Dec. 24, 1963 K. S. VAN EPPS ET AL 3,115,163

MEANS FOR STOPPING THE FLOW OF FLUID IN A CONDUIT

Filed Sept. 12. 1960 4 Sheets-Sheet 1

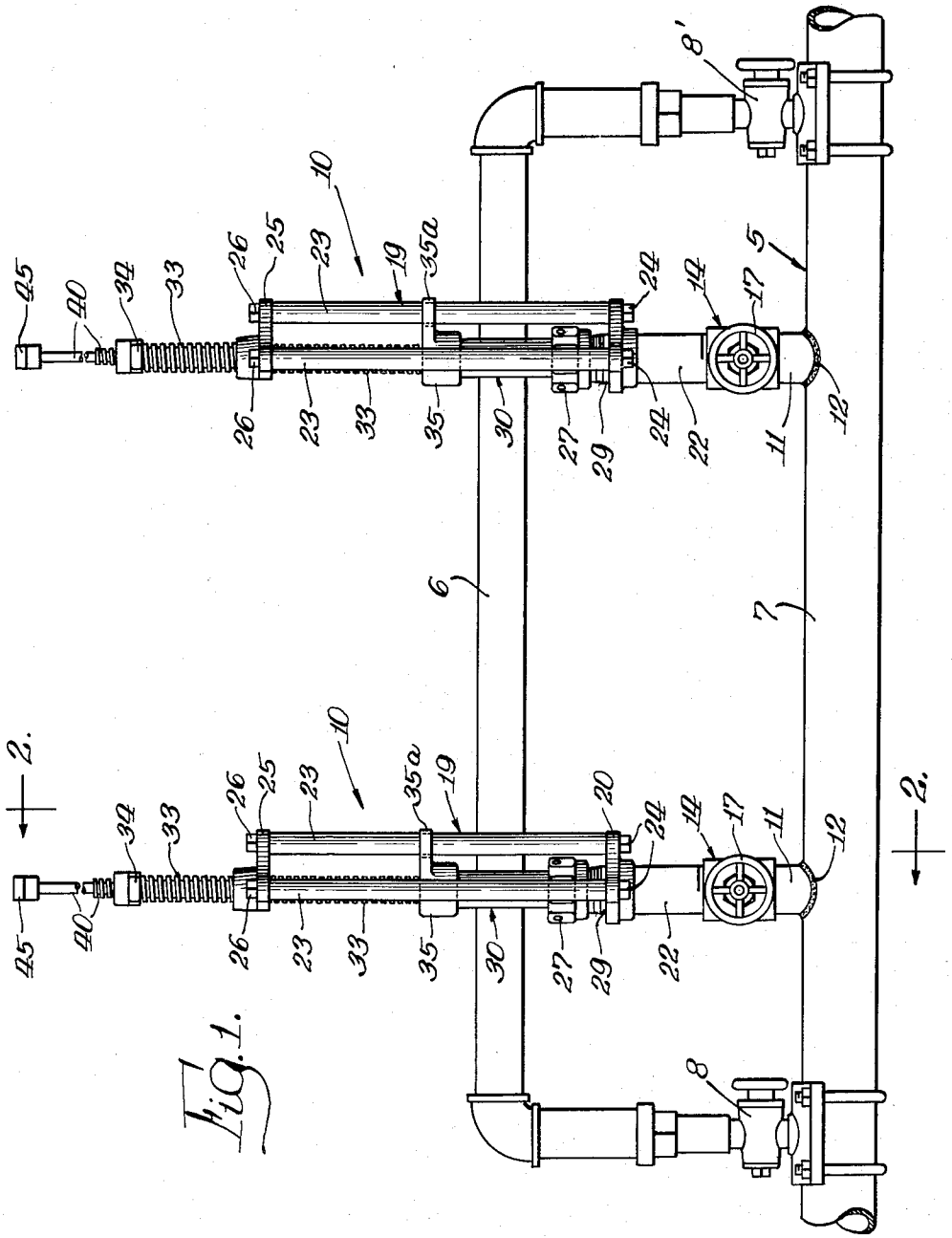



Fig. 1.

INVENTORS
Kenneth S. Van Epps,
Walter E. Magnus,
By Brown, Jackson, Boettcher & Dienner
Atty's.

Dec. 24, 1963 K. S. VAN EPPS ET AL 3,115,163

MEANS FOR STOPPING THE FLOW OF FLUID IN A CONDUIT

Filed Sept. 12, 1960 4 Sheets-Sheet 2

Fig. 2.

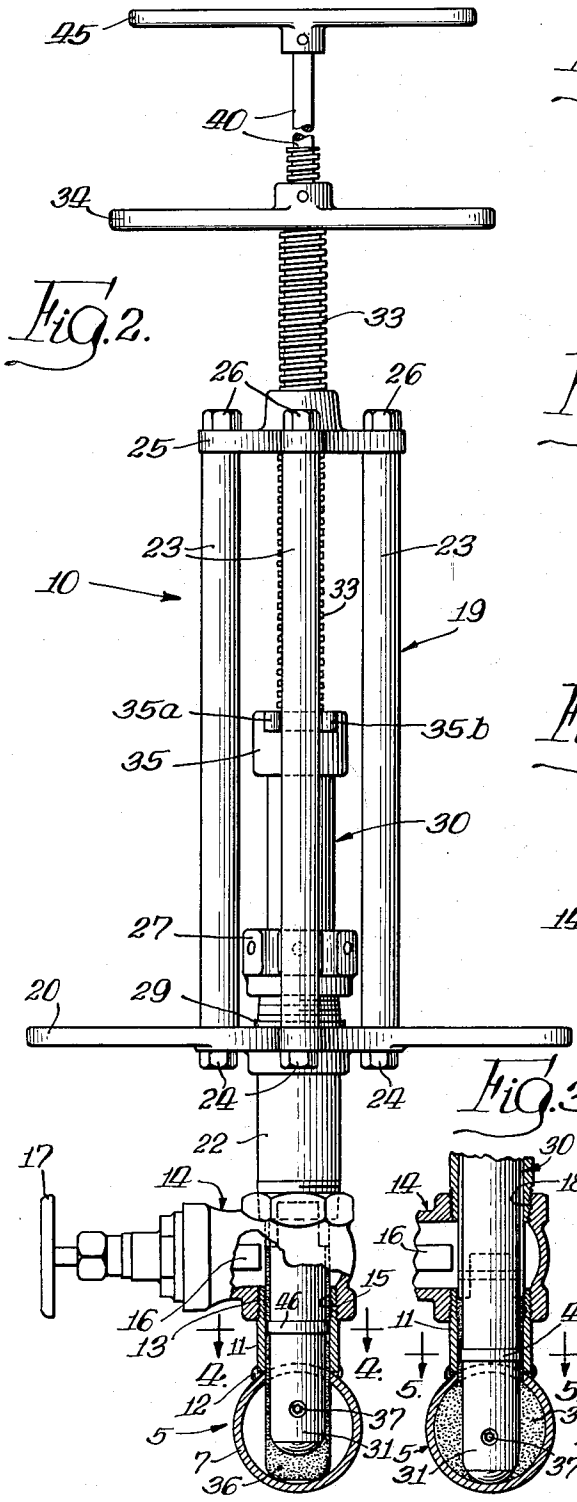



Fig. 4.

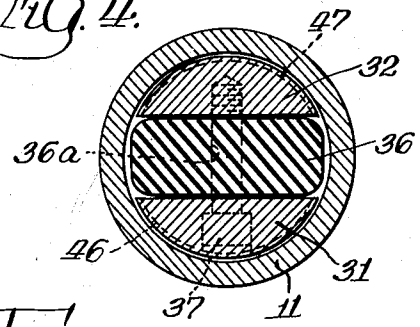



Fig. 5.

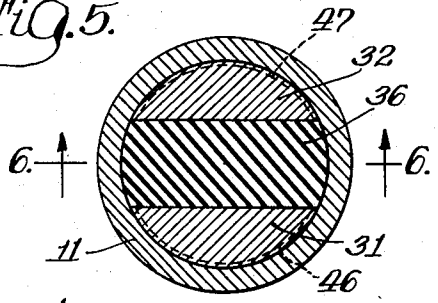



Fig. 6.

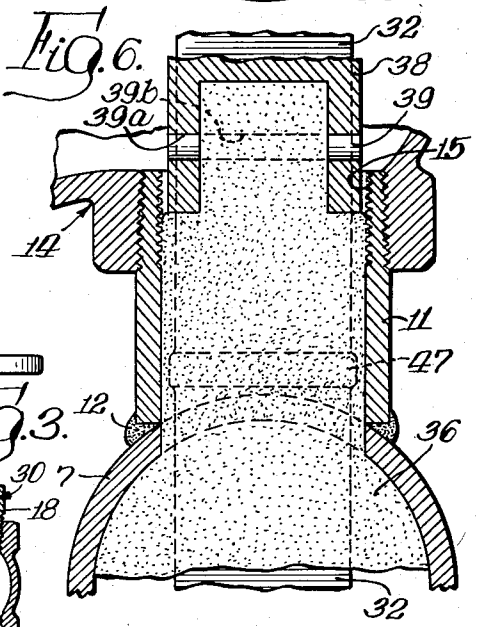
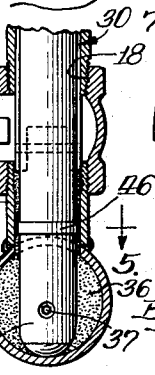



Fig. 3.

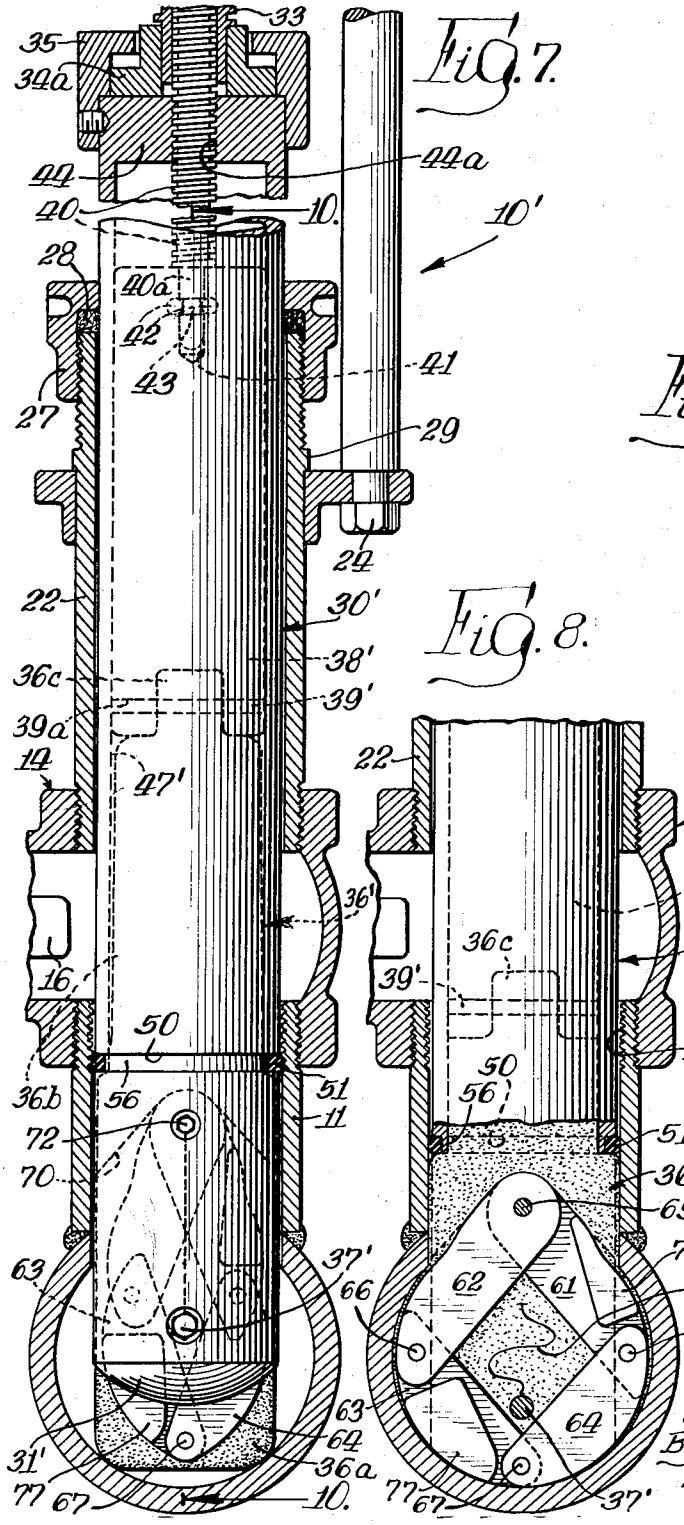


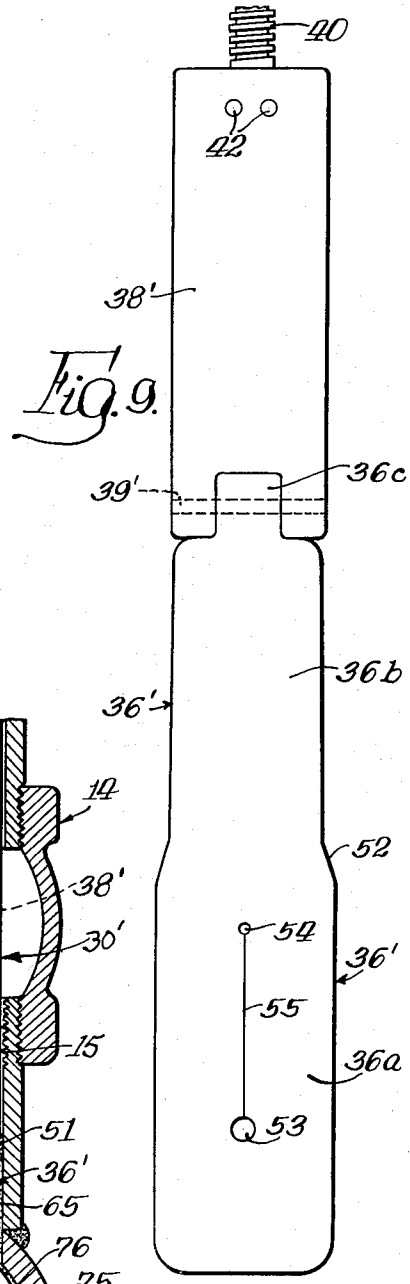

INVENTORS.
Kenneth S. Van Epps.
Walter E. Magnus.
By Brown, Jackson, Boettcher & Dienner
Attys.

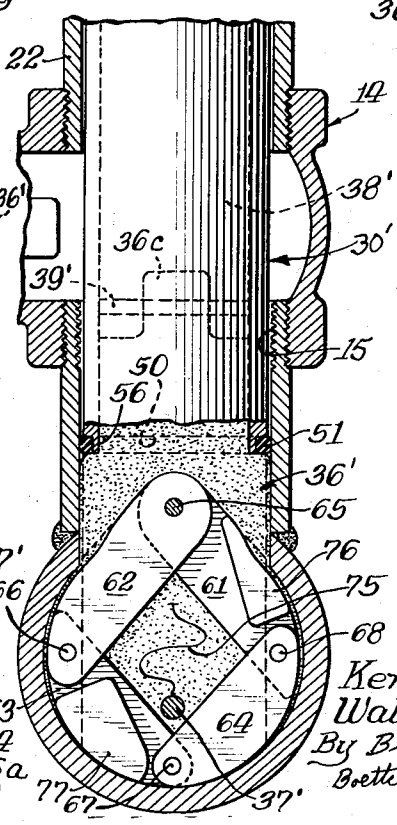
Dec. 24, 1963 K. S. VAN EPPS ET AL 3,115,163

MEANS FOR STOPPING THE FLOW OF FLUID IN A CONDUIT

Filed Sept. 12, 1960 4 Sheets-Sheet 3




INVENTORS.
Kenneth S. VanEpps,
Walter E. Magnus,
By Brown, Jackson,
Boettcher & Dienner
Atty's.

Dec. 24, 1963 K. S. VAN EPPS ET AL 3,115,163

MEANS FOR STOPPING THE FLOW OF FLUID IN A CONDUIT

Filed Sept. 12, 1960 4 Sheets-Sheet 4

Fig. 10.

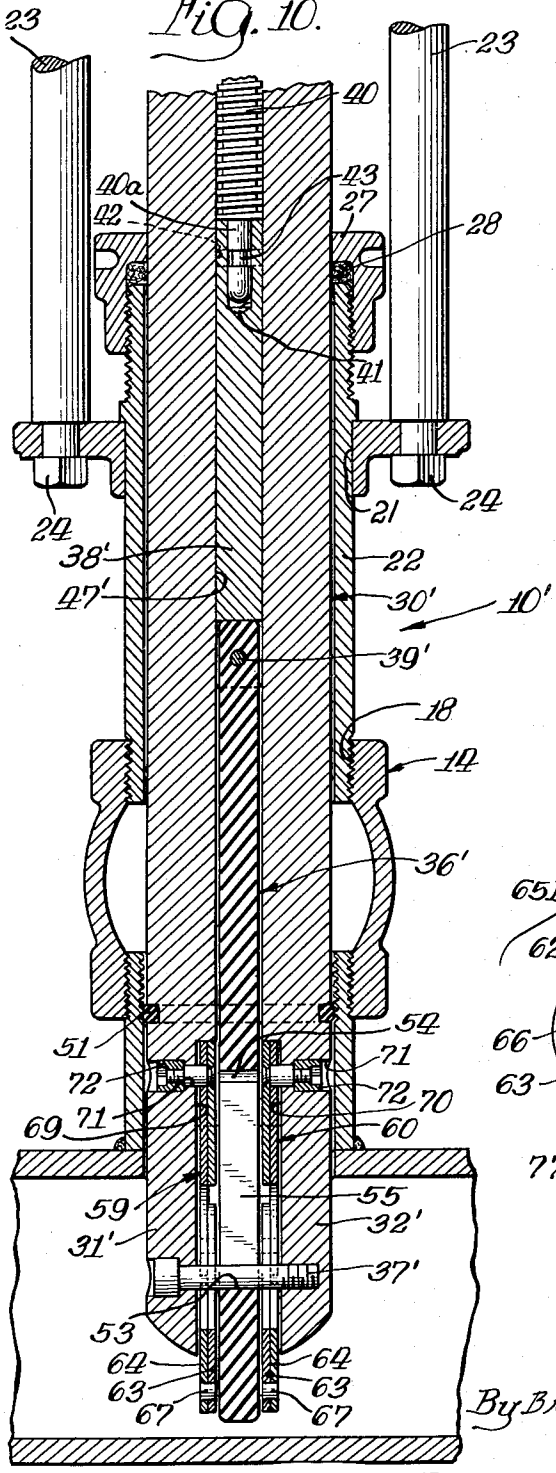



Fig. 12.

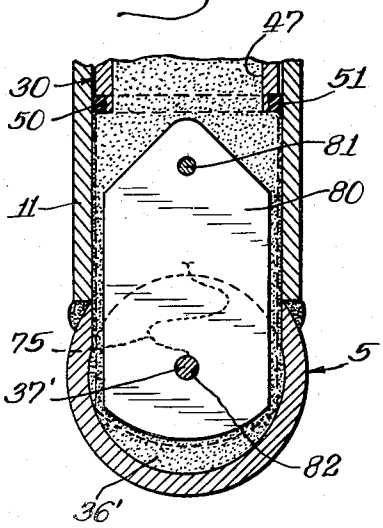
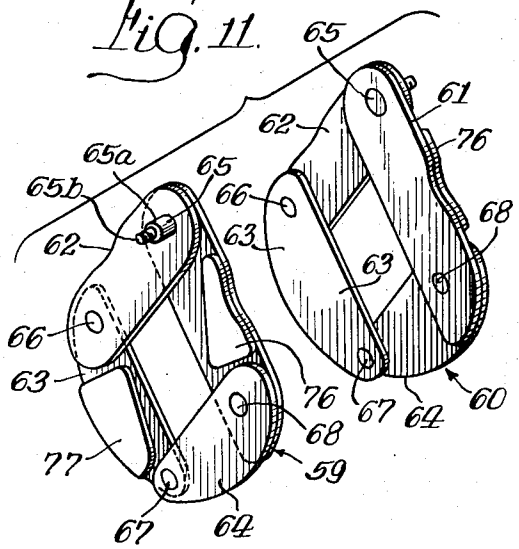



Fig. 11.




INVENTORS.
Kenneth S. VanEpps,
Walter E. Magnus,
By Brown, Jackson, Boettcher & Dienner
Attys.

United States Patent Office 3,115,163 Patented Dec. 24, 1963



3,115,163

# MEANS FOR STOPPING THE FLOW OF FLUID IN A CONDUIT

Kenneth S. Van Epps, 4015 Harvey Ave., Western Springs, Ill., and Walter E. Magnus, 66 Robin Road, Carpentersville, Ill.

Filed Sept. 12, 1960, Ser. No. 55,589
6 Claims. (Cl. 138—94)

Our invention relates to means for stopping the flow of fluid in a conduit, and has particular utility in a gas distributing system. However, the invention may be applied to conduits for other fluids as will become apparent when the drawings and description are considered.

Where a section of gas pipe is to be worked upon, either for repair purposes or to extend the capped end, or to provide branch conduits, it is essential that gas not be allowed to escape, both because of its explosive nature and the fact that it may contain poisonous elements.

A variety of mechanical devices has been devised for the purpose of providing an adequate stopping means for a gas pipe. However, they suffer from various defects or inconveniences or high costs, and it is a particular object of our invention to provide a device which will be very sure in its stopping action, simpler to use and relatively less expensive than devices presently available.

It is a particular object of the invention to provide means for stopping the flow of gas distributed under high pressure, such as a pressure of 100 lbs. per square inch guage, which is now commonly used in many gas distributing systems. While Witt Patent 2,272,734, of which our invention is an improvement, was intended to accommodate higher pressures than prior devices, in operation we have found that it is not feasible to employ the Witt structure in systems having much greater than 35 lbs. per square inch gauge. By changes in construction, additions and changes in materials, all cooperating to provide an improved mechanism, we have greatly improved the structure illustrated in Patent 2,272,734 to the point where our device is adapted to stop pressures in the range of 100 to 125 lbs. per square inch gauge safely and certainly, and to be convenient in use by the men who must employ the device. Our device has the further advantages of longer life and adaptability to a variety of pipe diameters.

The foregoing and other objects and advantages will appear from the following description when taken with the drawings described below. (In some views the surface of the resilient plug has been stippled in order that its position may be distinguished from that of other plane surfaces formed of metal.)

FIGURE 1 is a side elevation of a gas main with a by-pass extending around a portion of it and with stopper devices of our invention associated with the main for stopping the flow of gas through the by-passed portion;

FIGURE 2 is an elevational view, slightly enlarged, taken on the line 2—2 of FIGURE 1, and showing the device of our invention associated with a main and with the resilient stopper element, or plug, of the device in an initial inserted position;

FIGURE 3 is a fragmentary view similar to that of FIGURE 2, but showing the resilient plug in its expanded, sealing position;

FIGURE 4 is an enlarged cross-sectional view on the line 4—4 of FIGURE 2;

FIGURE 5 is an enlarged cross-sectional view on the line 5—5 of FIGURE 3;

FIGURE 6 is an enlarged fragmentary view of the plug's sealing position such as that shown in FIGURE 3;

FIGURE 7 shows a modified form of structure for use in a gas main having a larger diameter than that of FIGURES 1 through 6 and showing the resilient plug in an initial inserted position in the gas main;



FIGURE 8 is a view similar to that of FIGURE 7, but with portions broken away, showing the plug element in its expanded sealing position;

FIGURE 9 is a view showing the plug of the type shown in FIGURES 7 and 8, and its holder in vertical elevation;

FIGURE 10 is a vertical sectional view taken on the line 10—10 of FIGURE 7;

FIGURE 11 shows, in perspective, a pair of supporting members for the resilient plug in the form of parallelogram linkages such as those shown in FIGURES 7, 8 and 10; and

FIGURE 12 shows a substituted member for one of the parallelogram linkages of FIGURE 11 when the device of our invention is used in a gas main smaller than that illustrated in FIGURES 7, 8 and 10.

Referring first to FIGURES 1 through 6, there is shown a gas main 5 having a by-pass line 6 connected about a portion 7 of the gas main which is either to be repaired or to have a branch connected thereto or some other operation performing on it. The by-pass 6, including valves 8 and 8', is provided in a manner well known in the art prior to the carrying out of any desired operation on the portion 7. After the by-pass 6 has been installed, stopper devices 10 of our invention are installed. As a first step a nipple 11, appropriately shaped at its lower end, is carefully welded to the portion 7 on either side of the area where either a connection or a repair is to be made. The upper outer end of the nipple is threaded, and mounted thereon is a shut-off valve 14. If it is desired to have the nipple of a particular size which is different from that of the opening in the valve housing 14, an intervening adapter may be employed in a known manner. The upper inner end of the nipple is threaded, as at 15, in a particular manner which will be described hereinafter. It may receive, internally, a threaded plug which is employed after the entire operation is completed upon portion 7 of the gas main 5.

The valve 14 is preferably provided with a sliding valve closure member 16 for opening and closing the valve upon turning of the handle 17. After the nipple 11 and valve 14 have been positioned as indicated, the valve handle 17 is turned to its closed position and a packing gland (not shown), through which a shell saw may be inserted, is threaded into the upper outlet 18 of valve 14. The valve 14 is then opened, and by means of the saw being guided in the packing gland and by the smooth interior surface of the nipple 11, a hole may be accurately cut in alignment with the axis of the nipple. After the saw and gland are withdrawn beyond the sliding valve member 16, the valve member is closed and the packing gland and saw are removed. The saw and packing gland employed for this purpose have not been separately illustrated, since they are known structures in the art.

Referring now more particularly to FIGURES 2, 3 and 4, a frame structure 19 comprising a lower supporting plate 20 having an opening 21 (FIG. 10) for receiving a removable stuffing box member 22 and three openings through which reduced threaded ends of supporting rods 23 may be inserted and secured by nuts 24, is provided. An internally threaded upper plate 25 is also provided and has three correspondingly located openings through which the upper reduced threaded ends of rods 23 may be inserted and secured by nuts 26. The stuffing box member 22 is threaded externally at its upper and lower ends, the lower end being adapted to be threaded into the outlet 18 of the valve 14 and the upper end being adapted to receive an apertured internally threaded cap 27. Suitable packing 28 is carried within the cap 27.

It will be noted that the stuffing box member 22 has an external shoulder 29 which is adapted to seat against the top surface of the supporting plate 20, with member 22 having a tight fit within the aperture 21. This permits the stuffing box member 22 to be readily replaceable and that is an advantage, since the lower threaded end of the stuffing box structure 22, while being transported and being made ready for use, is subject to being damaged.

Indicated generally by the reference numeral 30 is a carrier member comprising a cylindrical steel bar slotted along the greater portion of its length to provide a pair of fork arms 31 and 32 (FIGS. 2 and 4). The carrier 30 is adapted to be moved downwardly through or upwardly through said stuffing box structure 22 by means of a pusher, or feed, screw 33 which threads through the internally threaded portion of plate 25 of frame structure 19, and has a handle 34 at its upper end for rotating the same. The lower end of the feed screw 33 has a flanged member secured to it, such as the member 34*a* of FIGURE 7, which bears downwardly against the top end of the carrier 30 when the handle 34 is manipulated to cause the carrier 30 to move downwardly. A cap structure 35 is secured to the carrier member 30 by set screws or other means and the feed screw 33 passes through an opening in said cap. The lower flanged portion 34*a* of the feed screw 33 is of a greater diameter than the opening in the cap 35, and therefore may bear against the upper inner surface of the cap when the handle 34 is manipulated in the opposite direction to retract the carrier member 30. Cap structure 35 has a pair of spaced arms 35*a* and 35*b* (FIGS. 1 and 2) which straddle one of the rods 23 to prevent rotation of the carrier 30 when feed screw 33 or feed screw 40 (described below) are rotated by their respective handles 34 and 45.

Slidable between the fork arms 31 and 32 of the carrier member 30 at the lower ends of said arms is a resilient stopper element, or plug, 36 which, at its lower end, protrudes a short distance beyond the lower ends of said fork arms, as may be seen best in FIGURE 2. A bolt 37 at the lower end of the fork arms 31 and 32 secures those fork arms relative to each other so that the same may be spread apart only a pre-determined amount, and the bolt passes through an aperture 36*a* (FIG. 4) in the plug 36. The plug 36 is slightly less wide than the inside diameter of the nipple 11 for easy passage therethrough, and its thickness corresponds approximately to the distance between the fork arms 31 and 32. At its upper end the resilient plug 36 is of reduced width to permit it to fit within the forked lower end of a metal holder member 38 which fits between and is also guided by the fork arms 31 and 32 of the carrier 30. A connecting pin 39 (FIG. 6) extends through aperture 39*a* in the fork arms of the holder 38 and through an aperture 39*b* in the upper end of the resilient plug 36 to secure the holder 38 and plug 36 together.

At its upper end the holder 38 is rotatably connected with a second feed screw 40 by the latter's reduced end 40*a* (FIG. 7) which rotates within a socket 41 of the holder 38 and is secured therein by a pair of pins 42 extending transversely of the holder 38 and fitting within a reduced neck portion 43 of the lower end 40*a* of the feed screw 40, in a manner such as that illustrated in FIGURES 7 or 10. The feed screw 40 is threaded through the closed end 44 (FIG. 7) of the carrier 30 and has a free rotating fit within the hollow feed screw 33. Feed screw 40 is manipulated by handle 45.

Referring now to FIGURES 2 through 6, it will be observed that the fork ends 31 and 32 of the carrier 30 have on their exterior surfaces projecting arcuate sealing ribs 46 and 47, respectively, and these cooperate to form a sealing means against the smooth inner surface of the nipple 11 when the resilient stopper element is expanded and forces the fork arms 31 and 32 slightly apart. Preferably, the nipple 11 is a cold-drawn seamless steel tubular structure. It is also preferred that the ribs 46 and 47 be formed integrally with fork arms 31 and 32, respectively, although they could be formed as separate members and secured to said fork arms. The advantage of forming the nipple of cold-drawn seamless steel is that it not only facilitates a good seal between the ribs 46 and 47 and the inner surface of the nipple, but also, because such inner surface of the nipple is much smoother than can be obtained by machining the inner surface. That is additionally important because the smooth surface does not tear the resilient plug 36 which must slide through it, and also because it provides a true guide for the cutting saw so that it may cut ou the top of the gas main 5 in true axial alignment with the nipple. The upper internal threads 15 of the nipple 11 are formed with their crests flat and composed of portions of the smooth internal surface of the nipple (see FIG. 6). This permits the resilient plug 36 to slide through the nipple without tearing or shaving the plug's surface. Such thread is adequate for receiving an externally threaded closure plug when the entire operation is through. It is not a matter of concern whether such closure plug forms a perfect seal, since we prefer to use, in addition to such closure plug, an outer cap threaded on the external threads of the nipple. With such structure, it is easier to check for gas leakage than when relying solely on a closure plug internally of the nipple.

Considerable study has been given also to the composition of the resilient plug 36 itself. A greasy type lubricant is needed for inserting the resilient plug through the nipple, sliding it between the fork arms 31 and 32, and then into engagement with the inner wall of the gas main when expanding the plug against that wall. This has produced a problem when the plug has been composed of natural rubber, since the rubber deteriorates from contact with the grease, and therefore requires earlier replacement which is expensive in time and materials. If an oil resistant synthetic rubber is used it has, of course, good resistance to the greasy lubricant, but has a disadvantage, after being expanded, of very slowly resuming its original shape when pressure is relieved in order to permit withdrawal of the stopper element from the gas main. From considerable experiment and analysis, we have found that if the plug 36 is composed of approximately 75% to 80% oil resistant synthetic rubber, and the balance of natural rubber, that a very satisfactory material results. Also, the plug should have a durometer in the approximate range of 45—55. Experimental use of a stopper element having a durometer of approximately 50—52 and composed of approximately 80% oil resistant synthetic rubber and the balance of natural rubber has shown it to be a preferred structure having long life, resistance to wear and a relatively rapid contraction to its original shape after it has served in its expanded condition as a plug for the gas main.

Referring now more particularly to the operation of the stopper device 10 illustrated in FIGURES 1 through 6 (and as supplemented by showings in certain portions of the other figures) and assuming that the nipple 11 is in place, the valve 14 is in gas tight relationship to it and the hole has already been cut in the gas main 5, the operator will thread the stopper device 10 into the outlet 18 of valve 14 into fluid tight relationship. At that time the carrier 30 is in a higher position than that shown in FIGURES 1 and 2 in order that the lower end of the plug 36 will not engage the valve closure member 16 which is then in a shut-off position. Also, the feed screw 33 and its handle 34, as well as the feed screw 40 and its handle 45, are in correspondingly higher positions. Once the device 10 is in gas tight relation to valve 14, the valve closure element 16 is retracted, as shown in FIGURE 2. As soon as the valve member 16 is retracted, handle 34 is so rotated so that the feed screw 33 will move the carrier 30 downwardly, thereby moving the holder 38 and the resilient plug 36 downwardly until the plug engages the bottom wall of the gas main 5, as shown in FIGURE 2. Further movement of the carrier 30 will

cause the protruding end of plug 36 to spread out until the lower end of the fork arms 31 and 32 engage the inner wall of the gas main 5. Then the inner feed screw 40, together with the holder 38 (sometimes hereinafter referred to collectively as the injector means), is actuated by rotation of the handle 45. This causes the feed screw 40 to thread downwardly through the threaded aperture 44*a* (FIG. 7) in the end wall 44 of the carrier 30 to advance the holder 38 and the resilient plug downwardly to cause the plug 36 to be expanded into the position shown in FIGURE 3. In that position the plug 36 tightly engages the walls of the gas main 5, fits tightly around the bolt 37 joining the fork arms 31 and 32, and spreads out laterally also against the side walls of the nipple, while acting to spread the fork arms 31 and 32 slightly apart from each other and into fluid tight engagement, by their ribs 46 and 47, with the inner surface of the nipple 11. In this way the resilient plug serves to shut off the flow of fluid longitudinally of the gas main and, in cooperation with the ribs 46 and 47 on the fork arms 31 and 32, seals against flow of gas upwardly along the nipple.

Where a T-connection is to be added to the gas main 5 at the portion 7 between two stopper devices 10, both of the stopper devices will be manipulated in the manner indicated above, and then when the T-connection or repair or other operation has been performed completely, the handle 45 of each stopping device will be raised so that the injector means is raised to permit the resilient plug 36 to be withdrawn. This initial step permits the plug 36 to contract to its original shape, as shown generally in FIGURE 2, and then the handle 34 is manipulated in order to raise the carrier structure 30 and to draw its forked arms 31 and 32 and the stopper element 36 upwardly above the level of the valve closure element 16 of valve 14. The particular composition of the resilient stopper element is such that it readily regains its original shape to permit prompt withdrawal of the carrier 30 and yet has an appropriate hardness and resistance to grease which gives it a long life. Next, the valve 14 is closed by moving the valve closure element 16 to the right, as viewed in FIGURE 2. After that both stopper devices 10 may be unthreaded from the valve structures 14, and the nipple 11 is then plugged by means of a suitable tool (not shown) having a packing gland which is secured to the outlet 18 of the valve 14. The tool carries a plug and, after the packing gland of the tool has been threaded into the outlet of the valve, the valve 14 is opened by retracting the valve element 16, and the plug is threaded into the internally threaded portion 15 of the nipple 11. Such tool and plug are known in the art and need not be described in greater detail. After the nipple has been so plugged, the valve 14 may be removed and a closure cap then threaded over the externally threaded end of the nipple 11 to assure a gas tight closure. The by-pass line 6 is then removed and the openings made in the main 5 for it are plugged in any one of several manners known in the art.

The stopper device 10 of FIGURES 1 through 6 has been found particularly effective for stopping the flow of fluid in gas mains whose inside diameters range from the usual 1½" to 2" inside diameter and is able to stop gas flow successfully even in as wide a range as 1⅜" to 2⅛" inside diameter pipe and tubing. However, where the gas main is 4" in diameter, it is necessary to supply much more resilient material in order to plug the main, and therefore a larger stopper device is required. While it might be assumed that it would be a matter of merely enlarging the stopper device proportionately, experience has shown that adequate sealing of a 4" pipeline having high pressures such as 100 lbs. per square inch cannot be safely and certainly provided merely by adopting a larger device of the type shown in FIGURES 1 through 6.

For example, it has been found impractical in stopping a 4" gas main to rely upon metal ribs such as those indicated at 46 and 47 on the fork arms 31 and 32 of the carrier 30 in FIGURES 1 through 6. Although the nipple may be a cold-drawn seamless steel nipple and very smooth on the interior surface and truly circular, it is found that a safer and more certain seal can be arrived at by a modified stopper structure 10' which is illustrated in FIGURES 7, 8, 10 and 12. From those figures it will be seen that the fork arms 31' and 32' of the carrier 30' are not as long, relatively, as the fork arms 31 and 32 of carrier 30 shown in FIGURES 1 through 6. Instead, the carrier 30' has an internal generally rectangular slot 47' in which the holder 38' for the plug 36' is slidable, together with a portion of that plug. This arrangement is employed instead of having the carrier member slotted from side to side throughout a long length, because to do so would weaken the fork arms. As a consequence, the resilient plug 36' is differently formed than the plug 36 of FIGURES 1 through 6. By reference to FIGURE 9 is will be seen that it has a first, or lower, portion 36*a* which has a width corresponding approximately to the width of the fork arms, and which extends downwardly a short distance below the lower ends of the fork arms 31' and 32' and extends upwardly throughout that portion of carrier 30' where the arms are forked to a position on the carrier slightly below a peripheral groove 50. Groove, or recess, 50 is formed to receive an O-ring 51. The plug then tapers inwardly from each side, as at 52, and a second portion 36*b*, which is approximately as wide as the width of the internal passage 47', extends farther upwardly through the passageway 47' in the carrier 30'. There is then a third portion 36*c* of reduced width which fits between the forked ends of the holder 38' and is secured thereto by a pin 39' in the same manner as that illustrated in FIGURE 6. In this way a substantial length, and therefore volume, of resilient plug material may be provided through the length of the carrier 30' without weakening the carrier or its fork arms 31' and 32'.

A transverse hole 53 through portion 36*a* of the plug 36' connects with a smaller upper hole 54 through an intervening slit 55 which extends through plug 36'. Because a large amount of the resilient plug material must be fed into the gas main in order to stop it, the bolt 37' which joins the fork arms 31' and 32' and passes through the hole 53 in the plug 36' needs a place to move when the plug 36' is pressed downwardly and expanded. Slit 55 permits relative movement of the bolt 37 and plug 36'. In the smaller stopper device of FIGURES 1 through 6, the extent of downward movement of the plug 36 is such that it does not require a slit such as the slit 55 shown in FIGURE 9.

It will be observed that the peripheral recess 50 in the carrier 30' has a wall portion 56 (FIG. 8) radially inwardly to support it and to separate it from the plug element 36' in order that movement of the plug 36' will not result in the plug's rubbing against the O-ring and drawing it downwardly from its recess. Wall 56 has been found very desirable, since otherwise the plug 36' has a tendency to engage the O-ring and to pull it along the adjacent sharp corners of the fork arms, thereby easily severing it. The tapered portion 52 of plug 36' also assists in avoiding any such inter-engagement of the plug 36' with the O-ring 51. It will be apparent that the outside diameter of the O-ring is greater than the outside diameter of the carrier 30, as well as somewhat greater than the inside diameter of the nipple 11. In the nipple 11 illustrated in all figures of the drawings, the internal threads 15 at the upper end of the nipple 11 are so formed that their crests are flat and composed of portions of the smooth internal surface of the nipple. This is important in permitting the O-ring, as well as the stopper element 36', to pass through the nipple without causing a wearing or cutting action on them.

Just as in the device illustrated in FIGURES 1 through

6, the carrier 30' of FIGURES 7 through 12 is advanced or retracted by a feed screw 33, and the injector means comprising a feed screw 40 and holder 38' is used to advance or retract the resilient plug 36.

Because a large amount of resilient stopping material has to be employed in closing off a 4" gas main, supporting means on either side of the rubber stopper element 36' is provided to assure that the high pressures in the main will not shift the plug 36' longitudinally of the main, and permit leakage. The supporting means, indicated generally by the reference numerals 59 and 60, comprise parallelogram types of linkages as can be best seen in FIGURE 11. While a parallelogram shape of linkage is preferred, it is not essential that a true parallelogram be employed to accomplish the desired result. A description of one such supporting means or member 59 will be adequate for an understanding of both of them. Each one consists of four links, 61, 62, 63, 64, interconnected by hinge pins 65, 66, 67 and 68 respectively. The ends of hinge pins 66, 67 and 68 are flush with the external surfaces of their respective connected links. However, hinge pin 65 is flush on one side and has a shank portion 65*a* and a reduced threaded end 65*b* protruding laterally of the parallelogram linkage on the other side. Each hinge pin 65 is connected flush with a link 61 as by welding or other suitable means.

The vertical sectional view of FIGURE 10 shows how the parallelogram linkages 59 and 60 are associated with the fork arm 31' and 32' and with the resilient plug element 36'. On the inner surface of each fork arm below the level of the O-ring 51 there is a recess of a depth substantially corresponding to the thickness of the parallelogram linkage. These recesses are identified as 69 and 70 in FIGURE 10. Hinge pins 65 of the parallelogram linkages 59 and 60 have their extensions 65*a* and 65*b* disposed in bores 71 of the fork members, with the threaded extensions 65*b* of the hinge pins 65 extending into the enlarged portions of the bores 71 where Allen type nuts 72 may be fastened on the threaded ends 65*b* to secure the parallelogram linkages in place within the recesses 69 and 70. The threaded bolt 37' which secures the lower ends of the fork elements 31' and 32' together passes between the links as may be seen in FIGURES 7, 8 and 10.

The linkages 59 and 60 may be easily pressed into a collapsed position such as that shown in FIGURE 7 so that each linkage is no wider than the fork arms 31' and 32', and the linkages will retain their collapsed position because of the greasy lubricant used on the adjacent plug 36'. When the carrier 30' has been pushed downwardly by the feed screw 33 so that the resilient plug 36' first engages the bottom of the gas main 5 and then is further depressed, the bottom links 63 and 64 of each of the parallelogram linkages engage the bottom wall of the gas main 5 and cause the linkages, as well as the plug 36', to expand. When the bottom edges of the fork arms 31' and 32' have reached the bottom wall of the gas main 5, the linkages are in their fully expanded position and substantially conform, by reason of the particular shape of the links of each linkage, to the inside diameter of the gas main except for a slight clearance of approximately ⅛". Such clearance and the way the linkages are suspended by hinge pins 65 gives the linkages a "floating" action which is useful because of different internal diameters of different pipes and because, occasionally, the nipple 11 may not be exactly perpendicular to the main 5. Then the injector means, in the form of the feed screw 40 and the holder 38', is driven downwardly by rotation of the handle 45 to cause the resilient plug 36' to expand laterally into engagement with the side walls of the gas main, as well as to expand slightly in a direction longitudinally of the gas main against the linkages 59 and 60, which linkages are already expanded. The slit 55 in the plug 36' permits the plug to expand laterally more easily in the initial expansion than would be the case if it were not provided, and additionally permits the resilient material to flow around the bolt 37'. As the injector means is further worked downwardly, any opening at the slit 55 is completely closed and the bolt 37' is closely surrounded by resilient material so that there is no leakage of gas around it. Gas also is prevented from bypassing the resilient plug 36' by going up the nipple 11 and around the fork arms 31' and 32', since the O-ring 51 seals against the inner side of the nipple's wall and, additionally, the portion 36*a* of plug 36' expands laterally from between the fork arms 31' and 32' into engagement with the wall of the nipple 11. (It is not known exactly what configuration the slit 55 will take in each instance, but a conjectured configuration is that illustrated by the line 75 in FIGURE 8.)

In FIGURES 9, 10 and 11 it will be seen that links 61 and 63 of the linkage structures are reinforced by strengthening portions 76 and 77, which may be secured to those links by welding or otherwise. The strengthened portions are of substantially identical thickness to the thickness of the links so that they do not add to the overall thickness of the parallelogram linkages. By reference to the left-hand linkage of FIGURE 11, it will be seen that if gas under pressure is directed toward the right in that figure, the links 61 and 63 do not obtain a reinforcing, or backing-up, action from the links 62 and 64, as they might otherwise obtain if the gas pressure acted in the opposite direction. Hence, links 61 and 63 are provided with these reinforcement portions 76 and 77 to strengthen the entire linkage and they are so shaped that they do not interfere with the various links, when the links assume their retracted position as shown in FIGURE 7.

When it is desired to discontinue the stoppage of gas flow, the handle 45 is rotated so as to raise the holder 38' and the stopper element 36', and this permits the stopper element 36' to resume the shape indicated in FIGURE 7. Thereafter, the handle 34 may be rotated so as to move the entire carriage structure 30' upwardly, and to position the lower edge of the stopper element 36' at a level above the closure valve element 16 of valve 14, whereupon the valve 14 may be shut off as was described above in connection with FIGURES 1 through 6. The action of retracting the fork arms 31' and 32' of carrier 30' into the stuffing box 22 forces the parallellogram linkages 59 and 60 into a collapsed position.

One of the advantages of our invention is that the stopper devices 10 and 10' lend themselves to varying inside diameters of gas mains, many of which mains no longer have uniform diameters. This permits a greater versatility, and therefore a reduction in the number of different sizes and types of stoppers that are required by a gas distributing company. As pointed out above, the stopper device 10 of FIGURES 1 through 6 is adapted to be used with gas mains having a 1½" to 2" inside diameter, or even inside diameters varying from 1⅜" to 2⅛". The stopper device illustrated in FIGURES 7 through 12 is particularly suited with respect to 3" to 4" mains. It will be appreciated, however, that the structure 10' of FIGURES 7 through 12 will also lend itself to larger diameters of gas mains by an increase in the size of the stopper structure 10'.

In use in a 3" main, for example, it will be appreciated that the parallelogram linkages illustrated in FIGURES 7 through 11 will not be of a shape and size to permit their use, and hence they have purposely been made removable, and that very easily, by reason of the nuts 72 being readily reached from the outer surfaces of the fork arms 31' and 32'. For example, if it is proposed to use the stopper device 10' in a 3" main after it has been used in a 4" main, the device is removed from the valve 14, as explained above, and then the injector means is actuated by the handle 45 to extend the resilient plug 36' and its holder 38', until the pin 39' which connects the holder 38' and plug 36' is accessible. Then the pin 39' may be

removed and the threaded bolt 37′ may be removed to permit the plug 36′ to be disassociated from the carrier 30′. There is then room for the parallelogram linkages 59 and 60 to be moved sideways to withdraw their lateral bearing extensions 65*a* and threaded ends 65*b* from the bores 71 in the fork arms 31′ and 32′. In place of the linkages 59 and 60, there are substituted metal plates, such as the plate 80 of FIGURE 12, which fill in the recesses 69 and 70 at the inner surfaces of the fork arms 31′ and 32′. These plates have a width substantially corresponding to the width of the fork arms and a thickness substantially corresponding to that of the parallelogram linkages, and they extend downwardly to approximately the lower ends of the fork arms 31′ and 32′. The plates 80 also have a laterally extending hinge pin 81 like the hinge pins 65 of linkages 59 and 60, and additionally have an aperture 82 through which the threaded bolt 37′ may pass. When the plates 80 have been substituted for the linkages 59 and 60 and secured by the Allen nuts 72, and when the plug 36′ and threaded bolt 37′ have been replaced, then the plug and its holder 38′ are drawn upwardly by the feed screw 40 into the carrier 30′. Plates 80 are useful because they occupy space which might otherwise need to be filled in by the resilient plug.

While we have shown our invention in connection with a high pressure gas distributing system, it will be appreciated that the invention is broadly applicable for making a fluid tight seal at one or more points in any conduit. While preferred forms of the invention have been disclosed, it is not our intention to be limited to those, except insofar as the appended claims are so limited, since various changes and adaptations within the skill of the art may be made without departing from the scope of our invention.

We claim:

1. In means for stopping the flow of fluid in a conduit, a carrier having a diametrical slot extending from its lower end providing two spaced apart arms, one of said arms having a recess in its inner face and extending from its lower end, a restraining structure mounted in said recess and anchored to said one arm, said structure being expansible to a form approximating the interior of the conduit and being normally collapsed within the width of said arms and extending downwardly below said arms, a solid resilient plug member of substantial thickness slidable between said arms and along said structure in close proximity thereto, means for forcing said carrier downward effective for initially expanding said plug member radially by pressure contact with the lower inner portions of the conduit and also expanding said structure into pressure contact with the interior of the conduit, and means for forcing said plug member downward between said arms and alongside of said structure for further expanding said plug member radially into pressure sealing contact with the interior of the conduit, said restraining structure precluding displacement of said plug member in a direction toward said structure.

2. In means for stopping the flow of fluid in a conduit, a carrier adapted to be inserted into a conduit through an opening therein and a cylindrical fitting secured to the conduit in register with the opening, said carrier having a diametrical slot extending from its lower end providing two spaced apart arms, a solid resilient plug member slidable between said arms normally projecting beyond the lower ends thereof, two restraining structures disposed between said arms at opposite sides of said plug member and attached at their upper ends to said arms for movement therewith, said structures being normally collapsed within the width of said arms and extending therebelow and also being expansible by endwise pressure to a form approximating the interior of the conduit and then providing between them a space receiving said plug member, means for moving said carrier downwardly through the fitting and thereby forcing said plug member and the lower ends of said structures into pressure contact with the lower inner surface of the conduit effective for expanding said structures with their lower portions in pressure contact with the lower portion of the conduit and their upper portions anchored to said arms, and means for forcing said plug member downwardly between said arms and restraining structures thereby subjecting it to increased pressure effective for expanding said plug member radially into pressure sealing contact with the interior of the conduit.

3. In means for stopping the flow of fluid in a conduit, a carrier adapted to be inserted into a conduit through an opening therein and a cylindrical fitting secured to the conduit in register with the opening, said carrier having a diametrical slot extending from its lower end providing two spaced apart arms, one of said arms having in its inner face a recess extending from its lower end, a pantograph structure in said recess pivoted at its upper end to said one arm and normally in collapsed condition within the width of said arms and extending therebelow, a resilient plug member of substantial thickness slidable between said arms and said structure and normally projecting below said arms, said pantograph structure when collapsed projecting below said arms in proximity to the lower end of said plug member and being expansible by endwise pressure to a form approximating the interior of the conduit and then providing a restraining structure at one side and exterior of said plug member, means for moving the carrier downwardly through the fitting and thereby forcing said plug member and the lower end of said structure into pressure contact with the lower inner surface of the conduit effective for expanding said structure with its lower portion in pressure contact with the lower portion of the conduit and its upper end portion anchored to said one arm, and means for forcing said plug member downwardly between said arms and adjacent said restraining structure thereby subjecting it to increased pressure effective for expanding said plug member radially into pressure sealing contact with the interior of the conduit.

4. In means for stopping the flow of fluid in a conduit, a carrier having a diametrical slot extending from its lower end providing spaced apart arms, said arms having recesses in their inner faces extending from their lower ends, pantograph restraining structures respectively mounted in said recesses and each comprising an upper pair of links pivoted together and to said arms at their upper ends and a lower pair of links pivoted at their upper ends to the lower ends of said upper arms and pivoted together at their lower ends, said structures normally being collapsed and disposed within the width of said arms and extending downwardly below said arms, a solid resilient plug member of substantial thickness slidable between said arms and structures and free from the latter, said structures being expansible to approximately circular form by endwise pressure, means for forcing said carrier downward for expanding said pantograph structures, and means for forcing said plug member downward between said arms and structures for expanding said plug member radially of said expanded pantograph structures.

5. The invention defined in claim 4 wherein the pantograph structures are respectively detachably suspended from one of said arms by a hinge pin and means connected therewith and accessible from the outer side of said arm.

6. The invention defined in claim 4 wherein two of the links, which are not backed up in the direction of fluid flow by portions of the other links, are reinforced by strengthened portions.

**References Cited** in the file of this patent

UNITED STATES PATENTS

| | | |
|---|---|---|
| 708,076 | Postley | Sept. 2, 1902 |
| 2,272,734 | Witt | Feb. 10, 1942 |
| 2,381,248 | Bascom | Aug. 7, 1945 |
| 2,661,339 | Sparks et al. | Dec. 1, 1953 |
| 2,811,985 | Wells | Nov. 5, 1957 |