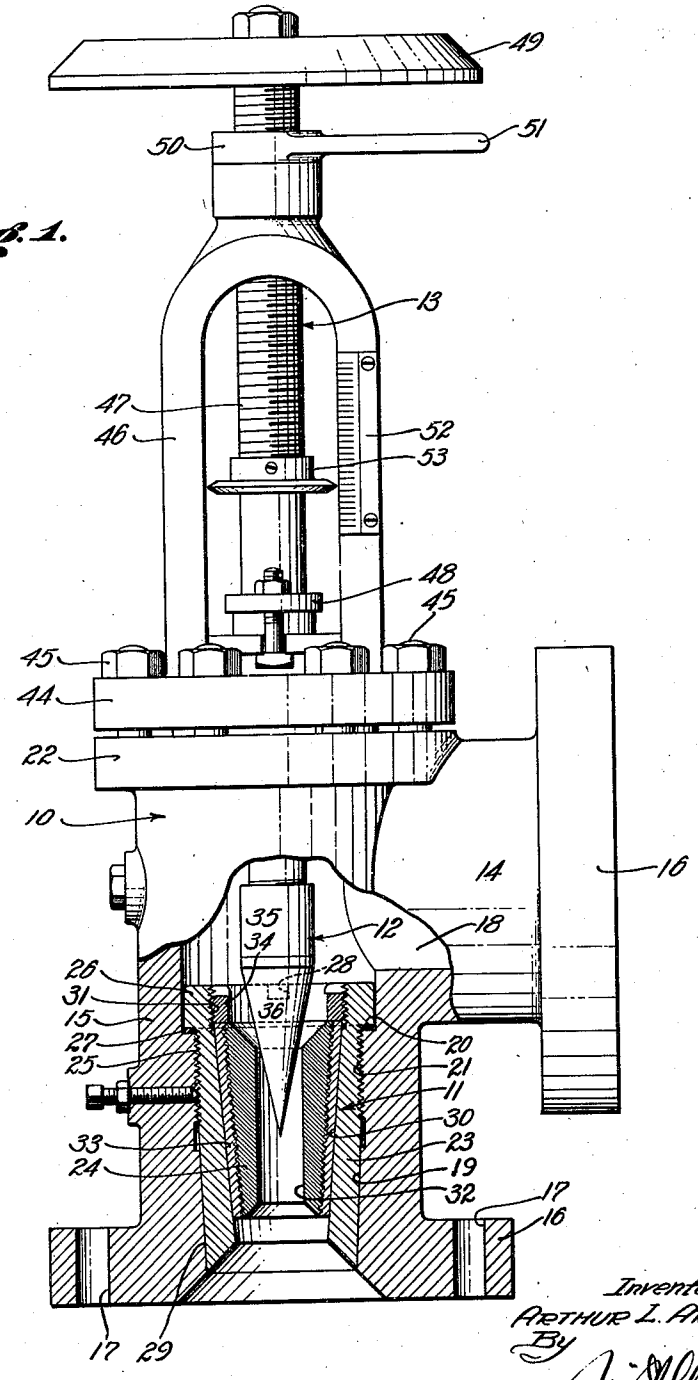
Nov. 10, 1942. A. L. ARMENTROUT 2,301,355

FLOW BEAN

Filed April 9, 1940 2 Sheets-Sheet 1

Fig. 1.



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FLOW BEAN

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Fig. 2.

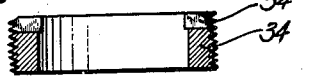


Fig. 3.

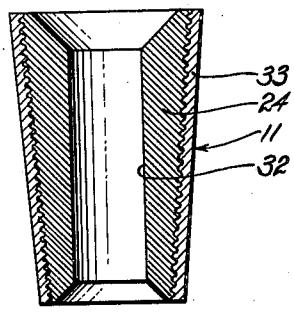


Fig. 4.

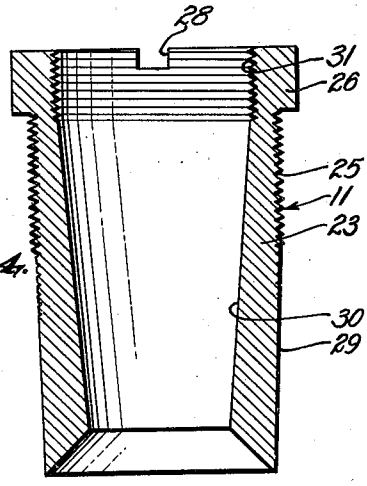


Fig. 5.

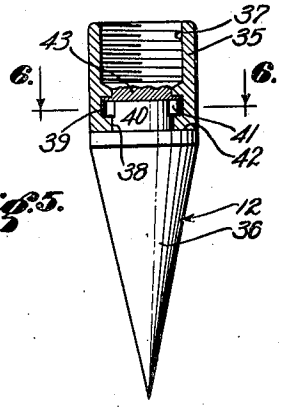


Fig. 6.

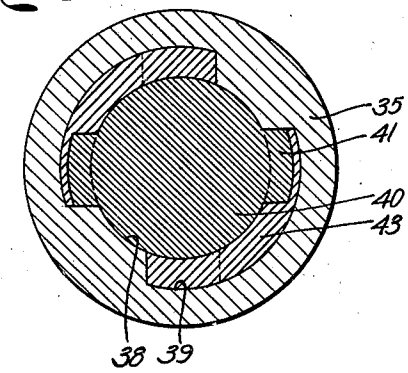


Fig. 7.

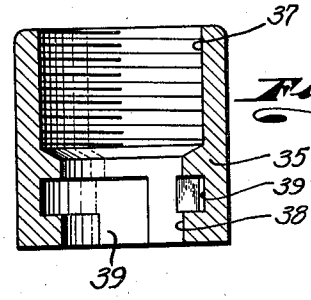
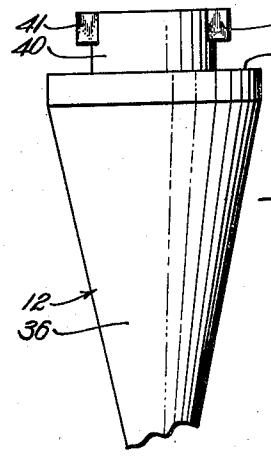


Fig. 8.



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Patented Nov. 10, 1942

2,301,355

UNITED STATES PATENT OFFICE

2,301,355

FLOW BEAN

Arthur L. Armentrout, Long Beach, Calif., assignor of one-half to Elwin B. Hall

Application April 9, 1940, Serial No. 328,646

4 Claims. (Cl. 138—45)

This invention relates to flow controlling devices and relates more particularly to flow beans for controlling or reducing the rate of flow of fluid. A general object of this invention is to provide an effective and very long wearing flow bean.

Flow beans are employed in numerous situations to "bean down" or reduce the rate of flow of fluid in pipe lines, the Christmas trees of wells, etc. The restrictions or chokes of the flow beans quickly cut out or wear away and in adjustable flow beans having regulable valve needles or tips, the wear takes place at both the chokes and the tips. Where the fluid handled contains abrasive material this wear is very rapid and the chokes and tips require frequent replacement. Attempts have been made to reduce the rate of this wear by constructing the chokes and tips of hardened steel, or the like, but owing to the fact that the chokes and tips must be machined, threaded, etc. to be removably secured in place, it has been found impossible to construct them of a material sufficiently hard to effectively resist the wear.

Another object of this invention is to provide a flow bean embodying a readily removable restriction or choke element constructed of a material that is very hard, to adequately resist wear.

Another object of this invention is to provide an adjustable flow bean embodying a replaceable choke and a replaceable tip for extending into the choke to regulate the flow, both the choke and the tip embodying wear taking parts of extremely hard material so that they have a long life and require replacement only after extended use or service. The choke and the control tip of the bean provided by this invention have active parts or flow controlling parts constructed of an extremely hard material that is substantially unaffected by the fluid action so that they may remain in active service for indefinite periods.

Another object of this invention is to provide a flow bean embodying novel means for removably supporting or mounting a choke element formed of a material having a degree of hardness that renders it unsuited for machining.

Another object of this invention is to provide a flow bean including means for removably and adjustably supporting a control tip element formed of an abrasion resisting material so very hard that it cannot be economically or effectively machined.

Another object of this invention is to provide a flow bean of the character mentioned in which the means for removably securing the hard choke element in place positively prevents fluid leakage past or around the element.

A further object of this invention is to provide a flow bean of the character mentioned that is inexpensive to manufacture and that is easily serviced or repaired.

The various objects and features of my invention will be fully understood from the following detailed description of a typical preferred form and application of the invention, throughout which description reference is made to the accompanying drawing, in which:

Fig. 1 is a side elevation of a flow bean embodying the invention with a portion broken away to illustrate the choke means in vertical cross section and the tip in side view. Fig. 2 is an enlarged longitudinal sectional view of the nut or retainer of the choke means. Fig. 3 is a longitudinal sectional view of the choke member. Fig. 4 is a longitudinal sectional view of the carrier for the choke member. Fig. 5 is a side view of the tip showing the carrier in longitudinal cross section. Fig. 6 is an enlarged transverse detailed sectional view taken as indicated by line 6—6 on Fig. 5. Fig. 7 is an enlarged longitudinal sectional view of the carrier for the tip and Fig. 8 is an enlarged side elevation of the tip element with the lower portion broken away.

The improved flow bean of the present invention may be said to comprise, generally, a body 10 to be connected in a conduit or pipe line, a choke 11 removably mounted in the body 10, a replaceable flow controlling valve part or tip 12, and means 13 for operating or adjusting the tip 12.

The body 10 is intended to be interposed in the line or pipe handling the flow to be governed, and the body is formed to carry the choke 11 and the tip 12 and its operating means 13. In the construction illustrated the body 10 is formed to constitute an L when connected in the pipe line. The body 10 includes two arms 14 and 15 extending at right angles to one another and joined at their inner ends. Means are provided at the outer ends of the arms 14 and 15 to facilitate the connection of the body 10 in the pipe line. In the particular case illustrated flanges 16 provided with bolt holes 17 are formed at the outer ends of the body arms 14 and 15. The arms 14 and 15 have communicating passages or openings 18 and 19, respectively. The opening 19 of the arm 15 is formed or shaped to receive the choke 11. An inwardly facing annular shoulder 20 is provided on the wall of the opening 19 adjacent its inner end and a thread 21 extends outwardly

from the shoulder. The portion of the opening 19 extending outwardly from the thread 21 has a tapered wall. The side of the body opposite the arm 15 is formed to receive and support the means 13. A flange 22 is formed on this end of the body and the opening 19 extends outwardly through the flange 22 to make the choke 11 accessible when the means 13 is removed.

The choke 11 is an important element of the invention. The choke 11 comprises a mounting member or carrier 23 removably secured in the opening 19 and a very hard wear taking restriction member 24 secured in the carrier 23 in a novel manner. The carrier 23 is an elongate tubular element constructed to be removably threaded in the opening 19 of the arm 15. The carrier 23 may be formed of steel, or the like, to be readily machined and threaded. An external thread 25 is formed on the carrier 23 to mate with the thread 21 and an outwardly projecting annular flange 26 is provided on the upper end of the carrier 23 to oppose the shoulder 20. A suitable gasket 27 is arranged between the shoulder 20 and the under side of the flange 26. Notches 28 are provided in the upper end of the carrier 23 to facilitate the threading of the carrier into and out of the opening 19. The carrier 23 has a tapered external surface 29 continuing downwardly or outwardly from the thread 25 and adapted to cooperate and seal with the tapered lower portion of the opening 19. The major portion of the opening 30 in the carrier 23 is tapered. The wall of the opening 30 tapers downwardly and inwardly toward the longitudinal axis of the carrier to be of maximum diameter at its upper end. The upper and inner portion of the opening 30 is provided with a thread 31. The extreme lower end portion of the opening 30 may be flared to join a correspondingly flared part of the opening 19. It will be observed that the carrier 23 of the choke 11 is a simple, inexpensive member.

The choke member 24 is one of the flow controlling or restricting elements of the device being in the nature of a tubular restriction seated in the carrier 23. In acordance with the invention the choke member 24 is constructed of a very hard material to be resistant to the abrasive action and the flow action of the fluid. It is a feature of the invention that the member 24 may be formed of an alloy or material having a degree of hardness that renders it unmachinable or unsuited for machining. In practice the material of which the member 24 is formed may have a hardness between 650 and 780 Brinnel. The choke member 24 may be cast or otherwise formed to have the required proportions and shape and, in accordance with the invention, the member requires no machining or working following its initial forming or casting.

The choke member 24 is an elongate tubular element whose opening 32 forms a restricted fluid carrying passage of the flow bean. The member 24 is frusto-conical, that is, its outer surface is tapered downwardly and inwardly and its ends may be flat. The hard wear resisting member 24 is proportioned to be received in the opening 30 of the carrier 23 with substantial clearance. The tapered outer surface of the hard wear resisting member 24 is preferably rough. The roughness of this surface may be the result of the usual casting operation, that is, the surface may be merely left rough following the casting of the member. If desired, the member 24 may be cast to have grooves, teeth, ridges, or the like, on its external surface, as best illustrated in Fig. 3 of the drawings. In any event the external surface of the member 24 requires no machining. The longitudinal opening 32 of the choke member 24 may be cylindrical throughout its major portion, as illustrated, or if desired, the opening 32 may be tapered. In the construction illustrated the upper end part of the opening 32 is enlarged and tapered. The opening 32 may be formed in the hard wear resisting member 24 by coring, that is, the member 24 may be cast to have the opening 32 and as the member is too hard to be machined the opening 32 may be allowed to remain as initially formed. The diameter of the opening 32 of course depends upon the extent that the flow is to be reduced, but in any case is less than the diameter of the opening through the pipe line. The length of the member 24 is less than that of the carrier 23 and the member 24 has its ends spaced inwardly from the ends of the carrier.

The means for securing the hard abrasion resisting member 24 in the carrier 23 is such that the member is securely retained in position and a dependable fluid tight seal is formed between the member and the carrier 23. A layer or shell 33 of relatively soft material is provided on the member 24. The shell 33 may be lead, babbitt, or the like, and is preferably a metal having a low melting point. The soft metal shell 33 is cast about the member 24 prior to the assembling of the member in the carrier 23. The metal of the shell 33 securely bonds with or adheres to the rough external surface of the member 24. The metal of the shell 33 has a low melting point and the shell may be cast about the member 24 without in any way affecting the molecular structure of the member. The external surface of the shell 33 is tapered and is finished to evenly cooperate with the tapered opening 30 in the carrier 23. The soft shell 33 may be readily formed and finished to accurately fit the opening 30.

The choke member 24 carrying the shell 33 is urged into the opening 30 so that the shell 33 effectively seals with the wall of the opening. An annular nut or retainer 34 has a thread mating with the thread 31 and is screwed outwardly to urge the member 24 into the tapering opening 30. This forces the shell 33 into fluid tight sealing contact with the wall of the opening 30. The outer end of the retainer 34 has notches 34a to facilitate its rotation. The hard wear resisting member 24 and its shell 33 constitute a unit that may be easily and quickly assembled in the carrier 23 either before or after the carrier has been arranged in the body 10. It is to be particularly noted that the rough unfinished and unmachinable member 24 is securely and dependably held in the carrier 23 by a means that positively prevents the leakage of fluid.

The regulable control member or tip 12 is adapted to extend into the choke 11 to further restrict the fluid flow through the bean. The tip 12 includes an adapter or carrier 35 and an active member 36 formed of very had wear resisting material. The carrier 35 may be a generally cylindrical part formed of steel, or the like, and is provided at its upper end with a longitudinal socket 37. A cylindrical opening 38 enters the lower end of the carrier 35 and joins the socket 37. J grooves or L grooves 39 are formed in the wall of the opening 38. The axial or longitudinal arms of the grooves 39 extend to the lower end of the opening 38.

The member 36 is a tapering or conical part

proportioned to have its pointed end enter the opening 32 of the choke member 24 to reduce the fluid passing area of the opening. In accordance with the invention the member 36 may be formed of a very hard abrasion resisting material that cannot be successfully worked or machined. In practice the tip member 36 may be formed of the same material as the choke member 24. The tip member 36 may be cast to have the required shape and its surfaces may remain rough or unfinished. A stem 40 of reduced diameter is formed on the upper end of the tip member 36. The stem 40 is proportioned to rather accurately enter the opening 38 of the carrier 35 and is provided with laterally projecting lugs 41. The lugs 41 are adapted to cooperate with the grooves 39. A shoulder 42 is provided on the member 36 at the base of the reduced stem 40 and the shoulder 42 is engageable with the lower end of the carrier 35. The parts are related so that the lugs 41 engage or are immediately adjacent the lower walls of the lateral branches of the grooves 39 when the shoulder 42 is in contact with the lower end of the carrier 35. The lugs 41 are arranged and proportioned to have clearance with the other walls of the grooves 39 when in their final positions in the lateral branches of the grooves.

Means is provided for securely fixing the tip member 36 to the carrier 35. When the carrier 35 and the tip member 36 have been brought to their final relative positions with the lugs 41 in the lateral branches of the grooves 39, lead 43, babbitt, or the like in a molten state is poured through the socket 39 into the opening 38. This molten metal fills all unoccupied spaces in the grooves 39 and occupies the upper portion of the opening 38. When the lead 43 has hardened the tip member 36 is securely fixed to the carrier 35.

The means 13 is operable to move the tip 12 longitudinally relative to the choke 11 to vary the fluid capacity of the annulus between the wall of the opening 32 and the surface of the tip member 36, and thus change the pressure and rate of flow of fluid through the bean. The means 13 may be varied considerably without departing from the broader aspects of the invention. In the construction illustrated the means 13 includes a cap 44 secured to the body flange 22 by studs or bolts 45 and a yoke 46 projecting upwardly from the cap. A screw 47 is screwed through an opening in the upper part of the yoke 46 and passes downwardly through a gland 48 on the cap 44 to enter the body 10. The lower end of the screw 47 is threaded in the socket 37 of the carrier 35 so that the screw supports and operates the tip 12. A hand wheel 49 is fixed to the projecting upper end of the screw 47 to facilitate manual operation of the screw. A lock nut 50 provided with an operating lever 51 is provided on the screw 47 to engage the upper end of the yoke 46 for the purpose of locking the screw in adjusted position. A calibrated scale 52 is provided on one arm of the yoke 46 and a ring 53 is secured to the unthreaded part of the screw 47 to move past the scale 52. The ring 53 has a sharp edge that may be read with the markings on the scale 52 to determine the position of the tip 12 relative to the choke 11.

It is believed that the operation of the improved flow bean will be readily understood from the foregoing detailed description. Assuming the body 10 to be connected in a fluid handling line, the member 36 entering the member 24 restricts the reduced opening 32 of the member 24 so that the flow through the body is materially restricted. The extent or degree of restriction may be varied by operating the screw 47. The abrasive and wear resulting from fluid flow occurring at the point of the restriction are taken by the very hard members 24 and 36. The members 24 and 36 are sufficiently hard to resist the wear. Accordingly, the choke 11 and the tip 12 may remain in operation for a long period before requiring servicing.

If it becomes desirable or necessary to replace or recondition the choke 11 or the tip 12, flow through the body 10 is cut off and the cap 24 is removed from the body. This exposes the choke 11 and the tip 12. The retainer 34 may then be threaded from the carrier 23 and the member 24 may be removed from the carrier. A new or replacement member 24 provided with its shell 33 may be inserted in the opening 30 and secured in place by the retainer 34. In some instances it may be desirable to replace the entire choke 11 in which case the carrier 23 is unthreaded from the opening 19 and a new or replacement choke is threaded in the opening. If difficulty is encountered in removing a worn choke member 24 from its carrier 23 the assembly may be subjected to a temperature sufficiently high to melt the shell 33 to free the choke member 24. To remove the tip 12 it is only necessary to unthread the carrier 35 from the screw 47. A new tip 12 may then be threaded on the screw. If desired the worn tip member 36 may be freed from its carrier 35 by subjecting it to a temperature sufficiently high to melt the lead 43 and this allows the lugs 41 to be moved out of the grooves 39.

Having described only a typical preferred form and application of my invention I do not wish to be limited or restricted to the specific details herein set forth, but wish to reserve to myself any variations or modifications that may appear to those skilled in the art or fall within the scope of the following claims.

Having described my invention, I claim:

1. A flow bean comprising a body having a fluid passage, and means for restricting the flow through the passage comprising a carrier of readily machinable material removably arranged in the body, a one piece cast metal flow restricting member of wear resisting material having a degree of hardness that renders it unsuitable for machining, and means securing the member to said carrier comprising a shell of soft metal on the member, the carrier and shell having cooperable wedge surfaces, and means forcing said wedge surfaces one against the other.

2. A flow bean comprising a body having a fluid passage, and means for restricting the flow through the passage comprising two units wholly within the passage, one a tubular flow passing unit set in the passage, the other a flow restricting unit entering the tubular unit, each unit including a separately formed member exposed to the action of the fluid and formed of a cast metal having a degree of hardness rendering it unfit for machining, a readily machinable carrier for the member, the member and carrier having spaced opposing surfaces, and a soft metal shell between said surfaces.

3. In a flow bean having a fluid passage, a choke comprising a tubular member of very hard cast metal unsuited for machining, a carrier of machinable material threaded in the passage having a tapered opening, a shell of machinable

metal cast on the member, and means urging the shell into the tapered opening.

4. In a flow bean having a fluid passage, a choke comprising a pre-formed tubular member of very hard material unsuited for machining, said member having a tapered exterior, a carrier of machinable material removably secured in the passage and having a tapered opening, a shell of soft metal cast on the tapered exterior of said member, and a retainer threaded with the carrier and forcing said member into the tapered opening so that said shell bears and seals in the opening.

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