

Oct. 6, 1959

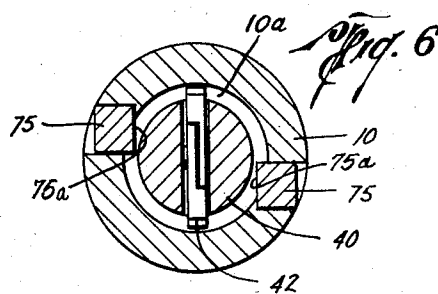
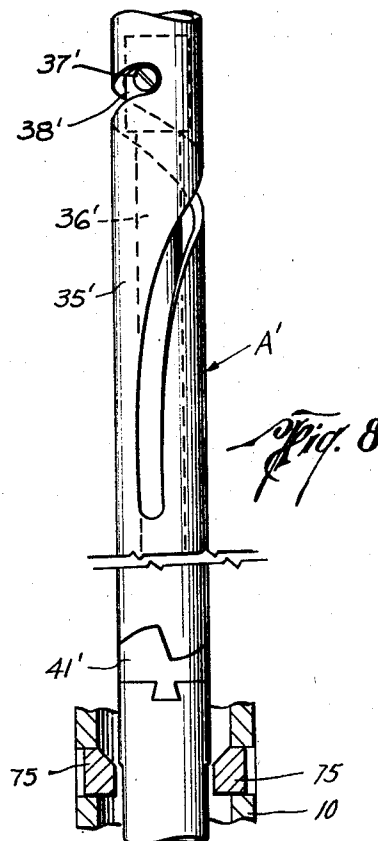
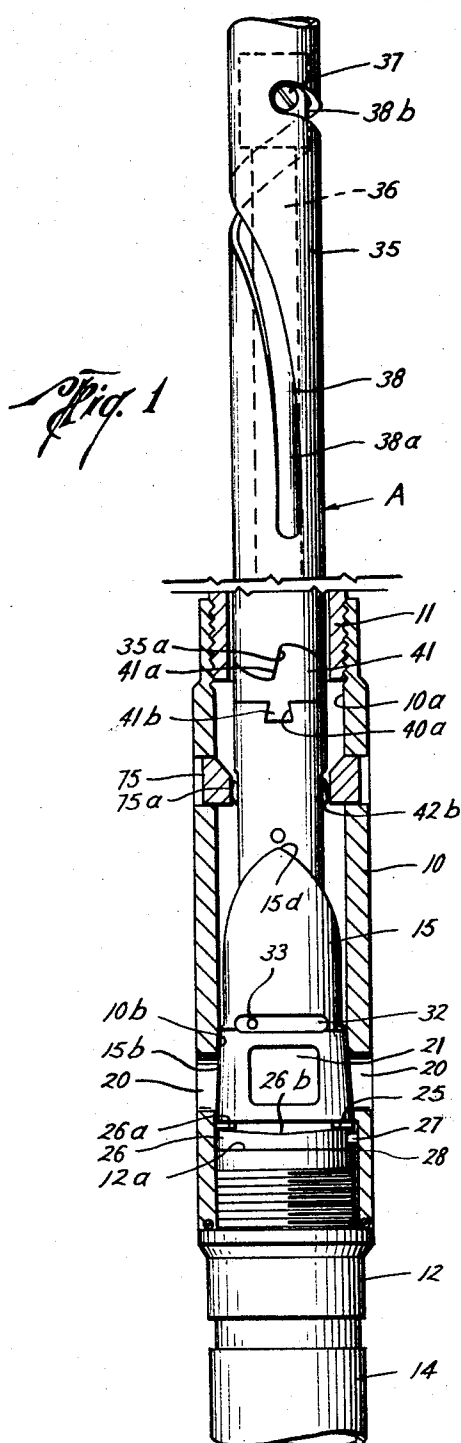
M. M. KINLEY

2,907,391

VALVES

Filed June 14, 1954

4 Sheets-Sheet 1



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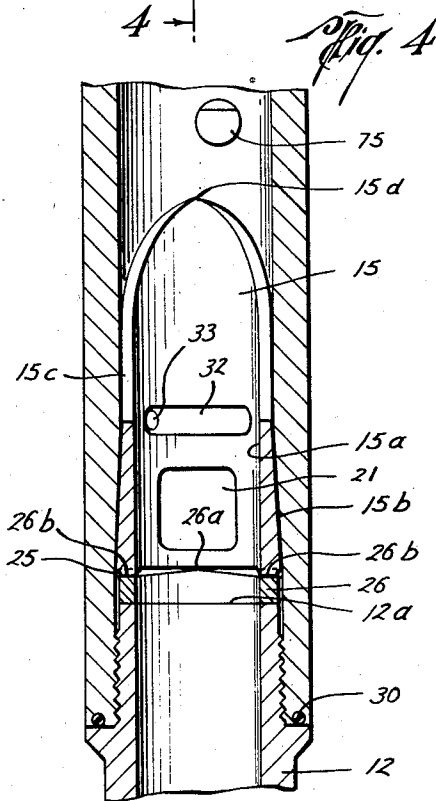
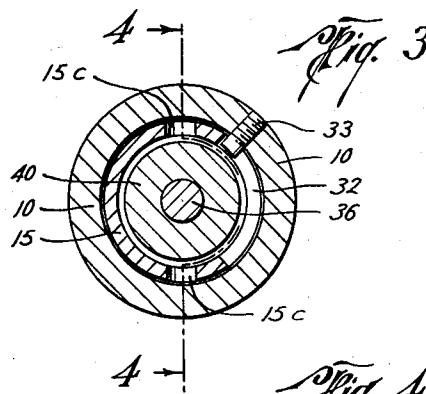
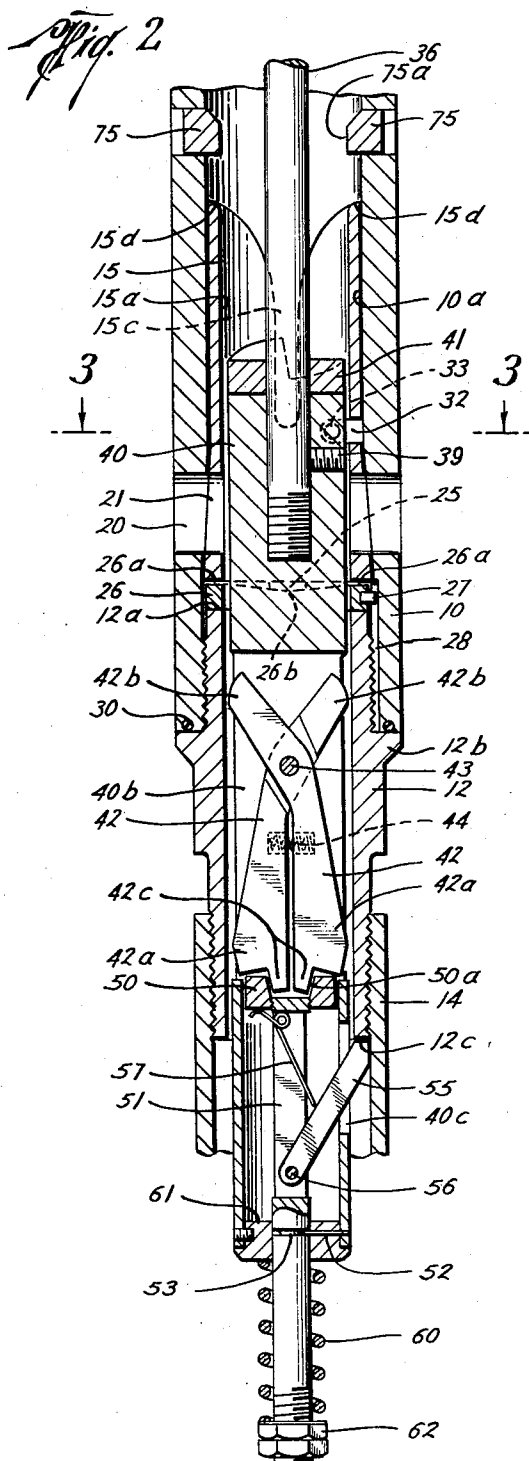
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VALVES

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4 Sheets-Sheet 2



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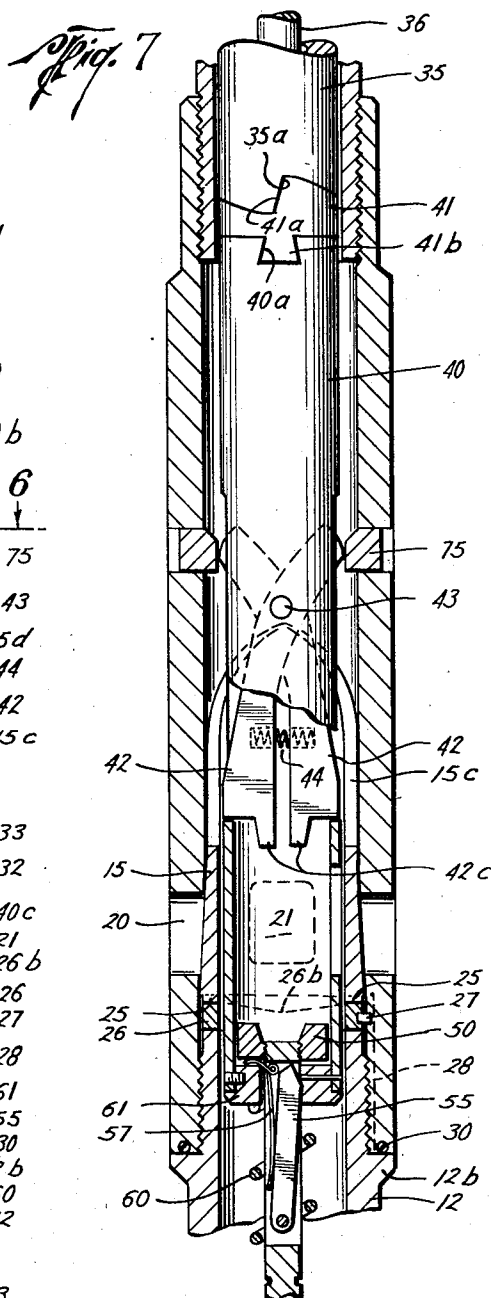
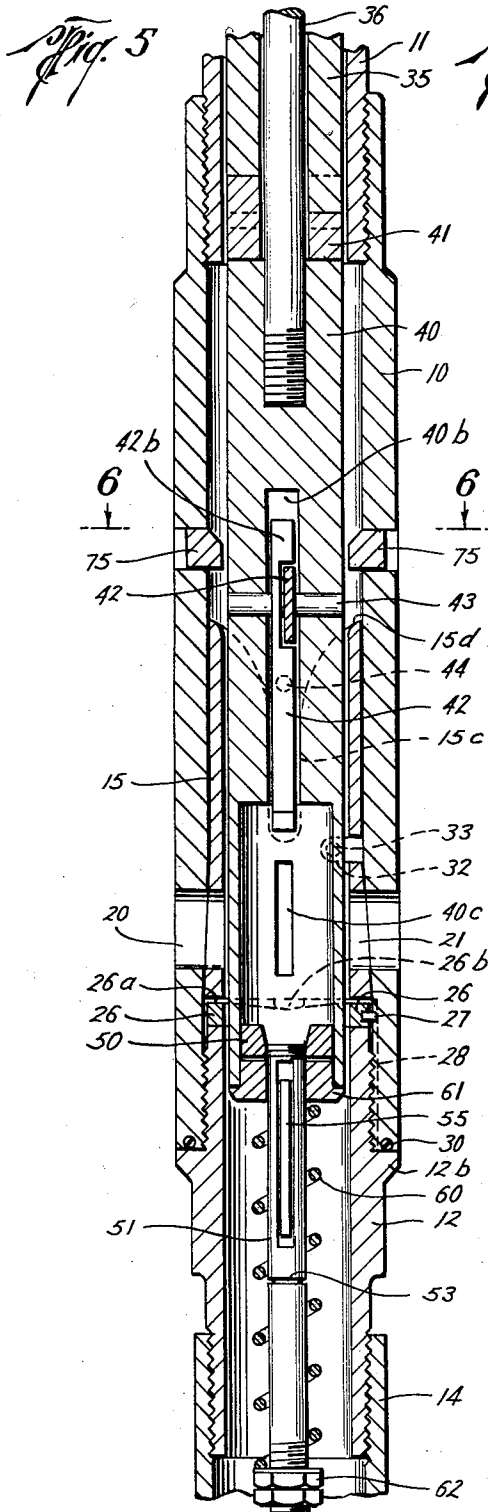
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VALVES

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4 Sheets-Sheet 3



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2,907,391.

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4 Sheets-Sheet 4

Fig. 9

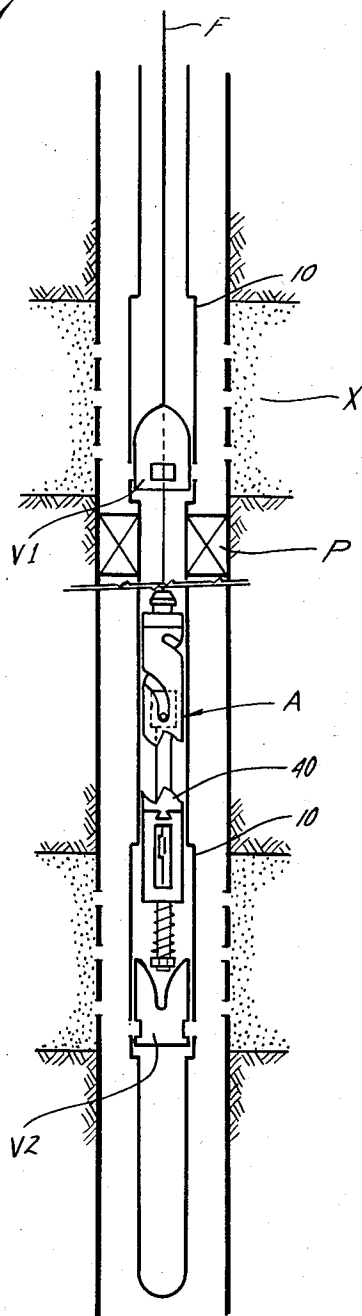
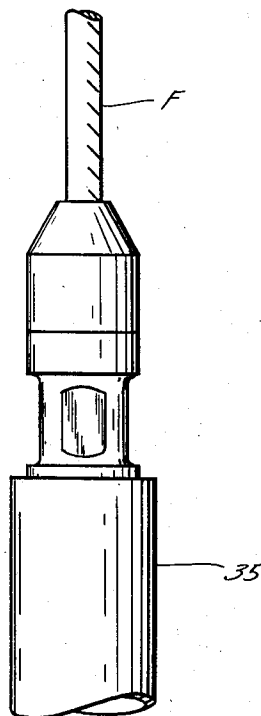


Fig. 1A



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2,907,391

VALVES

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18 Claims. (Cl. 166—224)

This invention relates to new and useful improvements in valves.

An object of this invention is to provide a new and improved valve adapted to be mounted in a well pipe and actuated by a rotary movement.

An important object of this invention is to provide in combination with a valve mounted in a well pipe for opening and closing by rotational movement, a rotary jarring device releasably engageable with said valve for actuating said valve.

Another object of this invention is to provide a new and improved valve which is adapted to be operated by rotational movement thereof applied to the valve mechanically through manipulation of a flexible line.

A further object of this invention is to provide a new and improved valve for use in a well pipe for operation from the surface of the well, wherein said valve is so constructed that substantially the full open bore of the well pipe is provided for the running of well tools therethrough, said valve being operated by rotational movement to thereby prevent actuation of said valve during the passage of the well tools therethrough.

A still further object of this invention is to provide a jar-actuated valve which is operable for opening and closing same by a jarring device which is adapted to move said valve from an open to a closed position or from a closed position to an open position with only a single trip of the jarring device into the well pipe being required for either operation.

Still another object of this invention is to provide in an improved valve construction wherein a plurality of valves are positioned in a well pipe and longitudinally spaced from each other, a jarring tool which is adapted to be selectively connected to one of said valves for operating same and thereafter to be released.

The construction designed to carry out the invention will be hereinafter described, together with other features thereof.

The invention will be more readily understood from a reading of the following specification and by reference to the accompanying drawings forming a part thereof, wherein an example of the invention is shown, and wherein:

Figure 1 is a view, partly in elevation and partly in section, illustrating the improved valve construction of this invention with the valve in a closed position.

Figure 1A is an elevation illustrating the wire line or other flexible support connected to the upper end of the actuating means.

Figure 2 is a vertical sectional view of the improved valve construction of this invention, illustrating the lowering of the actuating tool through the bore of the valve member.

Figure 3 is a horizontal sectional view taken on line 3—3 of Figure 2.

Figure 4 is a vertical sectional view taken on line 4—4 of Figure 3 and illustrating a portion of the improved

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valve construction of this invention, wherein the actuating means is not illustrated.

Figure 5 is a view similar to Figure 2, but illustrating the valve construction after the actuating means has been connected to the valve member when the valve member is in the open position.

Figure 6 is a horizontal sectional view taken on line 6—6 of Figure 5.

Figure 7 is a view similar to Figure 5, but illustrating the valve construction of this invention after the valve actuating means has effected a rotation of the valve member to a closed position.

Figure 8 is an elevation illustrating a modified actuating means or tool of this invention which is adapted to be used for moving the valve member in an opposite direction to the actuating tool illustrated in Figures 1—7.

Figure 9 is a view, partly in section and partly in elevation, of a plurality of the valve constructions of this invention mounted in a tubing string with a well packer.

In the drawings, the numeral 10 designates a valve housing which is tubular and which is connected at its upper end to a well pipe or tubing 11 which extends to the surface of the well. The lower end of the valve housing 10 is connected to an adapter 12, which, in turn, is connected to a lower section of well pipe 14, or, if desired, to a valve housing identical with or similar to the housing 10. Thus, the valve housing 10 is positioned in the well pipe or tubing string which extends from the surface of the well and it actually forms a part thereof, with the bore 10a of the housing 10 being of substantially the same diameter as the bore of the well pipe or tubing string. Within the valve housing 10, there is mounted a valve or valve member 15 which is adapted to be turned or rotated relative to the housing 10 and which is formed with a bore 15a therethrough, which is slightly smaller in diameter than the bore 10a of the housing 10, but which is also of substantially the same diameter as the diameter of the bore of the tubing string.

To provide fluid communication between the exterior of the valve housing 10 and the bore 15a of the valve member 15, one or more lateral ports 20 are provided in the valve housing 10, which are adapted to be moved into and out of alignment with one or more ports 21 in the valve or valve member 15, whereby the valve is either opened or closed, respectively. For turning the valve or valve element 15 to open or close same, an actuating or jarring means A (Figure 1) is provided which is suspended on a cable, wire line, or other similar flexible line F (Fig. 1A) which extends to the surface of the well, whereby the actuating or jarring means or tool A may be lowered and raised thereon and also manipulated thereby. As will be explained, the actuating tool A is so constructed that it can be lowered into the well pipe or tubing string 11, connected to the valve or valve element 15, then actuated by a manipulation of its flexible support line to impart a rotary motion to the valve member 15 to turn same for actuating the valve, and thereafter the actuating member A can be retracted from the well pipe or tubing string 11 for subsequent well operations wherein well tools are passed through the bore 15a of the valve element 15, if desired.

Considering the details of the valve construction of this invention, the valve element or member 15 has a lower external portion 15b which is tapered upwardly and inwardly. Such tapered surface 15b of the valve element or member 15 is adapted to contact in sealing engagement a similarly inclined or tapered seating surface 10b formed in the bore 10a of the valve housing 10 near the lower end thereof and adjacent the flow ports 20. The lower end of the valve member 15 has a plu-

ality of cams or cam lugs 25 formed thereon, each of which rests upon and is adapted to slide relative to a cam ring 26 which rests upon the upper end 12a of the tubular adapter 12. The upper end of the cam ring 26 is formed with a cam surface which has diametrically opposed high points or portions 26a and diametrically opposed low points or portions 26b, which are positioned between the high points 26a, whereby as the valve member 15 is moved from its open position (Figure 2) to its closed position (Figure 1), the cam lugs 25 ride from the low points 26b of the cam ring 26 toward the high points 26a, so that the valve member 15 is moved slightly longitudinally upwardly to tightly wedge the surface 15b of the valve member 15 into contact with the tapered surface 10b. Thus, a tight seal is formed between such metal surfaces 10b and 15b when the valve member 15 is in the closed position, because, as can be seen in Figure 1, the valve member 15 is raised with respect to the housing 10 when it is in the closed position.

The cam ring 26 is prevented from rotating relative to the valve housing 10 by reason of a key 27, which is mounted on the ring 26 and extends outwardly therefrom into a keyway 28, which is a longitudinal slot or groove formed in the bore 10a of the valve housing 10 at its lower end. To prevent fluid leakage between the threaded connection of the adapter 12 to the valve housing 10, an O-ring 30 formed of rubber or other similar elastic material is mounted between the lower end of the valve housing 10 and an annular radially extending shoulder 12b on the adapter 12.

The valve member 15 has a pair of diametrically opposed longitudinal slots 15c (Figure 2) which have upwardly curved walls which converge into diametrically opposed pointed upper ends 15d. The valve member 15 is also provided with a lateral slot 32, which extends in an arc of substantially 90 degrees, but preferably slightly more than 90 degrees, and receives a stop pin 33 mounted on the valve housing 10 (Figure 3). The diameter of the pin 33 is less than the height of the lateral slot 32 so as to permit the longitudinal movements of the valve member 15 relative to the valve housing 10 by reason of the co-action between the cam lugs 25 and the cam ring 26.

The actuating member or tool A, which imparts the turning or rotational movement to the valve member 15, includes an outer sleeve 35 (Figure 1) which has its upper end connected to a suitable support, such as a cable or flexible wire line (not shown). A rod 36 is positioned within the sleeve 35 and the parts 35 and 36 are longitudinally moveable relative to each other, with such longitudinal relative movement being controlled by the movement of a pin 37 extending outwardly from the rod 36 into a shaped guide slot 38 in the sleeve 35. The lower portion 38a of the slot 38 is vertical or substantially vertical and the slot 38 gradually increases in inclination as it progresses upwardly so that the upper portion 38b of the slot 38 is substantially lateral or horizontal. Such construction of the slot 38 results in the rotational movement of the sleeve 35 relative to the rod 36 as the sleeve 35 is permitted to fall by gravity from an extended position to the fully telescoped position shown in Figure 1. Thus, the sleeve 35 would be in the fully extended position when the pin 37 is at the lower end of the slot 38 and it is in the fully telescoped position when the pin 37 is at or near the upper end of the slot 38. It should be noted that although the lower portion 38a of the slot 38 is illustrated as vertical, it is generally preferable to provide such lower portion 38a with a slight incline from vertical so that there is no sharp change in the movement of the pin 37 in the slot 38 as the sleeve 35 is dropped.

The lower end of the rod 36 is threaded or otherwise suitably secured to a body 40, and such rod 36 is preferably prevented from rotating relative to the body 40

by a retaining set screw 39 (Figure 2). On the upper end of the body 40, an anvil ring 41 is mounted which has one or more substantially vertical or longitudinal surfaces 41a which are adapted to be contacted by substantially vertical or longitudinal hammer surfaces 35a formed on the lower end of the sleeve 35. The anvil 41 is retained in position on the body 40 since the anvil 41 is formed in the shape of a ring and the rod 36 extends through the bore thereof (Figure 2). Also, a dovetail joint is provided between the anvil 41 and the body 40 by means of the downwardly extending flared projections 41b which fit into complementary recesses 40a.

At about the midportion of the body 40, a longitudinal opening 40b is provided for the mounting of a pair of pivoted latching arms 42. The arms 42 overlap each other in scissor fashion with a pivot pin 43 extending through the overlapped portions of the latching arms 42. The lower portions 42a of the latching arms 42 are urged laterally outwardly by a coil spring or suitable resilient means 44 which is confined between the latching arms 42. The upper portion 42b of each of the latching arms 42 are actually retracting dogs which also extend outwardly from the longitudinal opening 40b, and such dogs 42b also tend to move outwardly and away from each other by reason of the urging of the coil spring 44.

When the actuating tool A is initially lowered into the tubing string 11, the latch arms 42 are held in a retracted position by means of a retaining or lock ring 50 which is connected to the upper end of a slideable shaft 51. The retaining ring 50 has a substantially circular central recess 50a into which fit projections 42c on the lower end of each of the latch arms 42. The retaining ring 50 and the slideable bar 51 are maintained in their upper or locked position during the lowering of the actuating or jarring tool A into the tubing string by a shear pin 52 which extends into an annular notch 53 formed in the slideable bar 51.

To shear the shear pin 52, a collar finder 55 is pivotally mounted on the member 51 at the pivot pin 56 and a spring 57 resiliently urges the finder 55 outwardly through an opening 40c in the lower portion of the body 40. The finder 55 is adapted to seat or catch on the annular shoulder 12c of the adapter 12 upon an upward movement of the actuating tool A after such tool A has been lowered through the bore of the valve member 15 and the adapter 12. A downward force is thus applied to the slideable member 51 to shear the pin 52, whereupon the coil spring 60 which is confined between an annular guide 61 and a nut 62 on the member 51 urges the slideable member 51 downwardly to retract the retaining ring 50 from the projections 42c. When the retaining or lock ring 50 is thus moved below the projections 42c, the spring 44 acts to urge the latching arms 42 outwardly so that as the actuating or jarring tool A is raised in the bore of the adapter 12 and the valve member 15, the latch arms 42 are urged outwardly into the longitudinal slots 15c of the valve member 15 to thereby connect the actuating or jarring tool A to the valve member 15. It should be pointed out that the finder 55 is retracted from its extended position shown in Figure 2 to a retracted position shown in Figures 5 and 7 when the shear pin 52 is released and the spring 60 urges the slideable bar or shaft 51 downwardly. Thus, the finder 55 does not interfere with the upward movement of the actuating or jarring tool A after the lock ring 50 has been released and moved downwardly with respect to the latching arms 42.

With the valve member 15 in the open position and the latch arms 42 engaged in the longitudinal slots or recesses 15c of the valve member 15, the upper portions or dogs 42b of the latch arms 42 are in the same horizontal plane as retracting lugs 75 which are mounted in the bore 10a of the housing 10. One retracting lug 75 is provided for each of the latch arms 42 and the latch lugs 75 are substantially diametrically opposed with re-

spect to each other and are positioned 90 degrees from the latch arms 42 when the valve member 15 is in the open position (Figures 5 and 6). The retracting lugs 75 are so positioned that their inner surfaces 75a (Figure 6) form a continuation of the inner surface or bore 10a of the valve housing 10, whereby as the dogs 42b move in a rotational direction relative to the valve housing 10, they contact the inner surfaces 75a of the retracting lugs 75 and are thereby moved radially or laterally inwardly, which also effects an inward movement of the lower portions 42a of the latching arms 42. The lower portions 42a of the latch arms 42 are retracted a sufficient distance to retract same from the longitudinal slots 15c so that the actuating tool A is permitted to then drop relative to the valve member 15 and further rotation of the valve member 15 is prevented, thus giving an indication of the completion of the closing of the valve member 15.

In the operation or use of the valve construction of this invention, the valve member 15 is positioned in the valve housing 10, which is assembled as shown in Figures 1 and 2, so as to form a continuation or a part of the well pipe or tubing string 11 from which such assembly is suspended. For purposes of explanation, it is assumed that the valve member 15 is in the open position with its ports 21 aligned with the ports 20 in the valve housing 10 (Figure 2). The jarring or actuating tool A is then lowered into the tubing string 11 and passes through the bore 15a of the valve member 15 a sufficient distance to position the finder 55 below the annular shoulder 12c of the adapter 12. Then, an upward movement of the jarring or actuating member A is effected so that the slideable member 51 is held against upward movement and, as a result, the shear pin 52 is sheared so that the spring 60 urges the lock ring 50 downwardly away from the latch arms 42 and also retracts the collar finder 55 (Figures 5 and 7). With the lock ring 50 out of locked position so that the latch arms 42 are expanded, the upward movement of the actuating or jarring tool A is continued until the latch arms 42 have been raised above the upper ends 15d of the valve member 15, whereupon the lowering of the actuating or jarring tool A results in a guiding of the latch arms 42 into the longitudinal connecting slots 15c of the valve member 15 to thereby establish a connection between the actuating means A and the valve member 15.

The flexible line supporting the outer sleeve 35 is then raised to position the pin 37 in the lower portion of the shaped slot 38, if such pin 37 is not already in that position. Then the sleeve 35 is permitted to fall or drop by slacking the flexible line and such falling or longitudinal movement of the sleeve 35 relative to the rod 36 effects a gradually increasing rotational movement of the sleeve 35 due to the guiding action of the shaped slot 38 moving relative to the pin 37. Since the slot 38 is preferably gradually increased in its inclination, the sleeve 35 has a considerable rotary force as it reaches its lower end of the travel with respect to the rod 36, and while such sleeve 35 is rotating, the hammer surface 35a contacts the anvil surface 41a of the anvil ring 41 to impart a rotary, jarring impact in a left-hand or counterclockwise direction (as viewed from the top of Figure 1) to the anvil ring 41. Thus, the surface 35a acts as a hammer which imparts the rotary impact to the anvil ring 41 and since the anvil 41 is connected to the body 40, and the body 40 is connected to the latch arms 42, which are engaged in the longitudinal slots 15c, the rotation of the anvil ring 41 effects a turning or rotation of the valve member 15. One lowering of the sleeve 35 with respect to the rod 36 is generally insufficient to turn the valve member 15 from the open to the closed position, so that the sleeve 35 is ordinarily raised and lowered several times in order to completely move the valve member 15 to its closed position (Figure 7). It should be noted that, as the sleeve 35 is lowered rela-

tive to the rod 36; the rod 36 is prevented from turning to the right or clockwise by reason of frictional resistance provided by the contact between the external surface of the valve member 15 and the internal surface or bore wall of the housing 10, or by any other suitable friction-resistant means.

As the valve member 15 is thus being rotated by the reciprocation of the outer sleeve 35 with respect to the rod 36, the cam lugs 25 are moved from the low points 26b of the cam surface toward the high points 26a on the cam ring 26. As the cam lugs 25 thus cooperate with the cam surface on the cam ring 26, the valve member 15 is urged longitudinally or upwardly a sufficient amount to tightly wedge the valve member 15 in sealing contact with the inner tapered surface 10b of the valve housing 10. Also, during such rotation of the valve member 15, the latch dogs 42b are moved relative to the retracting lugs 75 and, just before the pin 33 contacts the end of the slot 32, the dogs 42b engage the inner surfaces 75a of the retracting lugs 75 to urge the latch arms 42 inwardly and release same from their connected position in the longitudinal slots 15c. The retracting lugs therefore serve as a stop means to prevent further rotation of the valve member 15 with the actuating or jarring tool A illustrated in Figures 1-7, but primarily the retraction of the latch arms 42 by the lugs 75 serves to indicate at the surface of the well when the valve is closed because when the arms 42 are retracted, the tool A drops and an increased weight on the flexible support line is indicated at the surface of the well.

In Figure 8 of the drawings, a modified form of the actuating or jarring tool A is illustrated, and such modified tool is identified by the letter A'. All of the parts of the modified tool A' are identical with that illustrated in Figure 1 for the tool A, except that the parts are reversed so that instead of imparting a left-hand or counterclockwise rotational movement (as viewed from top of Figure 1) to the valve member 15 as with the tool A, a right-hand or clockwise rotational movement is imparted with the modified tool A' so that the tool A' is adapted to move the valve element 15 from the closed position to the open position. The latch arms 42 and the structure for mounting same at the lower end of the tool A of Figs. 1-7 would obviously be located at the lower end of the tool A' shown in Fig. 8. Preferably, the dogs 42b on the latch arms 42 shown in the tool A of Figures 1-7 are omitted from the tool A' so that the retracting lugs 75 do not interfere with the engagement of the latching arms 42 in the longitudinal slots 15c of the valve member 15. All parts of the tool A' which are similar or identical to the parts of the tool A have the same identifying numerals followed by a prime mark.

The operation of the modified tool A' of Figure 8 is the same as that shown in Figures 1-7, except that the rotation is in a different direction as above explained. Such modified tool A' would also be suspended from a cable or other flexible support and manipulated thereby.

It should be pointed out that in the closing of the valve member 15 by the use of the jarring tool A, the rotation of the valve element 15 with the tool A is limited by the co-action of the retracting lugs 75 with the dogs 42b, and by reason of such construction and co-action, the stop pin 33 does not contact the extreme left end or limit of the slot 32 (Figure 1). However, in the event the valve does leak when it has been moved to the closed position and when the dogs 42b have contacted the retracting lugs 75 to retract the latch arms 42, the tool A can be removed from the well tubing or pipe and latch arms similar to those illustrated in Figure 8 can be substituted for the latch arms 42 in the tool A so that the tool is identical with that shown in Figure 1 except that the dogs 42b are omitted. With such a construction, the valve element or member 15 can be further moved

to the left or counterclockwise (as viewed from the top of Figure 1) and the cam lugs 25 will ride up further on the cam surface of the cam ring 25 so that a further tightening or wedging of the valve member 15 in the valve housing 10 is effected.

It should also be pointed out that in the opening of the valve by the movement of the valve element or member 15 to the right or clockwise (as viewed from the top of Figures 1 and 8), the stop or limit of rotation of the valve member 15 is obtained by the contact of the stop pin 33 with the right end of the slot 32 (Figure 1).

In the usual use of the valve construction of this invention, a plurality of valves are positioned in the well tubing or pipe and are longitudinally spaced with respect to each other. In other words, a duplicate valve assembly is positioned above or below the valve assembly illustrated in the drawings and the valves are both constructed for operation or actuation by the jarring tools A and A'. With the lock arrangement, including the lock ring 50, for retaining the latch arms 42 in the retracted position (Figure 2), the jarring tool A (or A') can be lowered through the bore of each of the valves positioned in the well pipe or tubing. Therefore, the jarring tool can be lowered to a particular valve which it is desired to actuate or operate, since the jarring tool A or A' can be lowered to the predetermined elevation at which the particular valve to be actuated is located and then the sequence of operations, as explained above, for their connection and actuation of the jarring tool on the valve element 15 can be effected.

Although various instances wherein it is desirable to selectively operate a plurality of valves in a well pipe will occur to those skilled in the art, the invention is particularly suitable for use in the dual completion of oil and gas formations in a well (Fig. 9), wherein one valve V-1 of the type described above in connection with Figs. 1-7 is positioned above a conventional well packer P and another valve V-2 of the same type is positioned below such packer P, with the upper valve V-1 being adjacent a gas formation X and the lower valve V-2 being adjacent an oil formation Y. With such arrangement, the valves can be manipulated by the manipulation of the actuating tool A of this invention so as to open either or both of the valves or the actuating tool A' can be used to close either or both of the valves at the desired times for effecting the various well operations such as washing of the mud from the well, acidizing, and the production of the oil through the tubing and the gas through the annulus in the well bore.

The foregoing disclosure and description of the invention is illustrative and explanatory thereof and various changes in the size, shape and material, as well as in the details of the illustrated construction may be made, within the scope of the appended claims, without departing from the spirit of the invention.

What is claimed is:

1. A side-door valve for use with a tubing string, including a stationary tubular housing having a transverse opening therein and connected in the tubing string, said tubular housing having a bore of substantially the same size as the bore of the tubing, a tubular valve member positioned in said housing for rotational movement relative thereto, means for connecting said valve member to said housing to prevent any substantial longitudinal relative movement therebetween during the relative rotational movement thereof, said valve member having a transverse opening therein adapted to be moved into and out of alignment with the transverse opening in said housing, a first stop means to stop the rotational movement of said valve member in one direction when said openings are aligned, a second stop means to stop the rotational movement of said valve member in the other direction when said openings are out of alignment, and a rotary jarring means supported in the tubing string on a flexible line,

means detachably connecting said rotary jarring means to said valve member to apply a rotary jarring impact thereto upon manipulation of the flexible line to turn said valve member relative to said housing from one of said stop means toward the other of said stop means.

2. The structure set forth in claim 1, wherein said valve member has a longitudinal groove therein, and wherein said jarring means includes a longitudinal projection adapted to fit into said groove for locking said jarring device to said valve member.

3. In combination with a valve mounted in a well pipe and adapted to be opened and closed by rotational movement thereof, a jarring device and a flexible line supporting said device for lowering or raising into the well pipe and for manipulating said device, said jarring device comprising, a first member having releasable connection with said valve for rotational movement therewith, a second member mounted with said first member for longitudinal movement relative thereto, means on said first member engaging said second member for converting said longitudinal movement of said second member into rotary movement thereof, and means for imparting the rotary movement of said second member to said first member with a rotary jarring impact, whereby a rotary jarring impact is applied to said valve to rotate same.

4. The structure set forth in claim 3, wherein said second member has a shaped slot therein, and wherein said means on said first member engaging said second member for converting said longitudinal movement of said second member into rotary movement thereof includes, a pin on said first member engageable with the wall of the shaped slot in said second member, whereby said pin is guided along the wall of said slot to effect the rotation of said second member.

5. The structure set forth in claim 3, wherein said second member has a shaped slot therein, and wherein said means on said first member engaging said second member for converting said longitudinal movement of said second member into rotary movement thereof includes, a pin on said first member engageable with the wall of the shaped slot in said second member, whereby said pin is guided along the wall of said slot to effect the rotation of said second member, and the wall of said shaped slot having a gradually increasing inclination whereby as said second member moves longitudinally relative to said first member toward said means for imparting the rotary movement of said second member to said first member, the rate of rotation of said second member gradually increases.

6. The structure set forth in claim 3, wherein said first member includes an inner mandrel having a transversely extending pin thereon and said second member includes an outer tubular body surrounding said inner mandrel, said flexible line having connection with the upper end of said outer tubular body, said second member having a shaped slot therein which has a substantially vertical lower wall merging into a gradually increasing inclined wall to guide said outer tubular body from a substantially vertical movement to a rotational movement as said pin follows said wall during the lowering of said outer tubular body relative to said mandrel.

7. The structure set forth in claim 3, including means associated with said valve and said jarring device for indicating to the operator at the surface whether said valve is open or closed.

8. The structure set forth in claim 3, including means to prevent said jarring device from passing below said valve when said valve is closed, and means for releasing the releasable connection between said jarring device and said valve to permit said jarring device to pass below said valve when said valve is open to thereby impose the weight of the jarring device on the flexible line, whereby the operator at the surface will know that the valve is open when the weight of the jarring device is suspended from the line and that the valve is closed when the

weight of the jarring device is not supported by the flexible line.

9. In combination with a valve mounted in a well pipe and adapted to be opened and closed by rotational movement thereof, a jarring device including, an inner mandrel, a lower body connected to said mandrel, means connecting said lower body to said valve, an upper tubular body slidably mounted on said mandrel for longitudinal movement relative thereto, means on said mandrel and said upper tubular body for converting said longitudinal movement of said upper tubular body into rotational movement thereof, and co-acting surfaces on said upper tubular body and said lower body longitudinally spaced from each other during the longitudinal movement of the upper tubular body relative to said mandrel and movable into jarring engagement with each other during the rotational movement of the upper tubular body to transmit the rotary movement of the upper tubular body to said lower body and thereby to said valve with a rotary jarring impact.

10. The structure set forth in claim 9, wherein said valve has a longitudinal groove therein, and wherein said means connecting said lower body to said valve includes a laterally extending projection mounted on said lower body and adapted to fit into said groove for latching said lower body to said valve, whereby rotational movement imparted to said lower body is transmitted to said valve.

11. A plug valve, adapted to be mounted in a well pipe, comprising an outer tubular housing in a well pipe, an inner tubular valve member mounted in said housing for rotational movement relative thereto, a fluid passage through said housing and said valve member for establishing fluid communication between the area exterior of said housing and the area inside of said tubular valve member, actuating means for rotating said valve member relative to said housing to close said fluid passage, means for connecting said actuating means to said valve member, and means on the valve housing engageable with said connecting means when said valve member has been rotated to close said passage to release said actuating means from said valve member.

12. A valve adapted to be mounted in a well pipe, comprising an outer tubular housing in a well pipe, an inner tubular valve member mounted in said housing for rotational movement relative thereto, a fluid passage through said housing and said valve member for establishing fluid communication between the area exterior of said housing and the area inside of said tubular valve member, means for rotating said valve member relative to said housing to open or close said fluid passage, said inner tubular valve member having an outwardly flared lower external surface, said tubular housing having an outwardly flared inner surface of substantially the same inclination as the flared surface of said valve member, and co-acting cam surfaces on said valve member and said housing for moving said flared surfaces into sealing contact as said valve member is rotated from the open to the closed position.

13. A rotary valve for use in a well pipe, comprising a tubular valve housing adapted to be connected to the pipe, a rotatable valve sleeve mounted in said housing and having a bore in fluid communication with the bore of the pipe, said housing having a port therein, said sleeve also having a port therein, said ports being movable into and out of alignment to open and close fluid communication between the exterior of the housing and the bore of said sleeve upon rotation of said sleeve relative to said housing, and said valve sleeve having a longitudinal groove formed therein at its upper end for engagement by an actuating tool for turning said valve sleeve relative to said tubular housing for opening and closing the flow through said ports.

14. The structure set forth in claim 13, wherein said tubular housing has an inner diameter which is larger than the inner diameter of said well pipe, and wherein said

valve sleeve has an inner diameter which is of substantially the same size as the inner diameter of said well pipe, the upper end of said valve sleeve terminating below the upper end of said valve housing to provide an enlarged diameter portion above the valve sleeve.

15. A side-door valve for use with a tubing string, including a stationary tubular housing having a transverse opening therein and connected in the tubing string, said tubular housing having a bore of substantially the same size as the bore of the tubing, a tubular valve member positioned in said housing for rotational movement relative thereto, means for connecting said valve member to said housing to prevent any substantial longitudinal relative movement therebetween during the relative rotational movement thereof, said valve member having a transverse opening therein adapted to be moved into and out of alignment with the transverse opening in said housing, a first stop means to stop the rotational movement of said valve member in one direction when said openings are aligned, a second stop means to stop the rotational movement of said valve member in the other direction when said openings are out of alignment, a jarring means supported in the pipe on a wire line and detachably connected to said valve member to apply a rotary jarring impact thereto upon a manipulation of said flexible line to turn said valve member relative to said housing from one of said stop means toward the other of said stop means, said valve member having a longitudinal groove therein, and said jarring means including a projection pivotally mounted on said jarring means, and a resilient means for urging said projection outwardly to thereby urge said projection into said groove to lock said jarring means to said valve member.

16. In a jar-actuated valve for use in a pipe, a tubular housing adapted to be connected to the pipe, an inner valve sleeve mounted in said housing and having a bore in fluid communication with the bore of the pipe, said housing having a port therein, said sleeve also having a port therein, said ports being movable into and out of alignment to open and close fluid communication between the exterior of the housing and the bore of said sleeve upon rotation of said sleeve relative to said housing, and rotary jarring means adapted to be supported in the pipe on a flexible line, means releasably connecting said rotary jarring means to said sleeve whereby a rotary impact is applied to said sleeve by said rotary jarring means upon a manipulation of said flexible line to turn said sleeve relative to said housing to move said ports in said housing and said sleeve out of alignment for closing fluid flow therethrough.

17. In a jar-actuated valve for use in a pipe, a tubular housing adapted to be connected to the pipe, an inner valve sleeve mounted in said housing and having a bore in fluid communication with the bore of the pipe, said housing having a port therein, said sleeve also having a port therein, said ports being movable into and out of alignment to open and close fluid communication between the exterior of the housing and the bore of said sleeve upon rotation of said sleeve relative to said housing, and rotary jarring means adapted to be supported in the pipe on a flexible line, means releasably connecting said rotary jarring means to said sleeve whereby a rotary impact is applied to said sleeve upon a manipulation of said flexible line to turn said sleeve relative to said housing to move said ports in said housing and sleeve into alignment for opening fluid flow therethrough.

18. In combination with a plurality of valves positioned in a well pipe and longitudinally spaced from each other with each of said valves having a longitudinal bore therethrough, an actuating tool having a body adapted to be lowered into the well pipe, latching means on said body adapted to connect said body to either of said valves, lock means releasably connected to said latching means to lock said latching means in a retracted position to permit the lowering of said tool through the bore of at least one of

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said valves without actuation of such valve, release means connected to said lock means to hold said lock means in locking position and operable to release said lock means when said tool is adjacent the valve to be actuated and prior to the actuation thereof, and an actuating means 5 connected to said lock means and engageable with a lateral shoulder in the well pipe for actuating said release means to thereby effect the release of said lock means whereby the connection of the latching means between said actuating tool and the valve is effected.

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