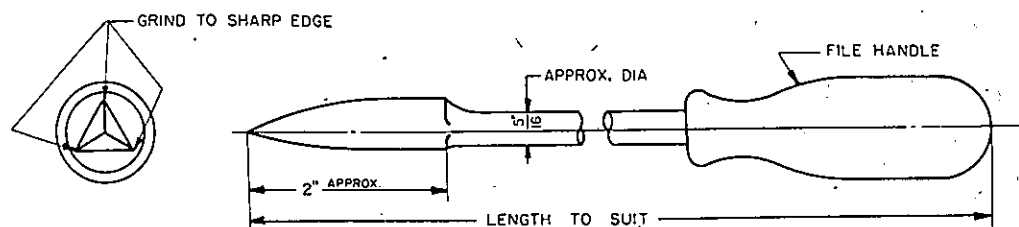
VALVE COVERS AND GASKET SEATS IN HEADER

Main valve covers must not be faced off in a lathe. If bearing surface of cover and gasket recess in throttle header do not present a clean appearance, the tools shown in Fig. 6 and Fig. 7 should be used. Fig. 6 shows alternate styles of scrapers which may be used to clean the surfaces of valve cover or gasket recess in header. Fig. 7 shows a lapping tool. This is used with a medium grade grinding compound and the handles used to turn it may be reversed, permitting it to be used on either the cover or the gasket recess in the throttle header.

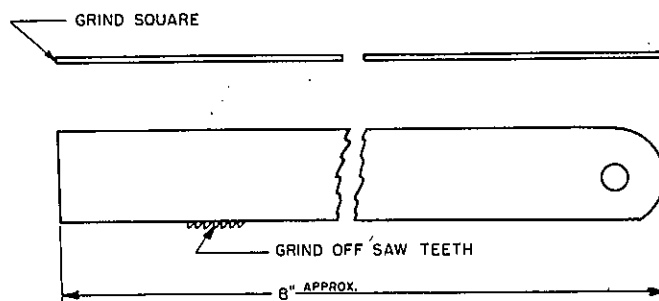
A reamer for cleaning gasket recess in the header is shown in Fig. 8. The design of this reamer permits its use where one or more gasket recesses require attention. The throttle valve need not be removed and adjacent valve covers may remain in place. This tool can be made up in the railroad company's shop, or purchased from the American Throttle Company to piece no. 14263.

The reamer is assembled by first applying the clamping bracket, Ref. 8, Fig. 8, after which two 1/4" diameter pins are screwed into the clamping bracket. The reamer, Ref. No. 6, and the pilot Ref. No. 7, are then put on over the 1/4" pins. The driving shaft assembly, Ref. No. 5, then goes on over the 1/4" pins. Next, the shaft feed assembly, comprising Reference No. 1, 2, 3 and 4, is applied. The clamping bracket, Ref. No. 8, is lifted by means of the two 1/4" pins, permitting the feed shaft to be locked in place in the clamping bracket, and then nut, Ref. No. 2, is screwed down.

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MAKE FROM 10" THREE SQUARE FILE



MAKE FROM A POWER HACK SAW BLADE

Fig. 6. Scrapers for Valve Cover or Gasket Recess In Header.

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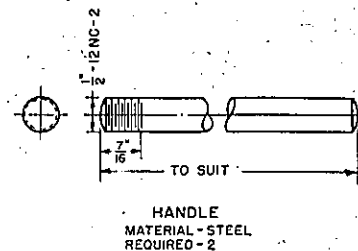
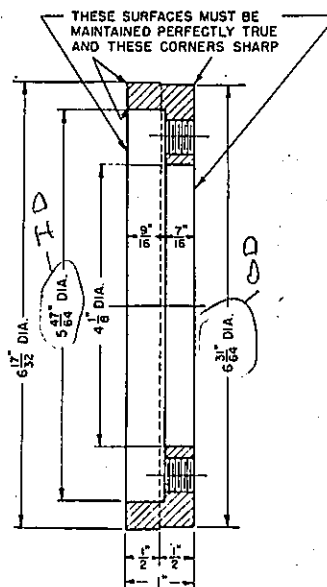
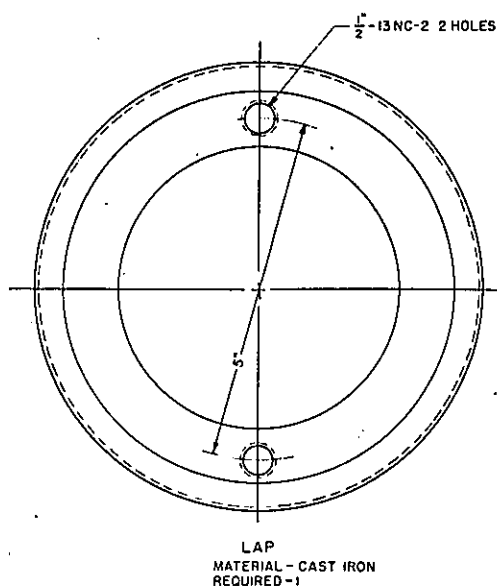
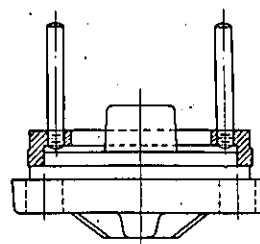
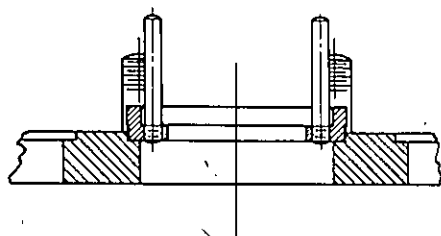


Fig. 7. Lapping Tool for Valve Cover Gasket Surfaces.

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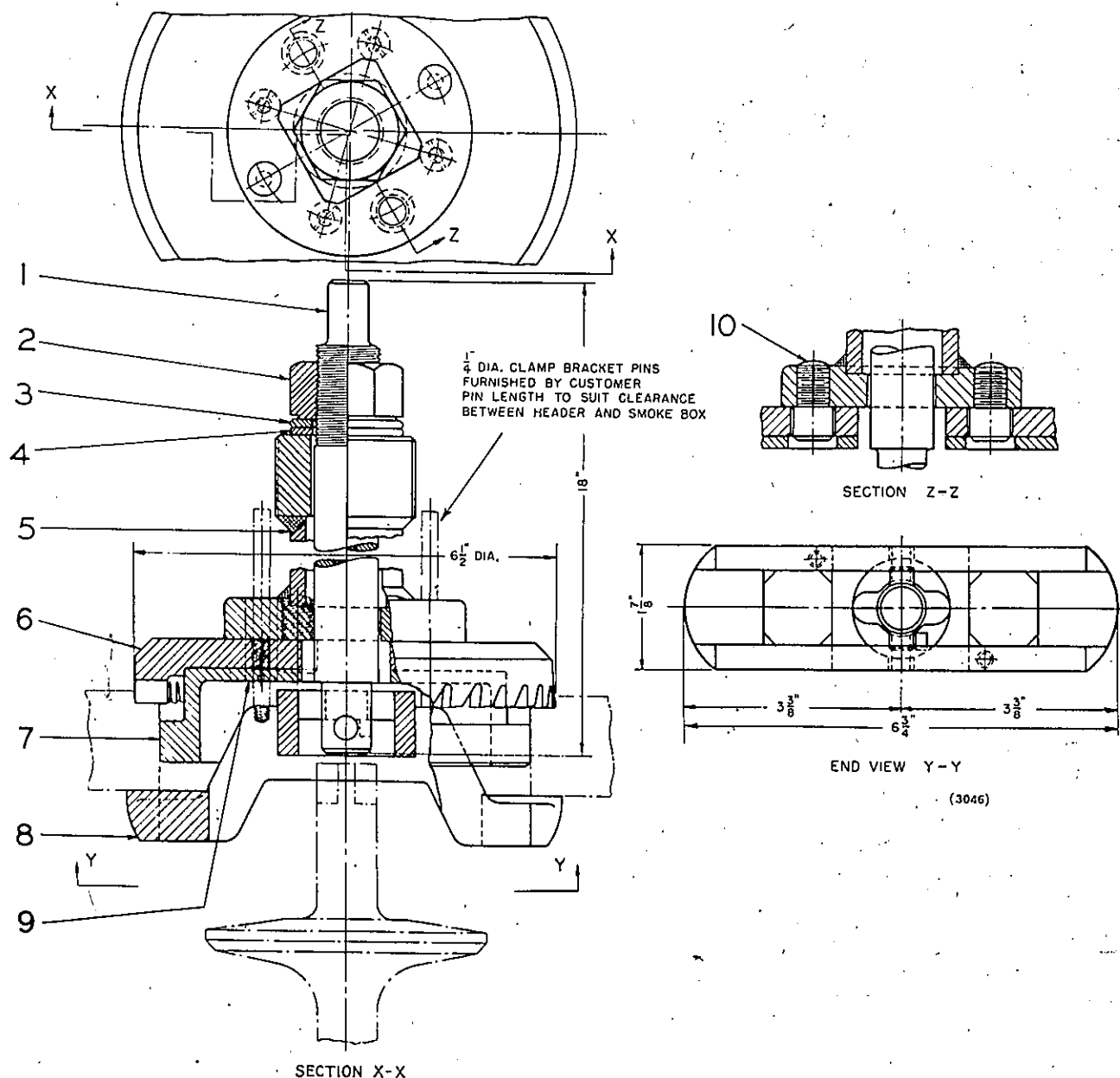


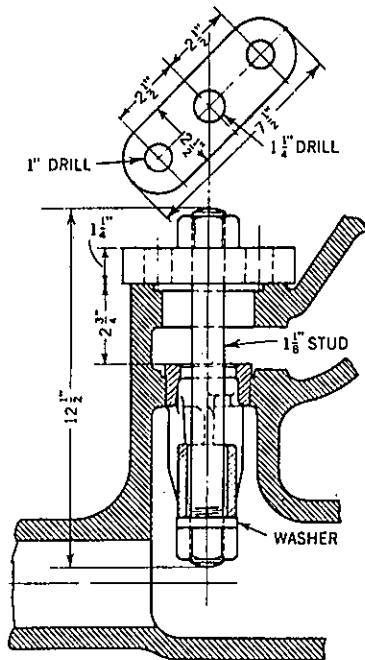
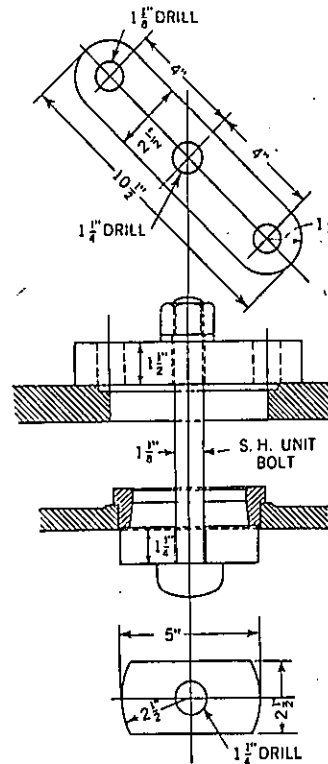
Fig. 8 Reamer Assembly

The 1/4" pins are then removed and the tool is ready for use. A wrench with handles at opposite ends should be fitted to the square at the top of the driving shaft assembly, Ref. No. 5. One or two revolutions of the reamer should suffice.

To remove the reamer, first loosen nut, Ref. No. 2, and turn the shaft, Ref. 1, in a counter-clockwise direction to disengage the shaft from the clamping bracket. One of the 1/4" pins inserted through the hole in the reamer will prevent the clamping bracket from revolving with the shaft in this step.

When a number of gasket recesses are to be dressed, the 1/4" pins will be unnecessary as the clamping bracket can be reached through the next cover hole.

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Fig. 9. Pilot Valve
Seat PullerFig. 10. Main Valve
Seat Puller

All valve cover gaskets should be of solid copper, 1/16 in. thick and properly annealed. If new gaskets are not available and the old ones are solid copper, they should be annealed before being re-applied. Graphite and oil on the valve cover studs will facilitate future removal.

MAIN VALVE SEATS AND PILOT VALVE SEATS

Fig. 11 illustrates the main valve seats in use and gives the principle dimensions of the seats as well as their position with reference to the header casting. Dimension "E" shows the

distance from the valve seat counterbore to the finished top of the throttle box. This dimension should be identical for all valve seats in any throttle. The valve seat counterbores may be reamed, if necessary, to produce this condition, but, in no case should dimension "E" be permitted to exceed the given figure by more than 1/32 in. When this condition prevails, new seats must be applied.

Replacement valve seats furnished by this company will be manufactured oversize at the point where they are fitted into the header casting. The diameter of the valve seat should be turned to .004 in. min. to .006 in. max. in excess of the hole in the header casting in order to provide a press fit.

Wear on pilot valve seats should not exceed 1/32 in.

Fig. 9 shows a tool for removing pilot valve seats. A similar tool for main valve seats is illustrated in Fig. 10. Valve seats should be thoroughly soaked with penetrating oil before they are pulled. Light tapping with a hammer

VALVE SEAT P.C. NO.	A	B	C	D	E	F
7194	3 9/16	5 1/2	1 1/16	9/16	3 29/32	4 13/32
7184	4 1/8	5 1/2	3/32	9/16	3 15/16	4 13/32
7911	4 1/2	5 11/16	3/32	9/16	3 15/16	4 13/32

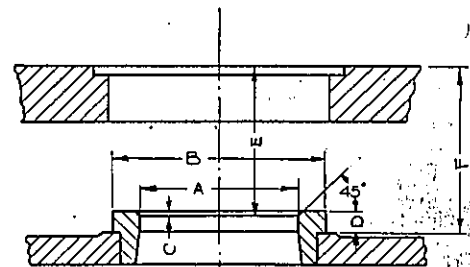


Fig. 11. Main Valve Seat

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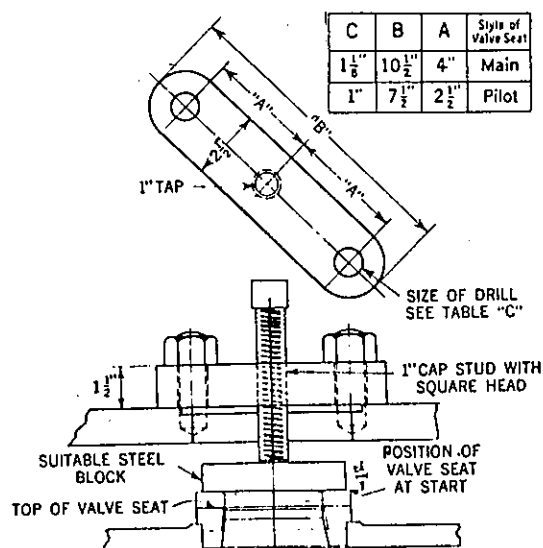


Fig. 13. Tool for Applying Valve Seats

valves. One cutter will service 3-9/16 in. and 4-1/8 in. valves. A larger cutter is shown for 4-1/2 in. valves.

may help to break any seal caused by corrosion.

When applying a new seat, the seat should be started into the bore, then forced into place by means of a tool shown in Fig. 13.

A tool for refinishing main valve seats is shown in Fig. 12. This tool can be used where one seat or more requires attention. A two-piece top guide is applied in place of the valve cover. Two dowel pins within the guide retain the feed nut. Pressure is maintained by turning the handles at the top of the feed screw and the arbor is turned, using a wrench having handles at opposite ends. The bottom guide shown is suitable for seats used with 3-9/16 in., 4-1/8 in. and 4-1/2 in.

CAMSHAFT BEARING PLUGS AND BEARINGS

Fig. 14 illustrates the present standard camshaft bearing plug assembly used to support the camshaft. It is different from early designs, in that there are two parts. The bearing fits into the plug and is easily removed for repairs or replacement without disturbing the plug. After the camshaft is replaced, be sure and check to see that bearings are in place.

It has been found that camshafts supported only at each end will sag and when this occurs the valve lift intervals will be adversely affected. The camshaft bearing plug and bearings should, therefore, be set up so as to support the camshaft and eliminate any sagging. The amount of sag can be determined by carefully measuring the distance from the finished top surface of the throttle box down to the top of the camshaft at each end and also at a point lined up as closely as possible with the bearing plug. These measurements are made through the valve openings. To take up sag, the joint surface "X" on the plug can be machined off to suit, thus permitting the plug bearing surface to be raised the desired amount.

Before making any adjustment to the camshaft bearing

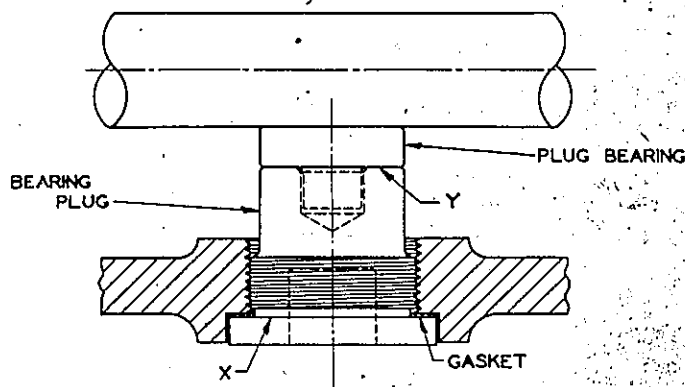


Fig. 14. Camshaft Bearing Plug

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plug and plug bearing, the camshaft bushing as shown in Fig. 21, should be examined for wear. This can be determined by gripping the camshaft through the extreme left valve opening and attempting to shake the camshaft. If undue wear is found in the bushing, it should be replaced.

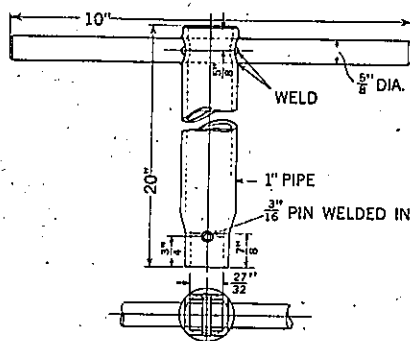


Fig. 15. Wrench for Grinding Disc-type Throttle Valves

GRINDING VALVES

If it is necessary to grind the throttle valves, first remove the smokebox cover plate and disconnect the throttle rod at the camshaft arm. Wash off all deposit, then remove all valve covers and gaskets, rotate the camshaft in the direction for opening the valves, and lift the valves. Use fine grinding compound, and grind just enough to provide a steam-tight joint. Excessive grinding will produce a shoulder in the valve face that will result in a leaky throttle because the valve cannot seat properly. A wrench for grinding the valves is shown in Fig. 15.

CHECKING VALVE INTERVALS

Valve intervals should be checked after the valves are ground. Fig. 16 shows a depth gage with which the valve intervals may be checked as follows:

1. Remove the valve covers and gaskets and disconnect the throttle rod so that the camshaft can be turned by the shaft arm. If necessary, loosen camshaft packing gland so as to permit easy turning of shaft.
2. Place the depth gage above the pilot valve as shown in Fig. 16 and measure the distance to the top of the pilot valve.
3. Turn the camshaft until the "A" cam is just touching the lifting surface of the "A" valve.
4. Then measure with the depth gage the distance to the top of the open pilot valve. The difference between the first measurement taken and the latter, will be the interval between the pilot and "A" valve. Proceed in the same manner to determine the intervals between the "A", "B", "C", "D", "E", "F", and "G" valves.

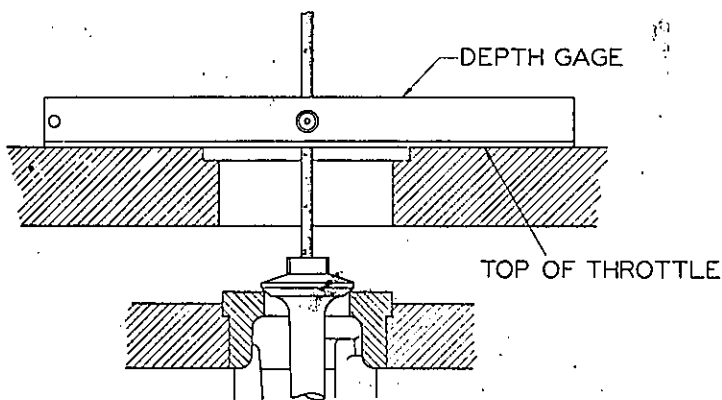


Fig. 16. Gage for Valve Intervals
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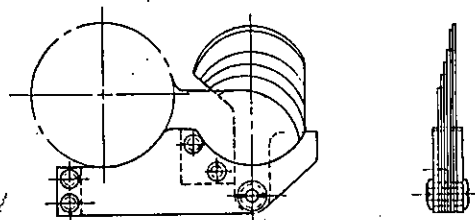


Fig. 17. Checking Cam Contours with Gage
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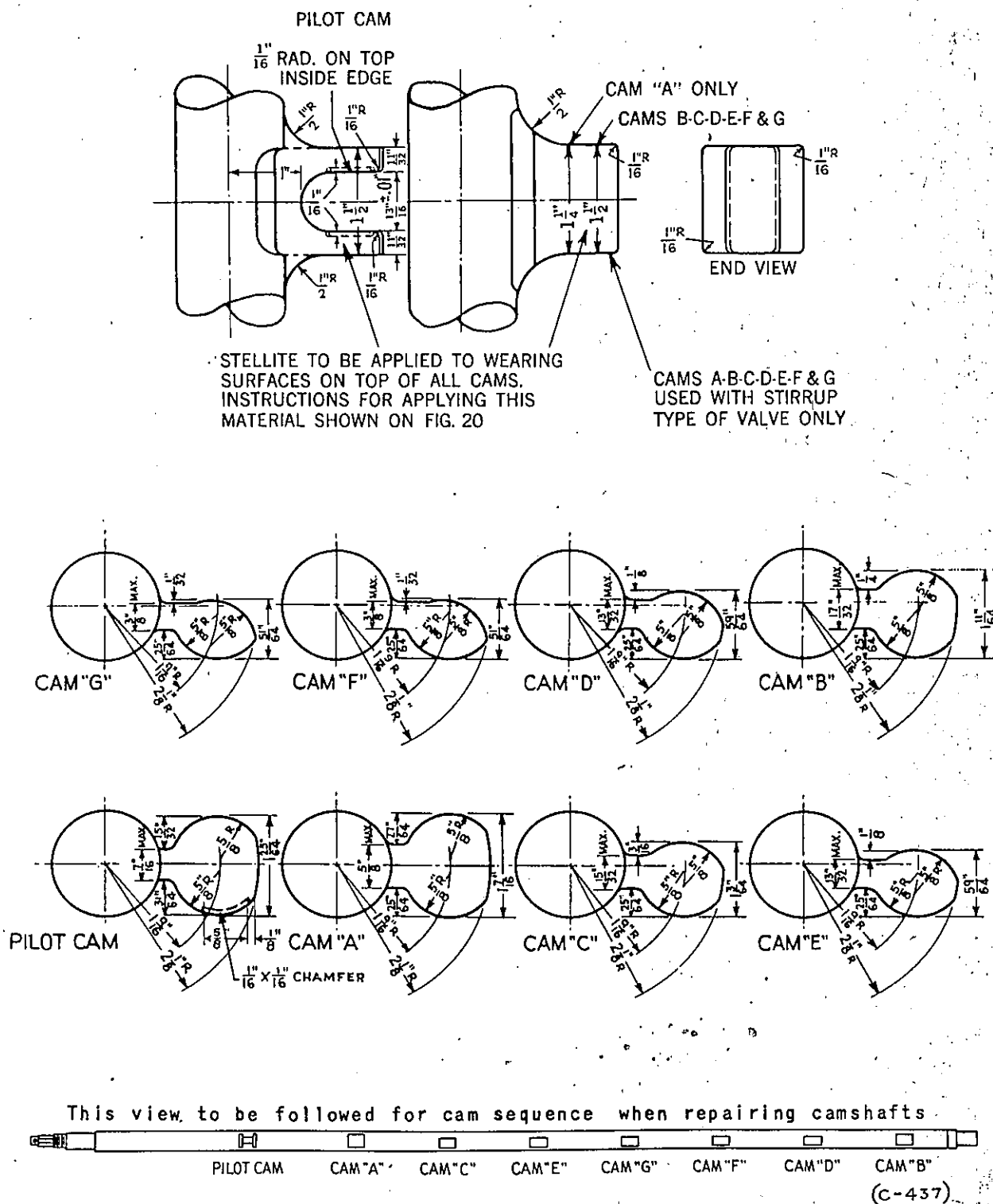


Fig. 18. Throttle Valve Cam Contours

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To determine the moment the cam touches the lifting surface of the valve, rest the fingers on top of the valve spindle. The slightest pressure of the cam against the lifting shoulder can be detected in this manner.

If the intervals are found not to be correct, attention should be given to the valves, valve seats and cams. Present standard intervals are as follows:

Pilot Valve to "A" Valve	- 1/4"
"A" Valve to "B" Valve	- 1/4"
"B" Valve to "C" Valve	- 1/8"
"C" Valve to "D" Valve	- 1/8"
"D" Valve to "E" Valve	- 0
"E" Valve to "F" Valve	- 1/8"
"F" Valve to "G" Valve	- 0

MODIFYING AND MAINTAINING CAM CONTOURS

Fig. 18 shows the dimensions of the cam contours for locomotives equipped with compensating levers. Fig. 18 also shows the sequence of the cams on the camshaft. It is the recommendation of this company that when camshafts from these locomotives are repaired, the cam contours be finished as shown here, regardless of their original dimensions.

The cam lifting-surfaces should not be permitted to wear in excess of 1/16 in. When this amount has been exceeded, the cam contour should be built up as described in the adjoining text by the addition of Haynes-Stellite. Fig. 17 illustrates the use of a gage for checking cam contours.

Sufficient stellite material must be added to permit finishing the cams to the given contour dimensions. The distance from the top of the cam lifting-surface to the top of the cam neck must also conform to the dimensions shown. If, in converting cam contours to the present standard dimensions, the thickness of the neck on the C, D, E, F and G cams is reduced to less than a minimum of 3/8 in., it will be satisfactory to build up the lower side of the cam neck by welding with sufficient material to maintain the minimum thickness. If this is done, the shaft should be air-cooled during the operation as described on page 18. When changes are made in existing cam contours, the bottom of the cam must always be used as a base line from which to work.

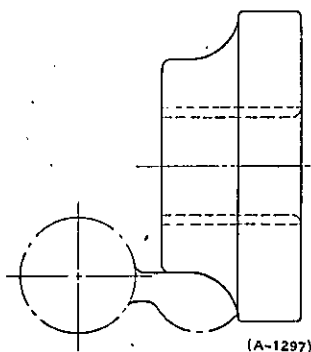


Fig. 19. Grinding
Cam Contours
with Stone

Following the application of Haynes Stellite to the cam lifting-surfaces, as shown in Fig. 20 and as described below, the following steps should be observed.

- A. The camshaft must be swung in a lathe and straightened.
- B. The excess metal must be removed from the sides and the slot in the cam jaw by grinding. This is done with a thin cutting stone 6 in. x 1 1/2 in. x 1-1/4 in. bore.
- C. In the roughing operation, the shaft is set up in a grinder and the desired contour of cams approximately roughed out with a small flat beveled stone 6 in. x 1 1/2 in. x 1-1/4 in. bore.

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D. The finishing operation may be done with stones made with grinding surface to conform to cam contours. Such stones can be furnished by this company.

Fig. 19 illustrates the use of a cam grinding stone used for the finishing operation. Cam grinding stones may be made of any of the materials listed on page 18.

APPLYING STELLITE TO THROTTLE VALVES AND CAMS

Haynes Stellite No. 1 welding rod is a hard metal which will retain its hardness up to a temperature of 1500 deg. F. Referring to Fig. 20, Haynes Stellite No. 1 should be applied as follows:

1. Use an oxyacetylene welding torch. Correct results are obtained by using an excess acetylene flame at all times. The excess bushiness of the flame should be twice as long as the inner sharply defined cone.
2. The surface to be Stellite must be clean. It is preferable to machine face before applying Stellite. The thickness of Stellite to be allowed on finished valve is shown in Fig. 20.

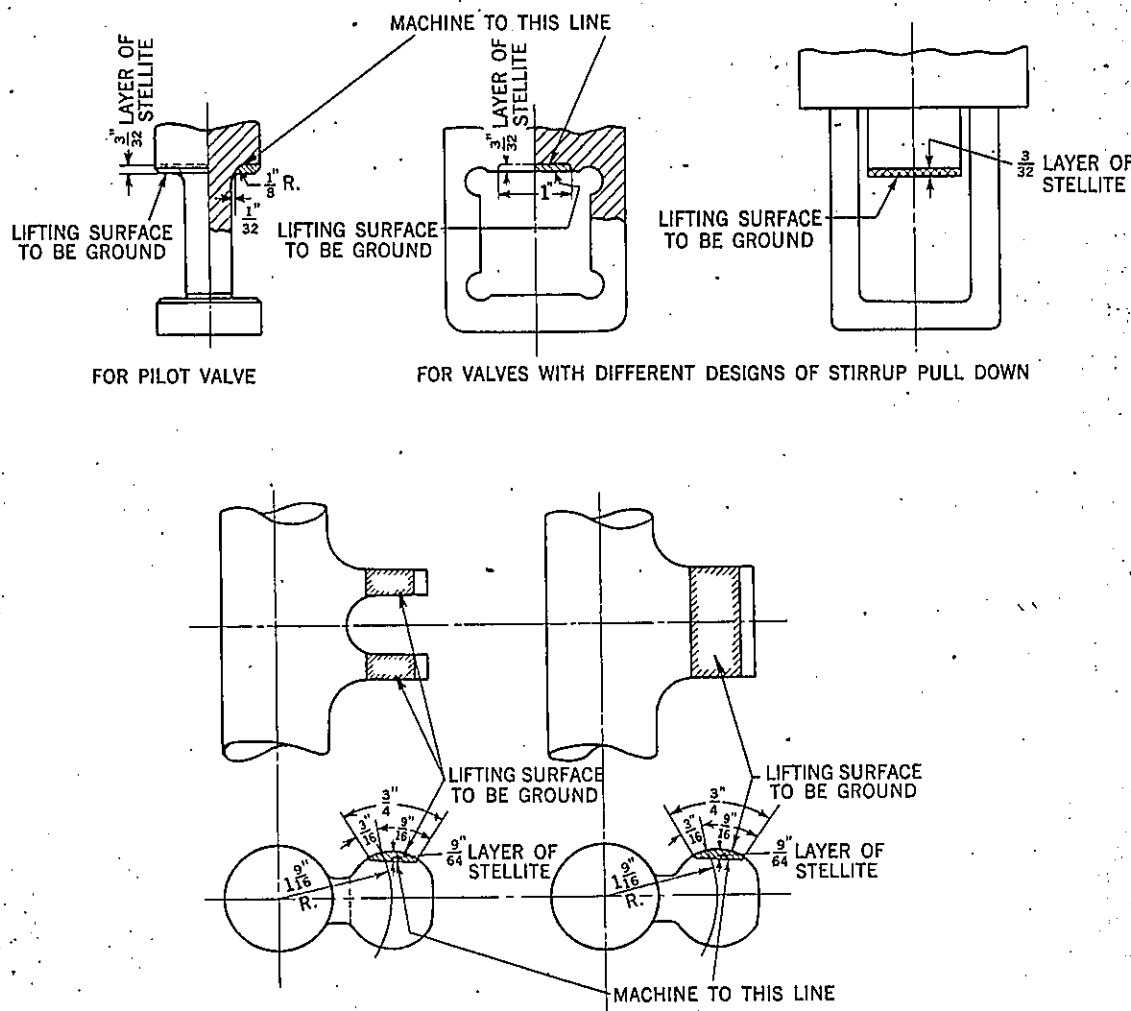


Fig. 20. Method of Applying Stellite to Throttle Valves and Cams

AMERICAN MULTIPLE-VALVE THROTTLES

3. Heat the surface of the steel until it begins to sweat cleanly. See note below regarding special procedure to be followed for Stellite cams.
4. Place Stellite rod into flame and when molten on the point, allow Stellite to flow onto the sweating steel.
5. At all times keep the steel just ahead of the Stellite weld up to a clean sweating condition, and in finishing the weld, carry the heat beyond the junction of the start and finish.
6. Do not allow Stellite to flow onto surface which is not sweating cleanly.
7. If the surface to be welded scales badly from heat and the Stellite will not flow readily onto it, increase the amount of acetylene in the flame. In rare cases the slightest amount of Oxweld Brazo flux will help for this operation.
8. It is important to make weld as smooth as possible to save excess grinding. Stellite can be machined only by use of a Carboloy tool - and then ground to finish.
9. On completion of welding operation, the parts should be ground to dimensions shown on detail drawings.
10. The following wheels are recommended for grinding Haynes Stellite surfaces:

Carborundum Co. 46 N Aloxite vitrified
Detroit - Star 46 M Staralox vitrified
Norton 46 M Alundum vitrified
Precision 46 M vitrified
Sterling 46 M vitrified

Note: - Additional procedure for Stellite Cams - The thin neck section which joins the cam to the shaft proper should be air cooled to prevent overheating during the Stellite operation so that maximum hardness and strength may be maintained in this section. To accomplish this, a low-velocity jet of compressed air should be directed against the underside of the cam neck section during the Stellite operation.

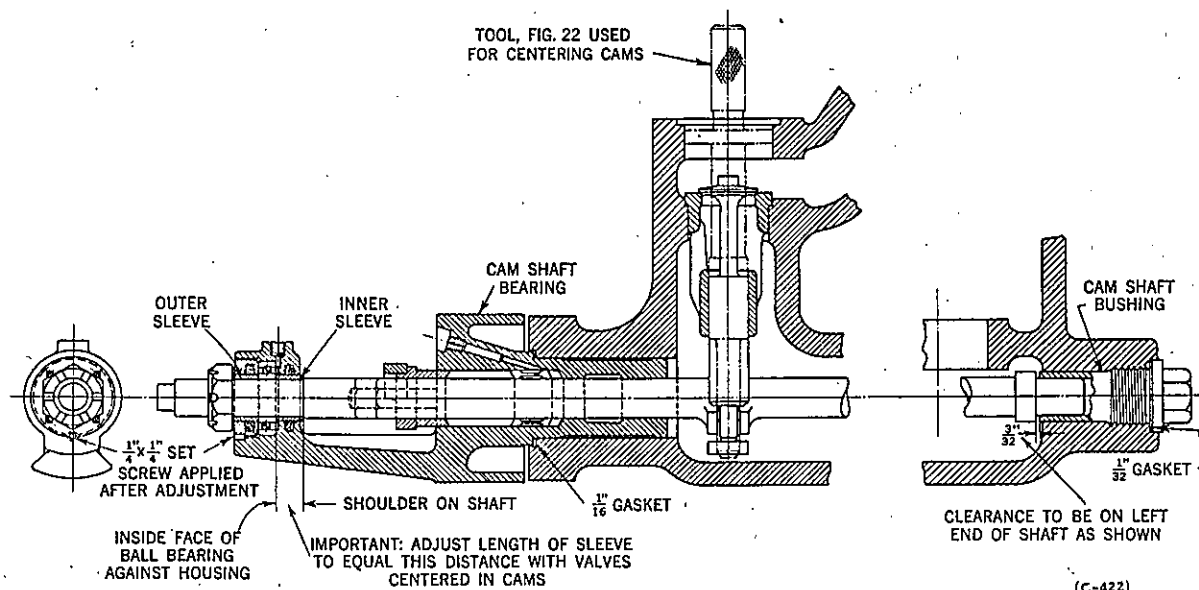


Fig. 21. Lateral Adjustment for Camshaft

MAINTENANCE INSTRUCTIONS

LATERAL ADJUSTMENT OF CAMSHAFT

Fig. 21 should be followed for the lateral adjustment of camshafts. Use the tool, Fig. 22 to center the cams and adjust the length of the inner sleeve to equal the distance from the camshaft shoulder to the inner face of the ball bearing (See Fig. 21). The outer sleeve should be of equal length. With all parts of the ball bearing assembly in place there will be no end play.

APPLICATION OF BRONZE TO CAMSHAFT (Packing Zone)

If the camshaft becomes corroded or badly pitted in the zone covered by the packing, the shaft must be turned down to a depth of at least $1/16$ in. for a length of $5\frac{1}{2}$ in., centrally located over the packing area. Bronze, such as Oxweld No. 25-M or equal, should be applied at this point and the shaft machined and polished to its original diameter.

MAINTENANCE OF VALVES

Pilot Valves

Pilot valves, together with dimensions for their maintenance, are shown in Fig. 23. Wear can be detected by comparing valves with the given dimensions.

These valves are subject to wear on the surface of the valve face and upon the surface lifted by the cam. The wear on the valve face should not exceed $1/16$ in. Wear in excess of this amount should be replaced as described on page 20. The diameter of the valve must also be maintained.

Wear on the surface of the valve lifted by the cam should not exceed $1/32$ in. and when worn in excess of that amount, it should be restored by the application of Stellite to a depth of $3/32$ in. as described in Fig. 20.

Main Valves

The "A" valves in use are shown in Fig. 24. Large main valves are illustrated in Fig. 25. Dimensions are given with other information for their maintenance.

The permissible limit of wear on the face of these valves is $1/16$ in. Wear in excess of this amount should be replaced as described on page 20. The diameter of these valves must also be maintained.

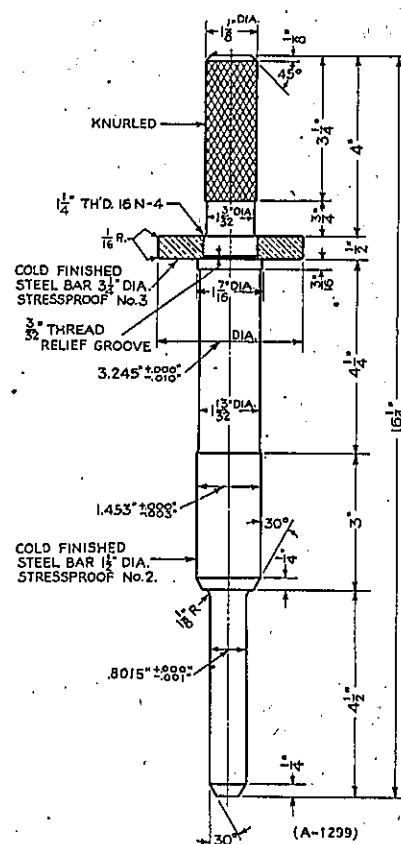


Fig. 22. Camshaft
Adjusting Tool

AMERICAN MULTIPLE-VALVE THROTTLES

REPAIR OF VALVE FACE

Pilot valves and main valves are alloy steel and the following procedure should be employed in welding:

WELDING PROCEDURE FOR REPAIRING ALLOY STEEL VALVES

1. Preheat to 500° F.
2. Arc or gas welding may be used and the following welding rods are recommended:-

Arc Welding

Metal and Thermit, "Molex"
General Electric, W-52
A. O. Smith, SW-75

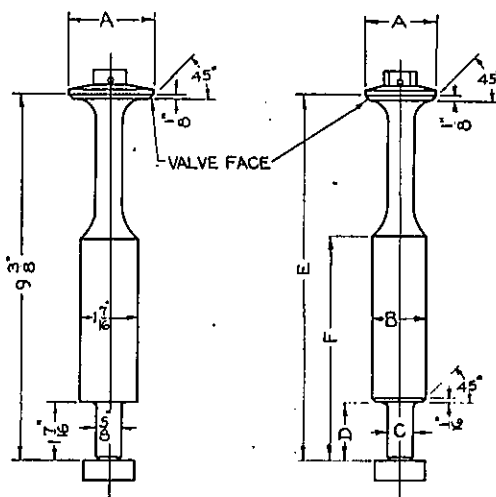
Gas Welding

Air Reduction Co.,
"Airco Carbon Moly"

3. Cool slowly after welding.
4. Hold at 1000° F. for at least 30 minutes.
5. Air Cool.

After valves have been welded, they should be refinished to the original dimensions and checked to insure correct alignment.

Wear may also be expected at the point where these valves are lifted by the cam. This wear should not exceed 1/32 in. and when this figure is exceeded, the worn material should be restored by the application of Stellite.



VALVE SIZE	PIECE NO.	A
1 1/8"	7907	1 13/16"
2"	7981	2 3/16"

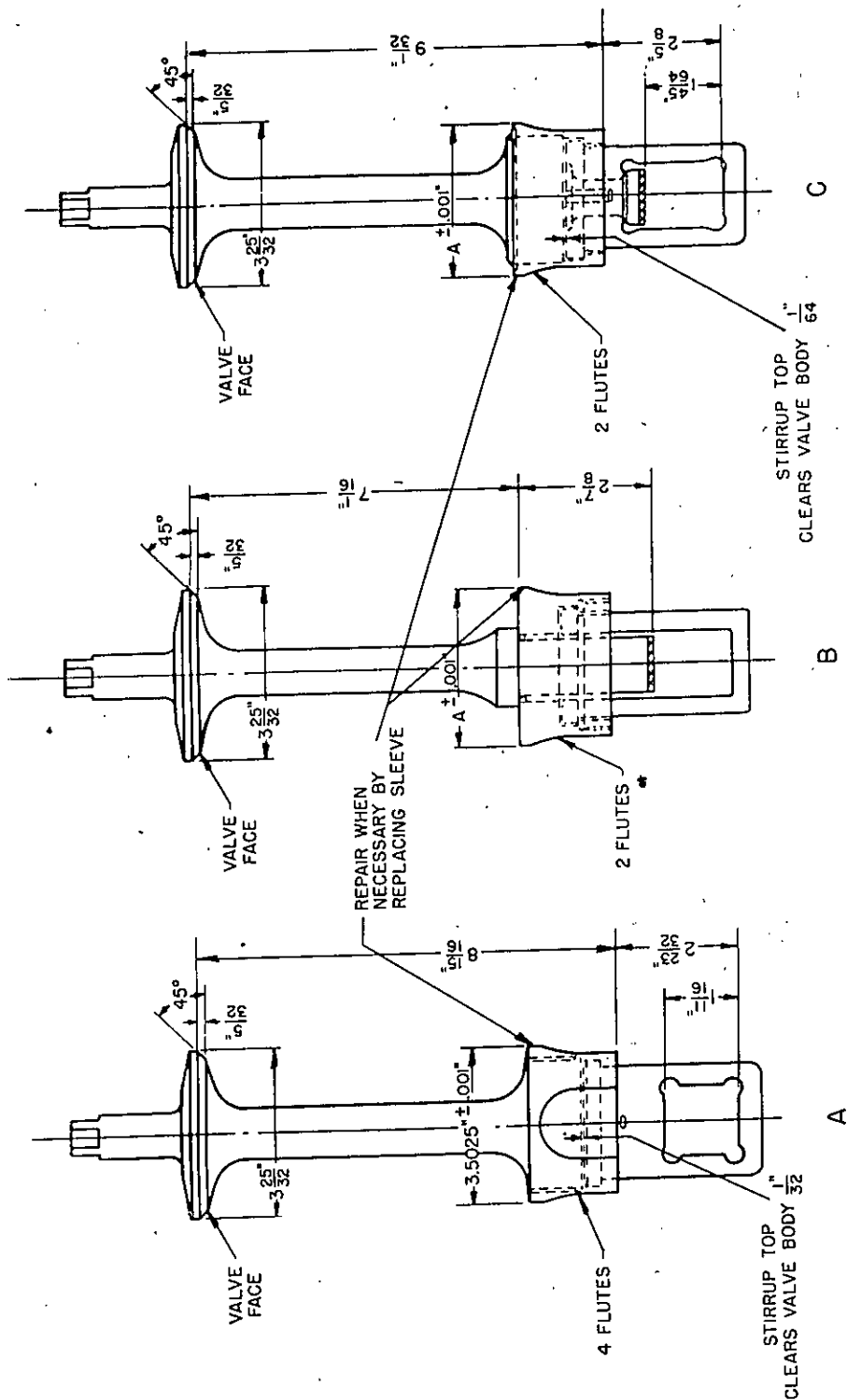
VALVE SIZE	PIECE NO.	A	B	C	D	E	F
1 1/8"	7094	1 13/16"	7/8"	5/8"	7/16"	9 3/8"	5 3/4"
2"	7095	2 3/16"	7/8"	5/8"	7/16"	9 3/8"	5 3/4"

Fig. 23. Pilot Valves

(A-1300)

In the case of the valve design, Fig. 24-C and 25-C, the Stellite lifting surface is applied to a small cylindrical steel insert, which is pressed into the valve stirrup and locked in place by a rivet, as shown. When the Stellite becomes worn 1/32 in. a new insert should be applied. To remove the worn insert, take out rivet and remove insert, using tool Fig. 30. After new insert is applied, lock it in position with new rivet.

All large main valve pistons are so dimensioned that the inside diameter of the guide in the header exceeds the outside diameter of the piston by .018 in. min. The same is true of "A" valve pistons when used with 4-1/2 in. main valves. The maximum allowable difference between the two diameters is .031 in. On "A" valves, used with 4-1/8 in. main valves, the inside diameter of the guide



PIECE NUMBER 7061

PIECE NUMBER	A
12157	3.5025"
* 12154	3.5025"
12158	3.5425"

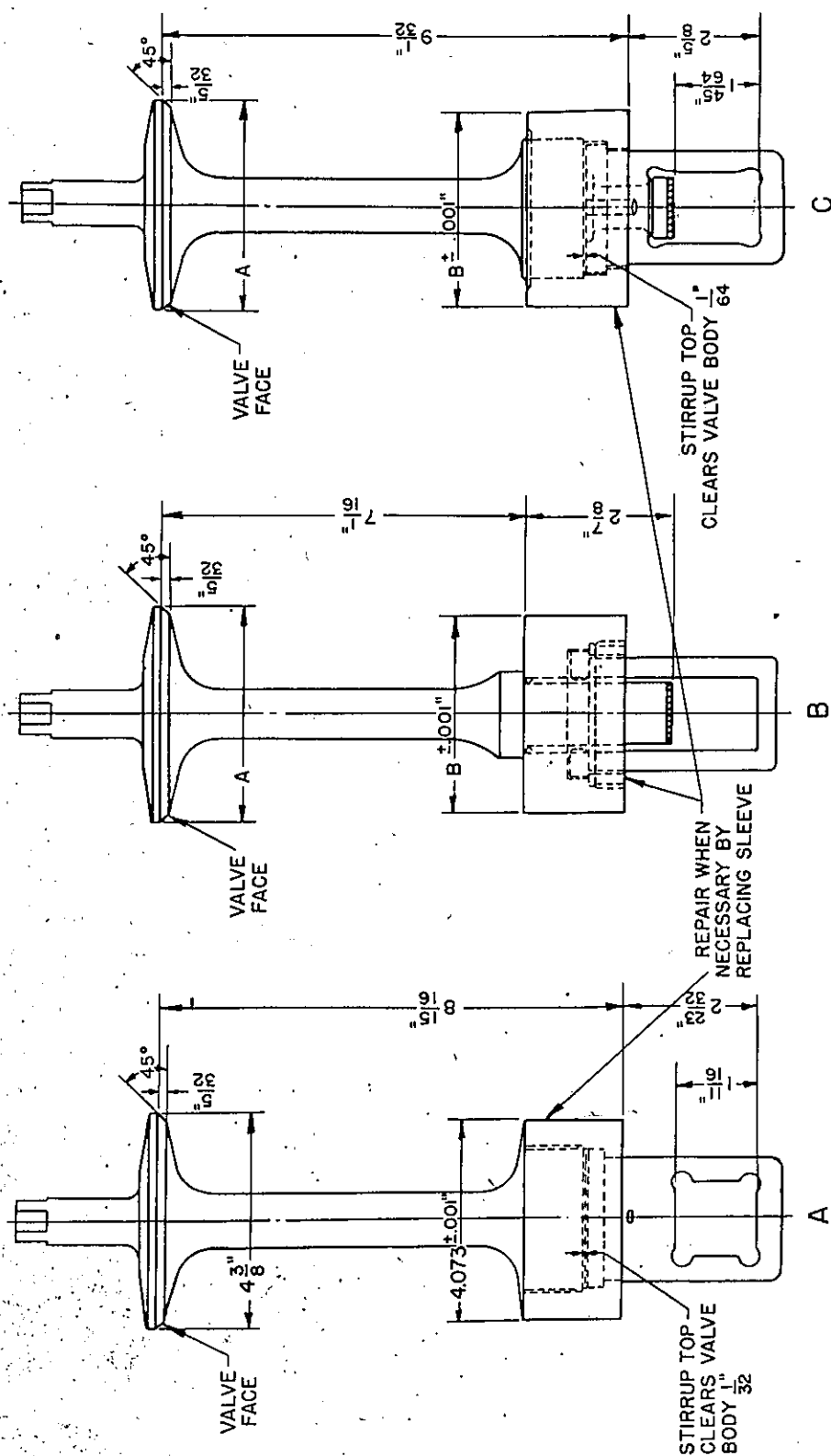
* FURNISHED WITH 4 FLUTES

PIECE NUMBER	A
13597	3.5025"
13598	3.5425"

(3052)

Fig. 24. "A" Valves

AMERICAN MULTIPLE-VALVE THROTTLES



4 1/8" MAIN VALVE
PIECE NUMBER 7056

VALVE SIZE	PIECE NUMBER	A	B
4 1/8"	12155	4 3/8"	4.073"
4 1/2"	12156	4 3/4"	4.448"

VALVE SIZE	PIECE NUMBER	A	B
4 1/8"	13594	4 3/8"	4.073"
4 1/2"	13596	4 3/4"	4.448"

Fig. 25. Large Main Valves

(3051)

MAINTENANCE INSTRUCTIONS

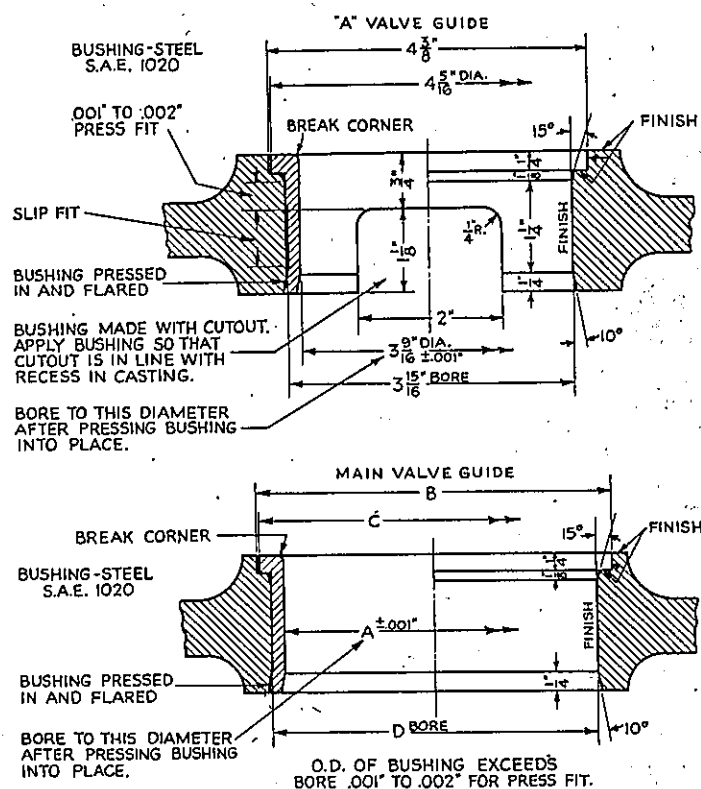
in the header exceeds the outside diameter of the piston by .058 in. min. In this case the maximum allowable difference in the diameters should not exceed .071 in.

When the difference of these diameters exceeds the limitations given, due to wear of balancing piston, the piston should be repaired and restored to original diameter. If the difference is due to wear in the piston guide, the guide should be bushed. If the wear cannot be taken care of by either one of these two operations, it will be necessary to restore the pistons to original diameter and also bush the guide. Never increase the diameter of the piston greater than its original dimension.

Fig. 29-A shows the manner in which valves (piece no. 12154, 12155, 12156, 12157 and 12158) are assembled by means of a welded pin securing the valve body to the balancing piston. Fig. 29-B shows the ring lock which retains the valve stirrup ring on these valves.

Fig. 29-C shows the valve assembly as used on valves to piece no. 13594, 13596, 13597 and 13598. The balancing piston sleeve is attached to the valve body by means of a shrink fit. It has a lip at the top which is rolled over to form an extra interlock with the valve body. To remove a worn sleeve, machine off the rolled lip and heat evenly with a torch until it drops away from valve body. To apply new sleeve, heat to approximately 1200° F., and shrink on to valve body with stirrup in place. Be sure that valve shoulders against sleeve as shown. After shrinking parts together, chuck the assembly in a lathe and roll lip over as shown, using a roller or burnishing tool. Spare sleeves are furnished by this company with the shrink fit diameter finished to the required standard size.

When repairs have to be made to the balancing pistons



(A-1303)

A	B	C	D
4 3/32"	4 13/16"	4 7/8"	4 1/2"
4 15/32"	5 1/16"	5 1/4"	4 7/8"

Fig. 26. Repair of Balancing Piston Guide

AMERICAN MULTIPLE-VALVE THROTTLES

or stirrups on the foregoing valves, Fig. 29-C should be followed. Replacement parts can be obtained from this company.

Stirrup valves (piece no. 7061 and 7056), shown in Fig. 25-A are of an early design and may be repaired by replacing the stirrup, body or balancing piston sleeve. These parts are obtainable from this company.

When balancing pistons, valve bodies or sleeves for any of the above mentioned valves are purchased from this company, these parts will be furnished over-size to permit the assembled valves to be turned in a lathe to the finished dimensions. This will insure the correct alignment of valve and piston.

For the best results, it is recommended that all throttle valves be returned to this company, where repairs will be made with the same careful attention that is used in the manufacture of new valves.

The balancing pistons of "A" valves and large main valves are manufactured with sleeves and are repaired by applying new sleeves. The recommended method of bushing balancing piston guides is illustrated in Fig. 26, 27 and 28. Fig. 26 gives dimensions and other data regarding the guide and bushing. The lower ends of the bushings may be flared by using a split tapered plug, which can be expanded by means of a center bolt through the valve opening.

Fig. 27 shows a tool for rough-boring and finishing the guide and for finishing the bushing after its application. The same tool, fitted with a suitable cutter is used for counter-boring the guide.

The top guide and feed nut are the same as those used with the Reseating Tool, Fig. 12 and it is similarly applied and operated, except that in this case the arbor is shown with a shank suitable for use with an air motor. A square end can be applied and the tool operated by hand if desired.

A tool for flaring the bushing is shown in Fig. 28.

MODERNIZING THROTTLES

The following text will describe improvements that may be made to existing throttles:

1. An improved arrangement for lubricating the camshaft in the packing zone includes the use of a lubricator with shut-off valve. This permits safe filling of the oil cup with throttle under pressure, by closing the valve during the operation. This arrangement, as well as the altered distribution of packing, which calls for two rings of packing to be inserted beyond the lantern gland, are recommended.

2. Steam packing glands of recent manufacture are made in three parts, the gland itself being split. The gland is held in place by a separate flange. The latter differs in shape from stuffing box glands of early design so as to provide easier wrench access to the camshaft bearing stud nuts. This arrangement permits removal of the packing gland and flange for convenience in applying new packing. It is interchangeable with earlier design.

This company will furnish additional information in connection with any of the above modifications upon request. Please give the class of locomotives, type and locomotive number.



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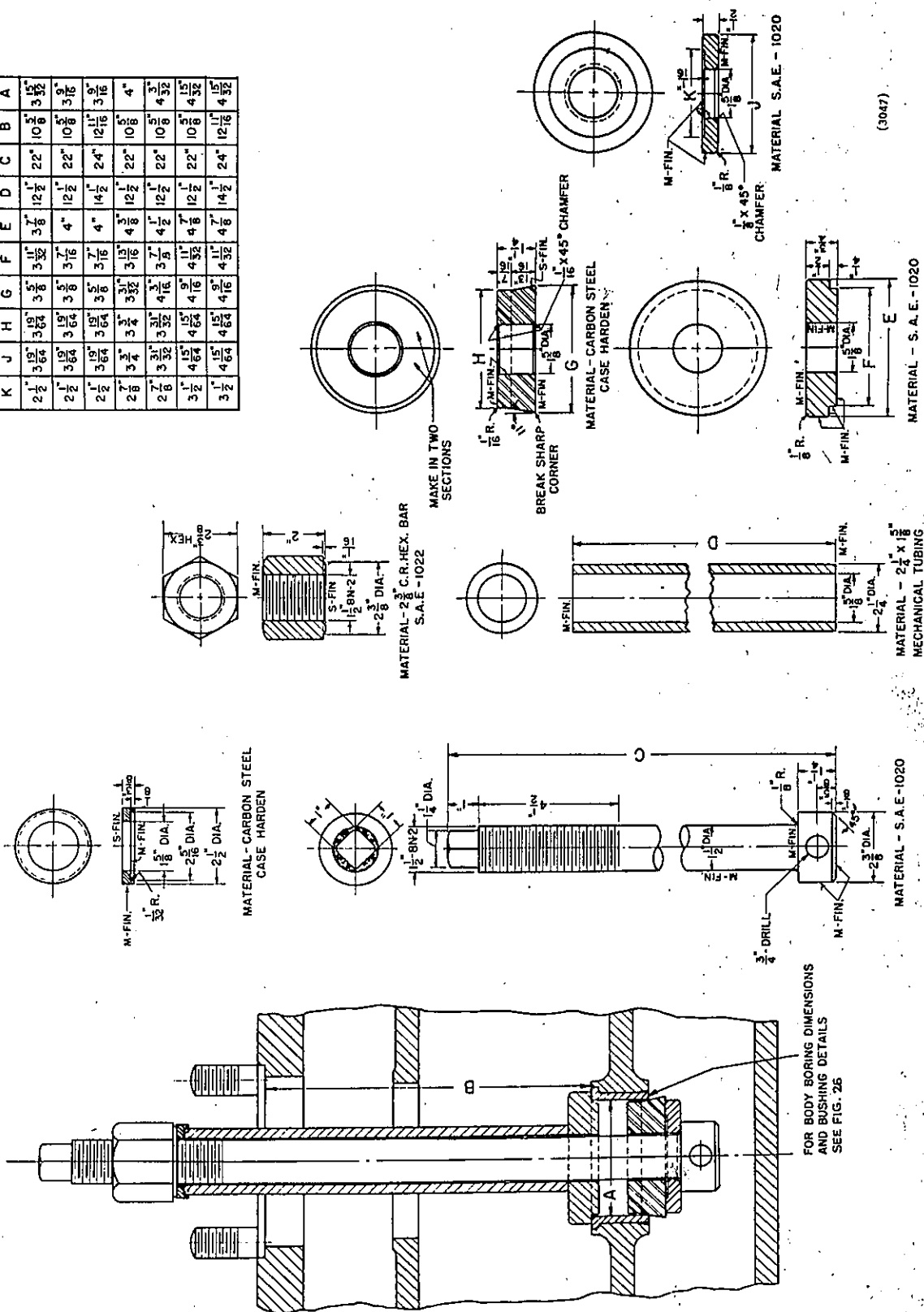
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Fig. 28. Flaring Tool for Balancing Chamber Bushing

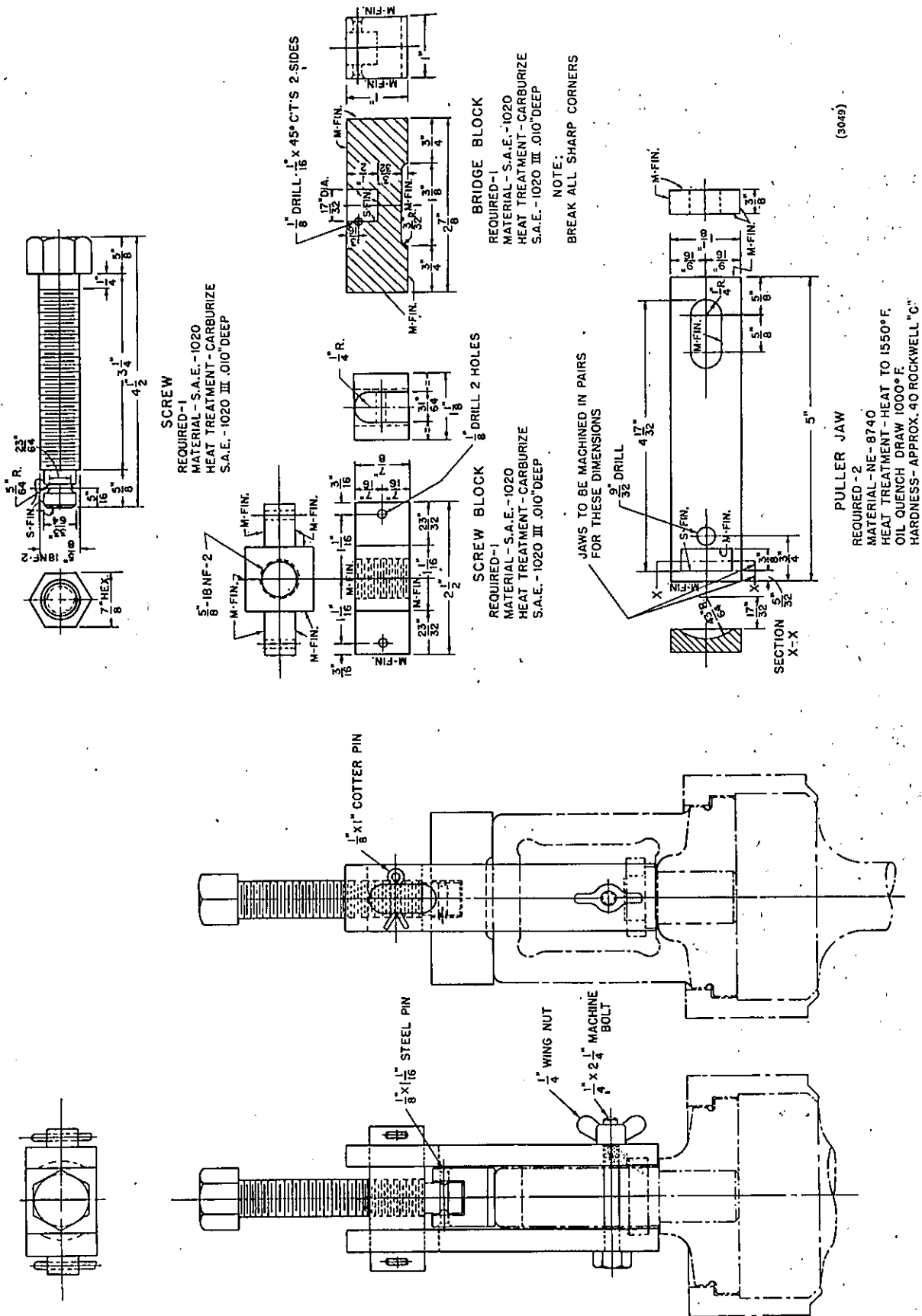
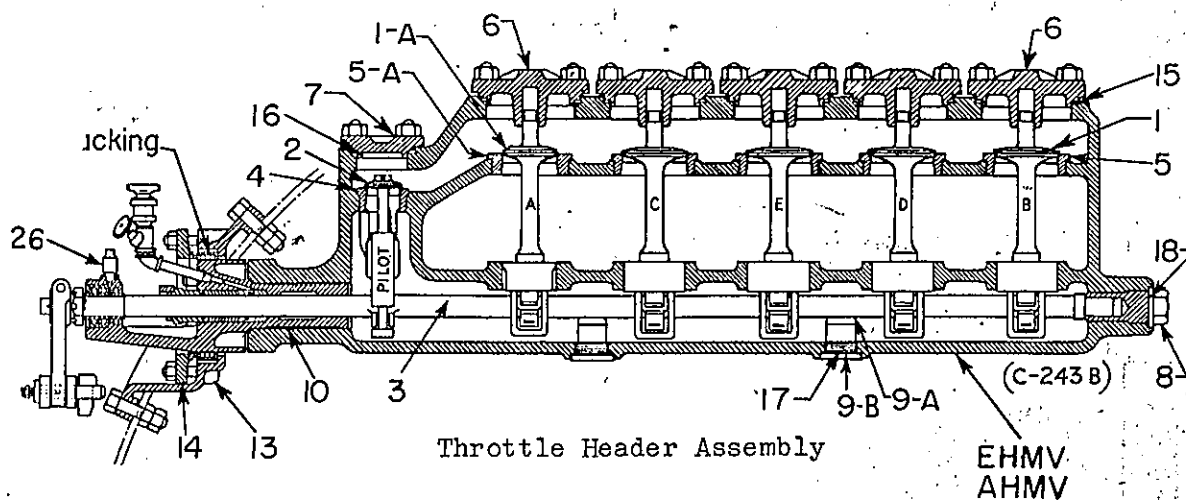
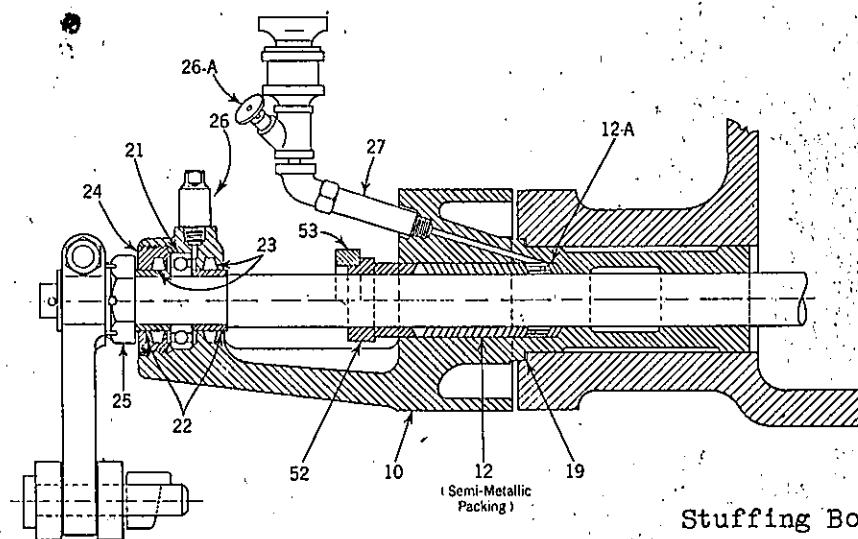


Fig. 30. Throttle Valve Stirrup Pin Puller

AMERICAN MULTIPLE-VALVE THROTTLES



Camshaft

CRANE OR
CALOCK

Stuffing Box

Fig. 31. Throttle Header Assembly, Camshaft and Stuffing Box

REF. NO.	NAME OF PARTS	REF. NO.	NAME OF PARTS
EHEMV	American multiple-valve throttle as an integral part of an Elesco type "A" or type "E" superheater header	12-A	Lantern Gland
AHEMV		13	Stuffing Box (Gas Joint)
1	Main Valve	14	Stuffing Box Gland (Gas Joint)
1-A	"A" Valve	15	Main Valve Cover Gasket
2	Pilot Valve	16	Pilot Valve Cover Gasket
3	Camshaft	17	Camshaft Bearing Plug Gasket
4	Pilot Valve Seat	18	Camshaft Bushing Gasket
5	Main Valve Seat	19	Camshaft Bearing Gasket
5-A	"A" Valve Seat	21	Camshaft Ball Bearing
6	Main Valve Cover	22	Camshaft Sleeves
7	Pilot Valve Cover	23	Camshaft Oil Rings
8	Camshaft Bushing	24	Camshaft Ball Bearing Retaining Plug
9-A	Camshaft Plug Bearing	25	Camshaft Nut
9-B	Camshaft Bearing Plug	26	Oil Cup
10	Camshaft Bearing	26-A	Lubricator
12	Stuffing Box Packing (Steam Joint)	27	Lubricator Extension
		52	Stuffing Box Gland (Steam Joint)
		53	Stuffing Box Gland Flange

3340.D-374 ID 1/2 THICK