Sept. 4, 1934. A. J. WEATHERHEAD, JR 1,972,821

METHOD OF MAKING VALVE BODIES

Filed April 27, 1932 2 Sheets-Sheet 1

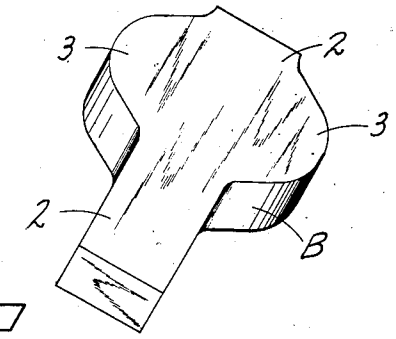


Fig 2

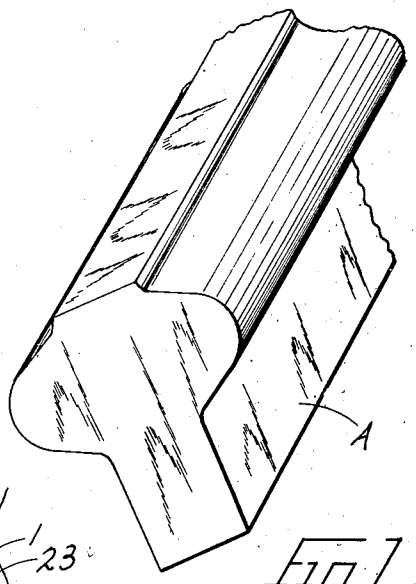


Fig 1

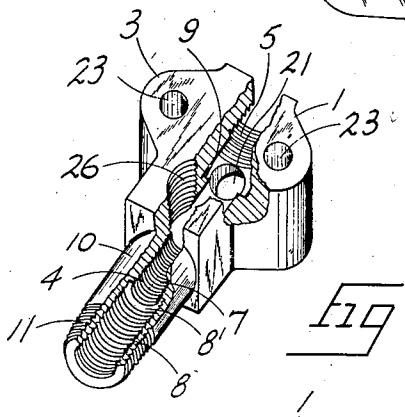


Fig 3

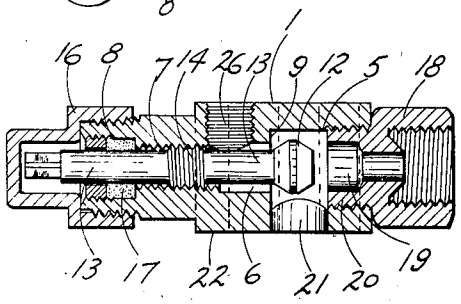


Fig 4

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METHOD OF MAKING VALVE BODIES

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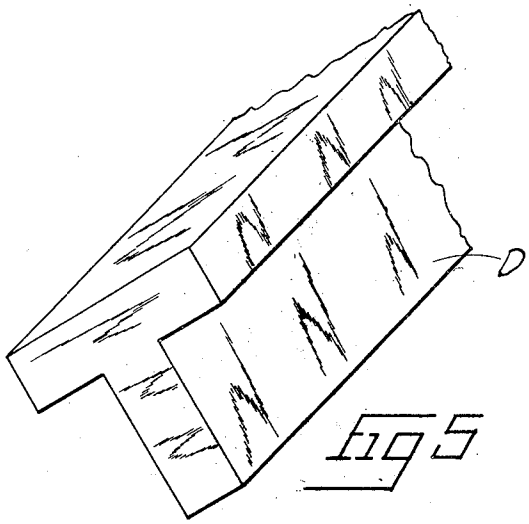


Fig 5

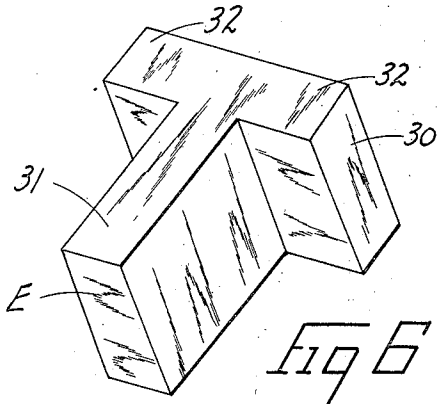


Fig 6

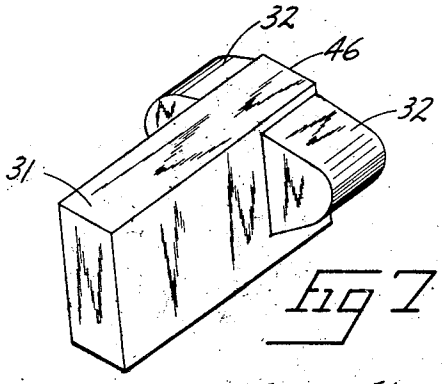


Fig 7

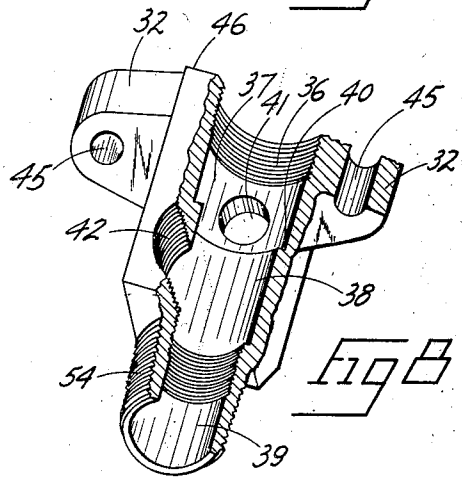


Fig 8

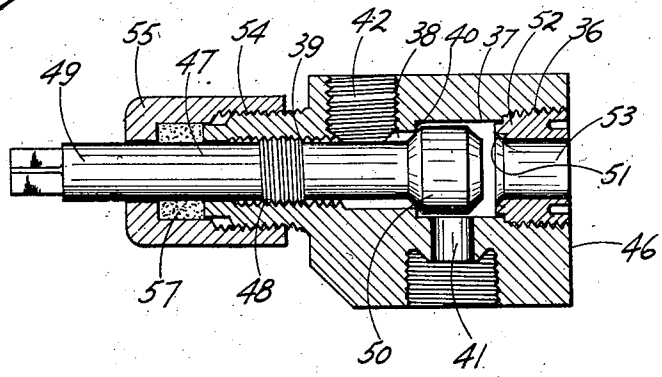


Fig 9

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METHOD OF MAKING VALVE BODIES

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Application April 27, 1932, Serial No. 607,721

13 Claims. (Cl. 29—157.1)

This invention relates to a method or process of making valve bodies, and is more particularly directed to the correlation of steps which begin with the formation of rod stock and include the finishing and treating of the finished valve bodies.

Heretofore, it has been common practice to cast or forge the valve body and complete it by such machining operations as were necessary although it has been recognized that if rod stock could be employed, it would be advantageous. Among the difficulties attendant on producing valve bodies from rod stock was the necessity of excessive machining to reduce the stock from standard cross section such as square, rectangular, hexagonal, etc. to the desired irregular design. Another very serious difficulty lay in the tendency of such bodies to fail from "season cracking" or disruption in the course of ordinary use.

The process of forming the rod stock, either by rolling and/or extruding and drawing set up various stresses and strains in the metal of the body which was aggravated and supplemented by the subsequent machining operations necessary to finish the unit. Such stresses and strains in the metal were fatal for adapting the unit for use in certain fields, particularly that of mechanical refrigeration with its arduous conditions of varying temperature, pressure and humidity. As a result of its condition of internal stress, as I believe, the valve body could not long withstand such service.

This destructive phenomena, known in the refrigeration trade as "season cracking" is a matter of no little moment in that the failure of a valve body or fitting may permit the escape of noxious gases which have and may jeopardize human life and property. Those familiar with the art of refrigeration are aware of the grave dangers that exist and will doubtless continue to exist so long as the physical properties of at least the valves and fittings are not to be depended upon.

It is one object of this invention to produce valve bodies from rod stock by an economical method that will make for the mass production thereof in an economical manner and will be available for universal use and service. Another object of this invention is to produce valve bodies from rod stock shaped in the manner most readily machined or operated upon, thus effecting an economy of material and reducing the amount of waste stock, holding the machining operations to a minimum particularly for shaping and finishing. Another object of my invention is to employ rod stock, in the production of valve bodies and to correlate the formation of the stock to the shape and size of the finished body in such a manner that substantially as little machine work is required to make the finished product as is now required with cast or forged stock. Another object is to produce valve bodies from rod stock that have all the strength and endurance as those which have formerly been produced in separately forged or cast bodies. A more specific object is to produce the valve bodies illustrated in the accompanying drawings by my improved method. A still further object is to widen the field of use of the unit and to increase the efficiency and durability thereof by removing the stresses and strains received during the process of manufacturing.

Other objects and advantages of the invention will appear in the following detailed description taken in connection with the accompanying drawings, in which:—

Fig. 1 is a perspective view of the rod stock from which the blanks are severed.

Fig. 2 is a perspective view of the severed blank from which the valve body may be made.

Fig. 3 is a perspective view, broken away and in section, illustrating the finished valve body after the several machining operations have been performed thereon.

Fig. 4 is a view in longitudinal cross section illustrating the valve body together with the parts which make up a complete valve.

Fig. 5 is a perspective view of a bar of rod stock from which blanks for producing a modified form of body are severed.

Fig. 6 is a perspective view of a blank in which a modified form of body may be made.

Fig. 7 is a perspective view illustrating the blank of Fig. 6 after certain preliminary operations have been performed thereon to effect a reduction in the design.

Fig. 8 is a perspective view partly broken away and in section illustrating the completed valve body made from the blank of Fig. 4.

Fig. 9 is a cross sectional view illustrating the valve body of Fig. 6 assembled with cooperating parts.

The first step in producing the valve bodies from a bar stock is to shape and form the rod stock into a design that will take the least number of subsequent steps to complete. The machining steps as a group constitute the steps next in order to bring the unit to a finished form. The final step in the preferred form of my process has to do with annealing the blank to remove the stresses and strains set up during the working of the

metal thereby according to the valve such durability and efficiency as will universally extend its field of use.

The valve body, as disclosed in Figs. 2 to 4 inclusive, that is produced by the process to be taught herein, is made from a blank or block generally indicated at B in Fig. 2 severed from a bar of rod stock A, which I provide in the form in cross section of a modified T illustrated in Fig. 1; the formation of which constitutes the first step in my process. The rod stock may be formed by extruding and drawing or rolling suitable metal such as, for instance, brass through rolls or dies having the desired shape. Those skilled in the art will understand that different metals should be worked in different ways. The shape of the rod stock and the reasons for so shaping the stock will be brought out in a discussion of the blank B, shown in Fig. 2, which is severed from the parent bar A.

As mentioned, the blocks or blanks B are severed from the parent bar along planes which are normal to the axis of the bar. This operation may be effected in an independent machine, or it may be carried out by a machine which effects other of the operations upon the block intended to form a valve body. This block may be considered as consisting of an elongated portion 2, substantially rectangular in cross section having angularly disposed ears or lugs 3 extending laterally from the base of the elongated portion 2, the faces of the ears being arcuately arranged to effect a reduction in stock, and by the same token to obviate any unnecessary machining operations to reduce the stock to such design. According to the design of the valve body employed in the illustration of the invention disclosed in Figs. 1 to 4, inclusive, it is desired to provide various chambers and passages essential to a valve in the elongated portion 2 and to turn the elongated portion to circular cross section to accommodate screw threads to permit joinder of additional instrumentalities to form a complete valve. The ears or lugs 3 are provided for the sake of securing the valve body to the object upon which it is intended to be mounted; the said lugs being apertured for this purpose.

Referring also to Figs. 3 and 4, it is to be noted that the finished valve is to carry the valve stem in its main longitudinal passage which lies at right angles to the axis of the original bar; that the auxiliary passages extend parallel to the axis of the original bar, or at least at right angles to the valve stem passage, and that the surface of severance of the blank from the bar includes the area of the adjacent one of the auxiliary passages and the engaging faces of the attaching lugs.

After severing the block B from the bar, it is operated on in a suitable lathe, either semi or fully automatic to form a passage 4, Fig. 3, extending throughout the length of the elongated portion 2 or leg of the T. The passage 4 may be symmetrical with respect to the elongated portion 2 in order to provide a proper distribution of the metal thereabout. The passage may be formed by boring from both ends of the elongated portion and is preferably so bored as to provide a plurality of bores 5, 6, 7 and 8, all co-axial but of different diameters.

The bores just mentioned, progressively vary in diameter from one end of the block to the other and are arranged in that order. The bore 8 is of larger diameter than the bore 7, both of which are tapped as shown, the bottom of the bore 8 forming a shoulder 8' which acts as a seat for a ring of packing material 17, Fig. 4. The shoulder 9 formed at the bottom of the bore 5 in the intermediate bore 6 is intended to form a valve seat and is finished with this view in mind by machining operations consistent with the machining operations necessary to produce such a seat. The bore 5 is also tapped for a short distance along its length, beginning at the upper end, to receive the threaded end 20 of a member 18, to be hereinafter referred to.

The sequence of operations of forming the various bores 5, 6, 7 and 8, in the passage 4, may follow in any order desired within the limits approved of for their sequence by the arrangement and nature of the bores. For instance, the bore 8 may be formed and threaded first and thereafter the bores 5, 6 and 7 formed in that order, followed by threading operations upon the bores 5 and 7.

While the block 1 is in position for forming the bore 8, the end of the elongated portion 2 may be turned to form a cylindrical portion 10, the end thereof being threaded as at 11. A reduction in the length of the rectangular portion 2 may be effected at this time if deemed necessary which is, of course, dictated by the use to which the valve is put, although in any event the end portion is threaded to receive a cap nut 16.

As illustrated in Fig. 4 of the drawings, the shoulder 9 cooperates with the valve closure member 12 integrally carried on the valve stem 13 provided with threads 14 engaging with the threaded bore 7. The stem of the valve is of smaller diameter than the threaded portion 14 so that the stem may, in assembly, be introduced through the threaded bores 5, 6 and 7 in that order until the threads 14 engage with the threaded bore 7. The valve stem 13 may then be turned to engage the threads 14 in the threaded bore 7. The stem 13 of the valve 12 extends beyond the ends of the cylindrical body 10 and the threaded bore 8 receives a packing ring 17, hereinbefore mentioned, and a packing nut 16 both of which surrounds the stem 13, the ring tending to seal the same against leakage therearound. The nut 16 is screwed on the threaded end of the stem which is squared to offer a convenient surface for applying a wrench or tool for rotating the valve.

The valve seat with which the valve 12 cooperates is provided with a screw threaded fitting 18 of the conventional type, known as a Weatherhead fitting, that is attached to the valve body by virtue of a threaded portion 20 subjoining the main body. The fitting 18 is provided with a bore 19 of such diameter as to be closed between the valve 12 when the latter is brought into engagement with the surface surrounding the bore 19. The valve, together with the parts 16 and 18, may all be formed by a production method similar to that employed in manufacturing the valve body which includes the production of the threaded chamber in the fitting 18 having a conical seat formed at the bottom thereof, all of which has been set forth in detail in a prior patent issued to me.

The next step toward completion of the valve body consists in the forming of a passage 21 through the body laterally into the passage 5. The passage 21 terminates in the plane face 22, this being the plane of severance of the blank from the bar, this face affording a surface adapted to be sealed in fluid tight engagement with a

gasket against a like surface upon the equipment with which the valve is to be associated. The passage 21, of course, is arranged to register with passages in the gasket and the plane surface upon which the valve body is mounted.

In this particular valve body, I also intend to provide for a filling or draining passage through which fluid may be introduced into the system or equipment with which the valve may be associated. Accordingly, the next operation involves the boring of a passage 26 through the body 1 laterally into the passage 6 and at a point spaced from the passage 21, the passage 26 terminating in the plane face, which is also a plane of severance of the blank from the bar, opposite the plane face 22 and is threaded by a subsequent tapping operation, to receive a suitable fitting or receiving a threaded plug or a cup valve. In some instances, it might be of decided advantage to employ the threaded passage 26 in conjunction with the lead going to some other part of the equipment. To accommodate such an event, the valve closure 12 is formed as a double truncated cone with the thickest portion arranged centrally of the closure. Hence, when the valve is raised, it engages with the material encompassing the end of the bore 6 and seals the passage 21 from the passage 26 or as far as that goes, seals the main passage through the fitting 18 from the passage 26.

The attachment of the valve body to a plane surface, bracket or other mounting, the nature of which will be largely determined by the kind of equipment that the valve is associated with, is accomplished through the ears 3 that are each apertured as at 23 in order to accommodate bolts or cap screws which secure the metal body in place. In the application of my process to making the valve body shown in Fig. 3, the attaching lugs 3 are preferably equal in depth to the full depth of the blank B, whereby strength is preserved while permitting the attaching bolts to pass as nearly as practicable to the inner longitudinal bore of the valve body.

Especially during the steps of drawing or rolling and machining the rod and blank, various internal stresses are set up in the metal that have previously made it impossible to use such valve bodies or parts in universal conditions of service.

Thus the final step in the preferred form of any valve bodies has to do with relieving these internal stresses. To this end I pass the units through an annealing furnace or leer and anneal the units to the extent necessary to relieve the stresses of cold working. This final step of annealing the bodies renders them free of internal stresses and strains that would otherwise limit their field of use and greatly reduce their utility. Further, the durability and efficiency thereof is increased for any class of work and it may be safely said that such final treatment places such bodies on a par with bodies produced by far more expensive and tedious processes.

The valve body just described is designed to be attached to and put in fluid communication with an object or vessel by clamping the plane surface of severance 22 against a similar surface of such vessel; a suitable gasket being employed. According to my method, this attaching surface is preferably formed in the operation of severing the blank from the rod, and thus lies in a plane normal to the rod. In instances where it is desired that the attaching surface be normal to the valve stem, my method can be advantageously employed in the succession of steps illustrated in Figs. 5 to 9.

In Figs. 5 to 9 inclusive, I have disclosed a modified form of valve, illustrating the changes in the shape and contour of the blank, and hence the shape and contour of the rod stock. Essentially, the valve body which I intend to produce is quite similar to the valve body of Figs. 1 to 4, inclusive, however, the lugs for attaching the body to a plane surface are such as to permit the attachment at the butt end of the fitting rather than along the side thereof and determines to a great extent the shape and design of the bar of rod stock.

Consistent with the method hereinbefore set out with regard to the valve body of Figs. 1 to 4, inclusive, the first step in the process lies in the shaping and designing of the bar of rod stock which is extruded, drawn and/or rolled, as already taught herein. From this parent bar, generally indicated at D in Fig. 5, is severed the blanks, generally indicated at E in Fig. 6. The blank or leg 30 formed in T-section having an elongated body portion 31 substantially rectangular in cross section and having plane surfaces on every face and is provided at one end thereof with lateral portions or ears 32 substantially rectangular in cross section and having plane surfaces on every face. To the eye, the blank to be considered is an enlarged and thickened T. The elongated body portion 31 provides the zone in which various passages are to be formed. The ears 32, as hereinbefore mentioned, offer means for attaching the valve at both ends thereof to the apparatus with which it is to be engaged.

The first step in fashioning this form of valve body may preferably constitute trimming the ears 32 to the design shown. This step may also include the operation of aperturing the ears at 45 to accommodate bolts for attaching the body to a plane surface or the part of the equipment to which it is to be joined.

The next step may well be the step of turning the elongated portion 31 to remove excess metal and to leave a stem 54 circular in cross section and externally threaded, as having the external contour shown is then drilled, bored and tapped in much the same manner as the first body was treated, being bored longitudinally of the elongated portion 31 so as to form three passages 36, 37, 38 and 39 which are co-axial and which are of progressively increasing diameter from the butt end of the blank to the opposing end and circular in cross section. The passage continues through the valve body in the form of a bore 37 which may be smaller or larger and a continuation of the bore 38. The bores 36 and 39 are threaded as shown. The shoulder 40, between the bores 37 and 38, is finished to form a valve seat with which one face of the closure member 50 is adapted to cooperate.

The body is then bored to form passages 41 and 42 in a manner consistent with that set out with regard to the body of Figs. 1 to 4, the passage 42 being threaded and the passage 41 being likewise threaded and provided with a Weatherhead seat according to my prior Patent No. 1,839,909, issued Jan. 5, 1932, at the base of the bore for the reception of the male member of a Weatherhead fitting.

In assembling the parts of the valve, the valve closure 47 is moved into the passage formed by the bores 36, 37 and 38 from the right hand end, as illustrated in Fig. 9. The valve stem 47 is provided with threads 48 adapted to engage with

the threads in the passage 39. The end 49 of the valve closure extends beyond the end of the elongated portion and is squared so that the valve may be manipulated by suitable tools. The valve closure seats against the shoulder 40, as mentioned, and against a shoulder 51 on the plug 52, threaded and sealed in the bore 36 and having a passage 53 to admit fluid into the chamber formed of the bore 37, thus the bore 37 forms a valve chamber while the bore together with the passage 53 make fluid connections therewith through the valve passage. It is to be noted that the external end of the plug 52 lies at least flush with the plane attaching surface 46, which has heretofore been finished in the operation of drawing or rolling the rod or bar. The bore 42 may act as a filling passage and may be plugged or joined with a conduit leading into the passage 38.

The valve stem is sealed against leakage at one end by virtue of a packing ring 57 which may be arranged within the nut 55. In this form of valve body, as in the form illustrated in Figs. 1 to 4, a final step in completing the same resides in annealing or heat treating to relieve the internal stresses and strains that may have been set up during the process of manufacture. After the body has been so heat treated, the various parts may be assembled in the manner just set out.

I have practiced my invention with very successful results using brass rod stock and it will be appreciated various of the precepts of my invention have equally good application regardless of the metal or materials used and that certain precepts and advantages of my invention may be modified only in degree when applied to other metals or materials without departing from the spirit of the invention described and claimed herein. While my process has been illustrated and described in connection with the production of a preferred and a modified form of valve body, I do not care to be strictly limited thereto or in any manner other than by the appended claims.

I claim:

1. The method of making valve bodies which consists in forming rod stock in substantially T-section with the leg of the T constituting the portion of the body to be drilled for the valve stem and with the head of the T constituting the portion of the body to be used for attaching or clamping lugs, severing the stock into suitable lengths forming a continuous passage thru the blank at right angles to the axis of the original rod for receiving the valve stem and thereafter forming at least one intersecting passage parallel to the axis of the original rod.

2. The method of making valve bodies which consists in forming rod stock in substantially T-section of height equal to the length of the finished valve, severing the rod into lengths equal to the thickness of the finished valve, forming a continuous passage thru the length of the blank at right angles to the axis of the original rod for receiving the valve stem and forming a passage thru the plane of severance of the blank into communication with said first named passage.

3. The method of making valve bodies which consists in forming rod stock in substantially T-section with the leg of the T constituting the portion of the body to be drilled for the valve stem and with the head of the T constituting the portion of the body to be used for attaching or clamping lugs, severing the stock into suitable lengths, forming a continuous passage thru the blank at right angles to the axis of the original rod for receiving the valve stem and thereafter forming at least one intersecting passage in angular relationship to said first named passage.

4. The method of manufacturing valve bodies comprising the steps of forming rod stock in substantially T-section having an elongated portion and laterally extending lug portions, boring the elongated portion to at least three different diameters in the direction of its length, said bores being progressively arranged in size from one end to the other of the elongated portion, threading the bores adjacent an intermediate bore, machining a valve seat on the shoulder at the intersection of the intermediate bore and the adjacent larger bore and thereafter annealing the finished body.

5. The method of manufacturing valve bodies comprising the steps of forming rod stock with an elongated portion and lateral portions on each side thereof, severing blanks therefrom, boring the elongated portion of the blank to at least three different diameters, said bores being progressively arranged in size from one end to the other of the elongated portion, threading the bores adjacent an intermediate bore, machining a valve seat on the shoulder at the intersection of the intermediate bore and the adjacent larger bore and drilling lateral portions to receive supporting means for the finished body.

6. The method of forming a valve body which comprises shaping metal into substantially T-shaped bars having an elongated portion and lateral portions at the sides of the elongated portion and being of substantially uniform cross-section throughout the length thereof, dividing the bars into pieces along planes perpendicular to the length of the bar, boring a passage through the elongated portion in a direction parallel to the plane faces and medial of the lateral portions, said passage progressively increasing in size toward one end, threading the passage adjacent an intermediate portion thereof, machining a valve seat in the intermediate portion, boring a passage laterally into the intermediate portion from one of the plane faces and thereafter annealing said body.

7. The method of forming a valve body which comprises shaping metal into T shaped bars having an elongated portion and lateral portions at the sides of the elongated portion and being of substantially uniform cross section throughout the lengths thereof, dividing the bars into pieces along planes perpendicular to the length of the bar, boring a plurality of concentric passages throughout the elongated portion in a direction parallel to the plane faces and medial of the lateral portions, threading two of the passages adjacent an intermediate passage, machining a valve seat in the intermediate passage, boring a passage laterally into the intermediate passage on one side of said seat from one of the plane faces, and boring a passage laterally into the intermediate passage on the other side of said seat from the other plane face.

8. The method of forming a valve body which comprises shaping metal into bars having an elongated portion and lateral portions at the sides of the elongated portion and being of substantially uniform cross-section throughout the length thereof, dividing the bars into pieces along planes perpendicular to the length of the bar, boring a plurality of concentric passages through the elongated portion in a direction parallel to the plane faces and medial of the lateral portions, threading two of the passages adjacent an intermediate

passage, machining a valve seat in intermediate passage, boring a passage laterally into the intermediate passage from one of the plane faces, boring a relatively large passage in the elongated portion concentric with and juxtaposed to the original passage therein, and threading said elongated portion internally and externally at the end containing the last mentioned bore.

9. The method of forming a valve body which comprises shaping metal into bars T shape having an elongated portion and lateral portions at the sides of the elongated portion and being of substantially uniform cross-section throughout the length thereof, dividing the bars into pieces along planes perpendicular to the length of the bar, boring a plurality of passages through the elongated portion in a direction parallel to the plane faces and medial of the lateral portions, said passages being concentric, threading two of the passages adjacent an intermediate passage, machining a valve seat in the intermediate passage, boring a passage laterally into the first passage from one of the plane faces, boring passages through the lateral portions from plane face to plane face and thereafter annealing said body.

10. The method of forming a valve body having a plane attaching and sealing surface with a fluid passage extending thereinto which consists in forming T-shaped rod stock equal in height to the length of the finished body and equal in width to the width of the finished body plus oppositely placed attaching lugs, severing the bar into lengths equal to the depth or thickness of the finished valve body along a plane surface which includes the said attaching and sealing surface, drilling and boring a continuous passage for the valve stem and closure member thruout the length of the severed part, forming a valve seat in the mid-portion of said passage, boring a communicating passage from the plane of severance and normal thereto between said valve seat and the open end of said first passage and drilling said attaching lugs normal to the said plane of severance.

11. A method of making hollow fluid conducting devices which includes the steps of forming material into a bar having a cross section substantially identical with the cross-section of the device to be produced, severing the bar along planes perpendicular to the axis thereof into lengths substantially equal to the thickness of the devices to be produced and thereby forming blanks having a projecting leg portion, thereafter machining said leg portion to form a substantially cylindrical portion having an axis substantially perpendicular to the original bar, forming a passageway through said cylindrical portion substantially at right angles to the axis of the original bar, and forming an intersecting passageway in angular relationship to said first named passageway.

12. A method of making hollow fluid conducting devices which includes the steps of forming material into a bar having a cross section substantially identical with the cross-section of the device to be produced, severing the bar along planes perpendicular to the axis thereof into lengths substantially equal to the thickness of the devices to be produced and thereby forming blanks having a shape approximating the shape of the finished devices and having a projecting portion, thereafter machining said portion to form a substantially cylindrical portion having an axis substantially perpendicular to the original bar, forming a passageway through said cylindrical portion substantially at right angles to the axis of the original bar, screw threading said cylindrical portion, and forming an intersecting passageway in angular relationship to said first named passageway.

13. A method of making hollow fluid conducting devices which includes the steps of forming material into a bar having a cross section substantially identical with the cross-section of the device to be produced, transversely severing the bar into lengths substantially equal to the thickness of the devices to be produced and thereby forming blanks having a shape approximating the shape of the finished devices and having a projecting portion, thereafter machining said portion to form a substantially cylindrical portion having an axis substantially perpendicular to the original bar, forming a passageway through said cylindrical portion substantially at right angles to the axis of the original bar, and forming an intersecting passageway in angular relationship to said first named passageway.

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