United States Patent

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[54] **SHUTOFF TOOL FOR PLASTIC PIPE**
7 Claims, 14 Drawing Figs.

[52] **U.S. Cl.** **251/8,** 24/263, 269/250, 269/275
[51] **Int. Cl.** **F16k 7/06**
[50] **Field of Search** ..... 128/346; 294/103; 24/263; 269/216, 126, 127, 129, 247, 250, 251, 272—275; 251/4, 7—10

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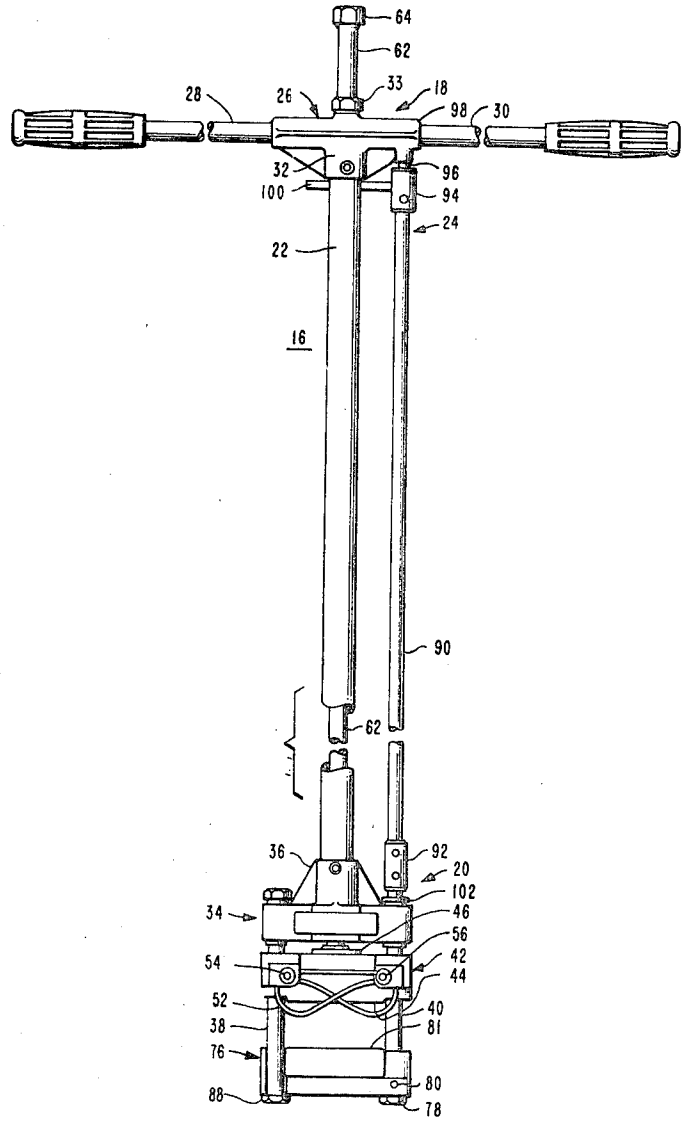
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Primary Examiner—William F. O'Dea
Assistant Examiner—Richard Gerard
Attorney—Beehler & Arant

ABSTRACT: A pipe shutoff tool, operable from above the surface of the ground, for squeezing closed a section of plastic pipe located below ground level. The tool includes a handle assembly coupled to a closure assembly so that opposingly mounted die members carried on the closure assembly may be moved into and out of engagement by jack means operable from the handle assembly. A die-positioning linkage extends from the handle assembly to one of the die members and is operable to rotate one of the die member between a first position, associated with squeezing shut the pipe, and a second position associated with mounting the tool onto the pipe. The tool further comprises separate spring devices centered on opposite faces of one die member for laterally and axially centering the tool on the pipe.



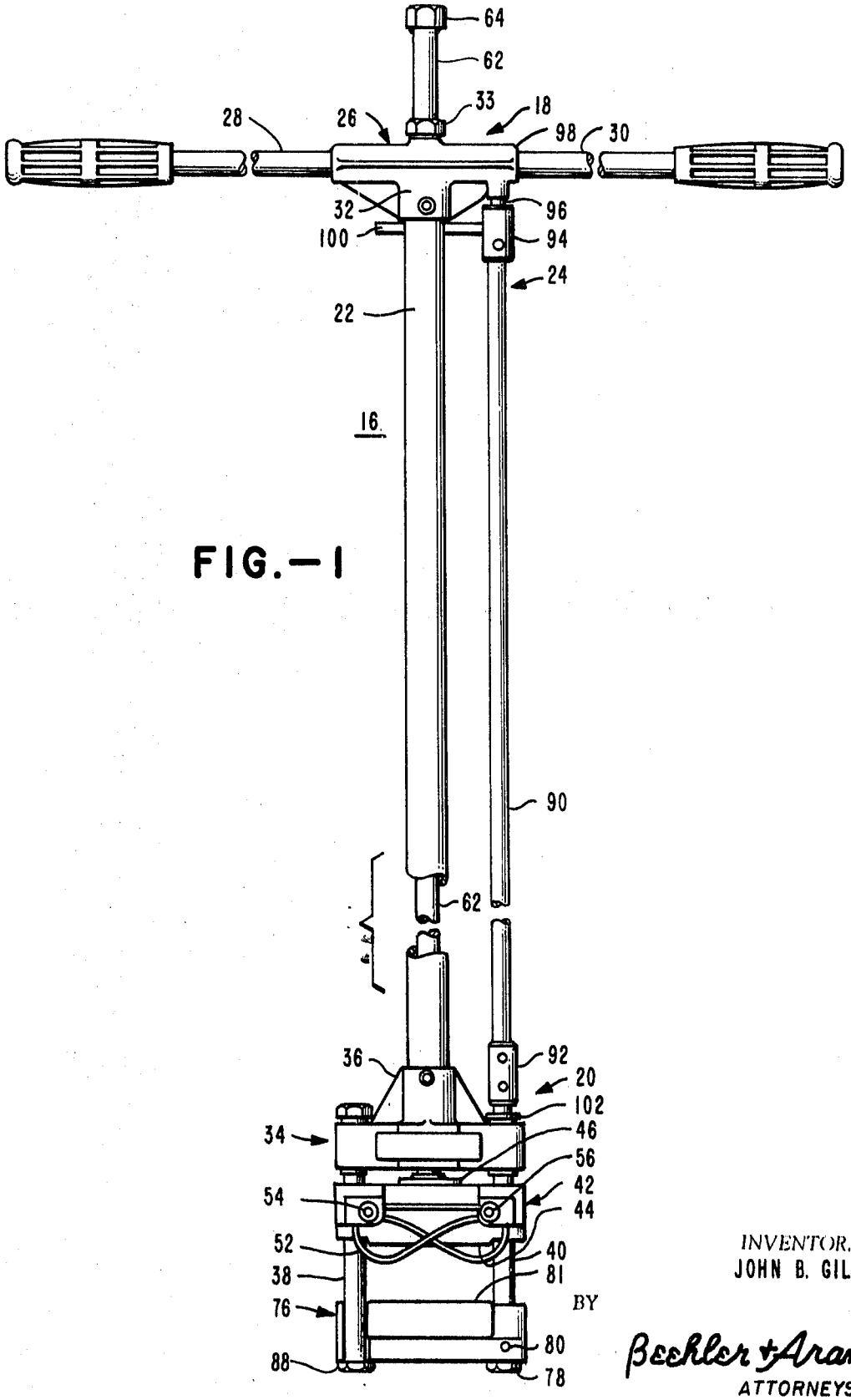


FIG.—1

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FIG.-4

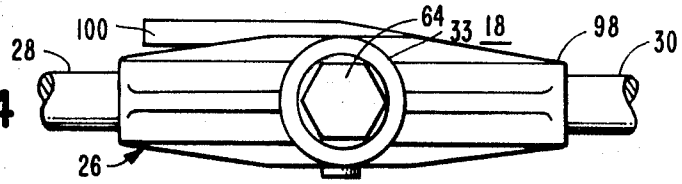
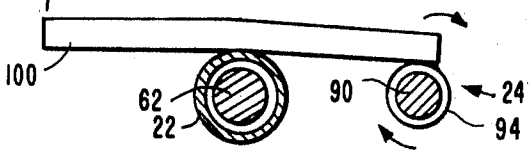


FIG.-5



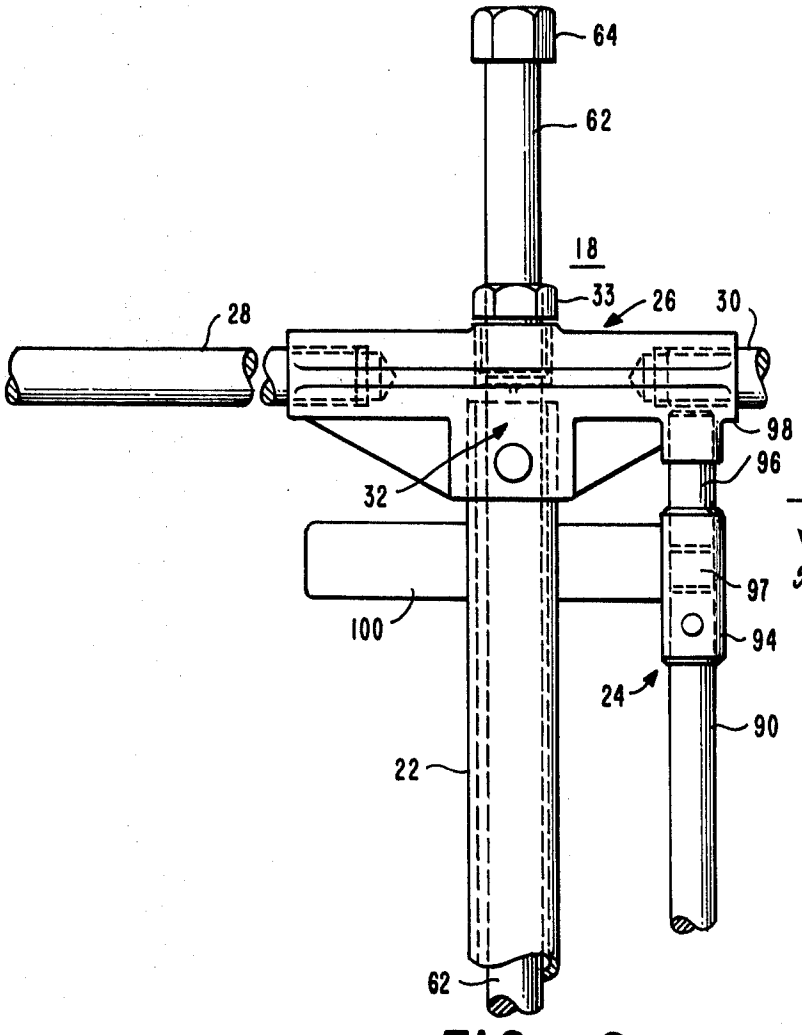


FIG.-2

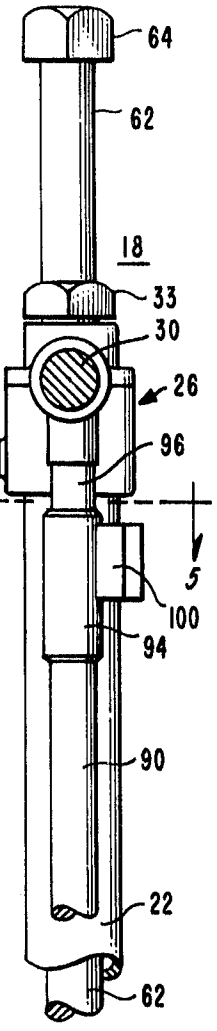


FIG.-3

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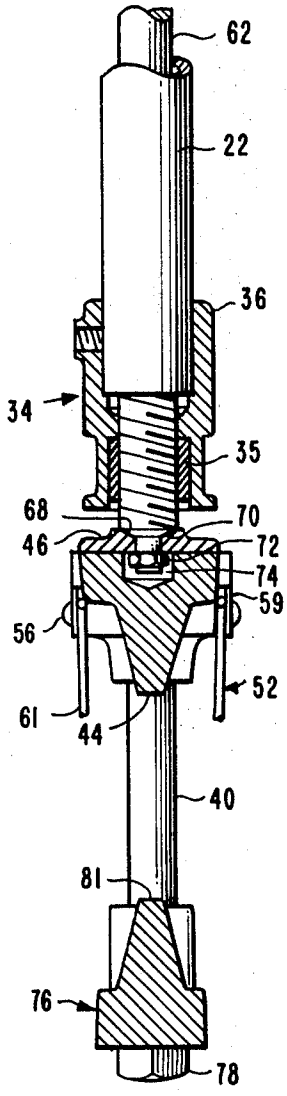


FIG. — 8

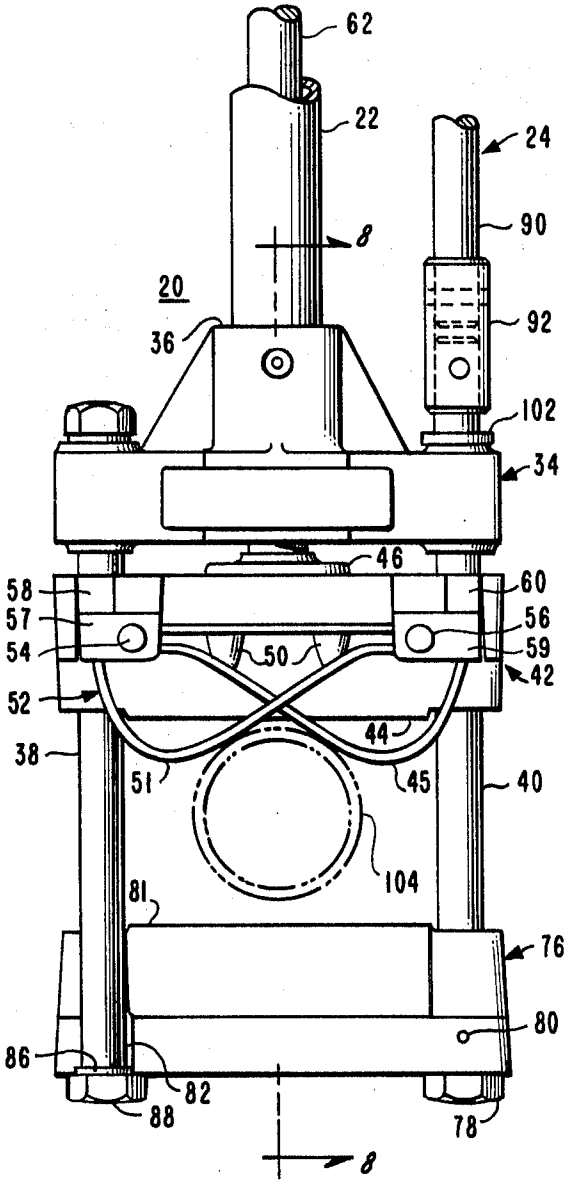


FIG. — 6

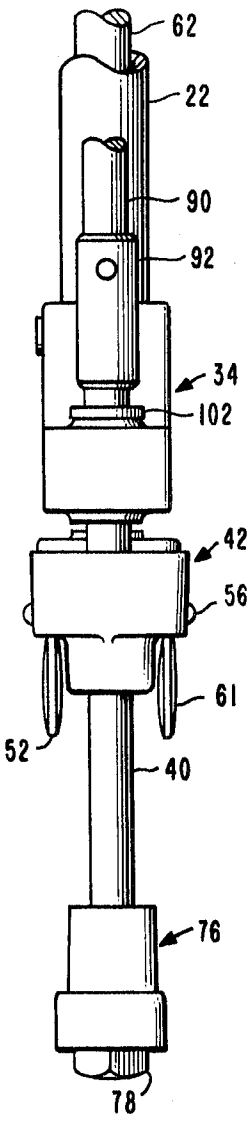


FIG. — 7

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FIG.—9

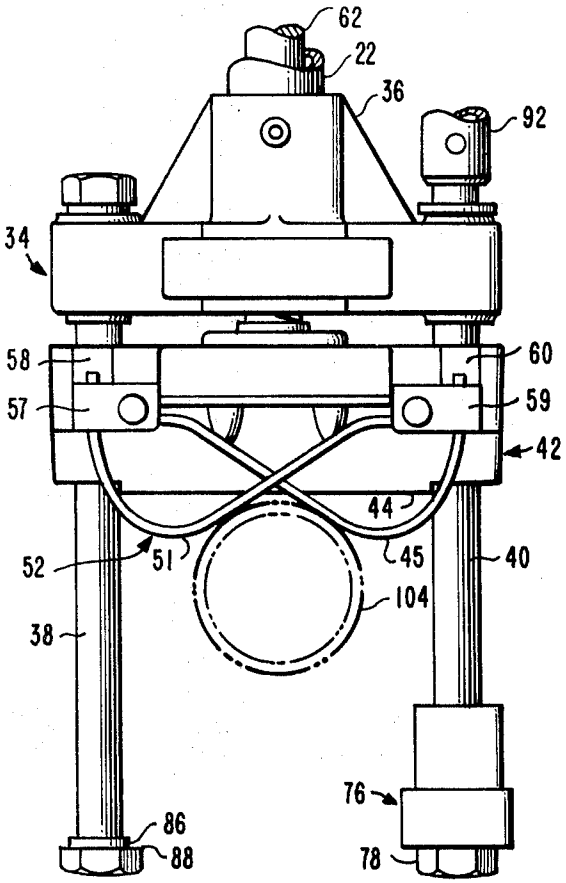
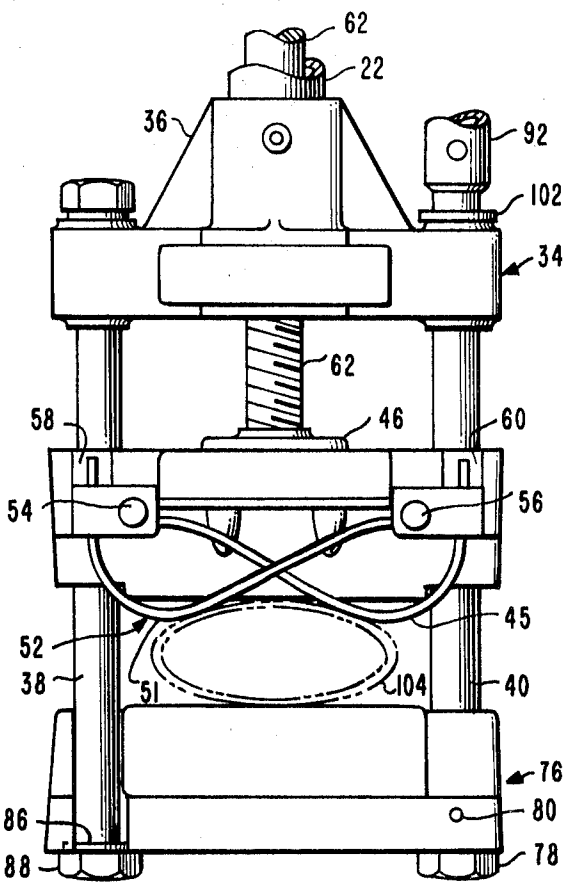


FIG.—11



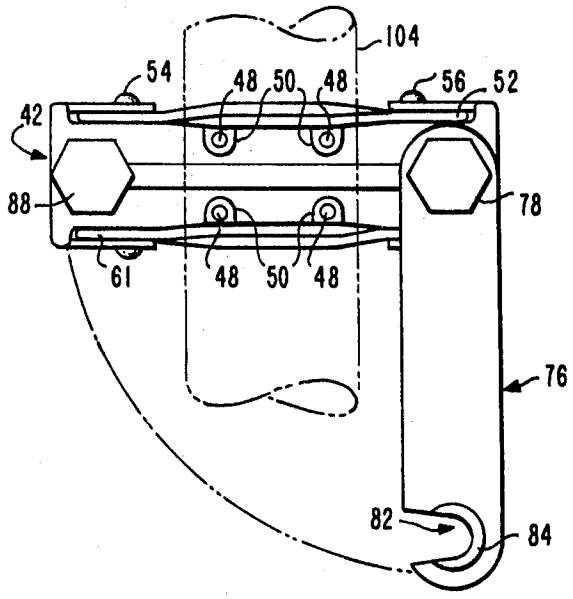


FIG.—10

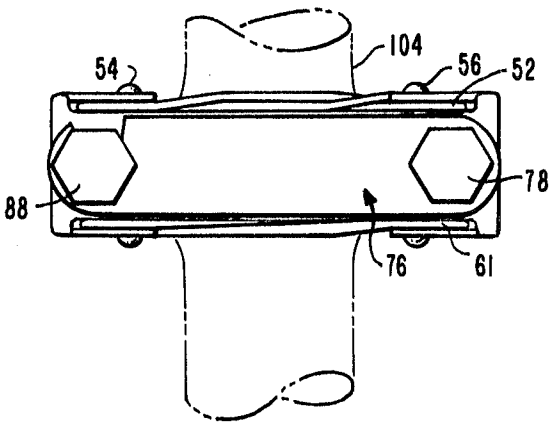


FIG.—12

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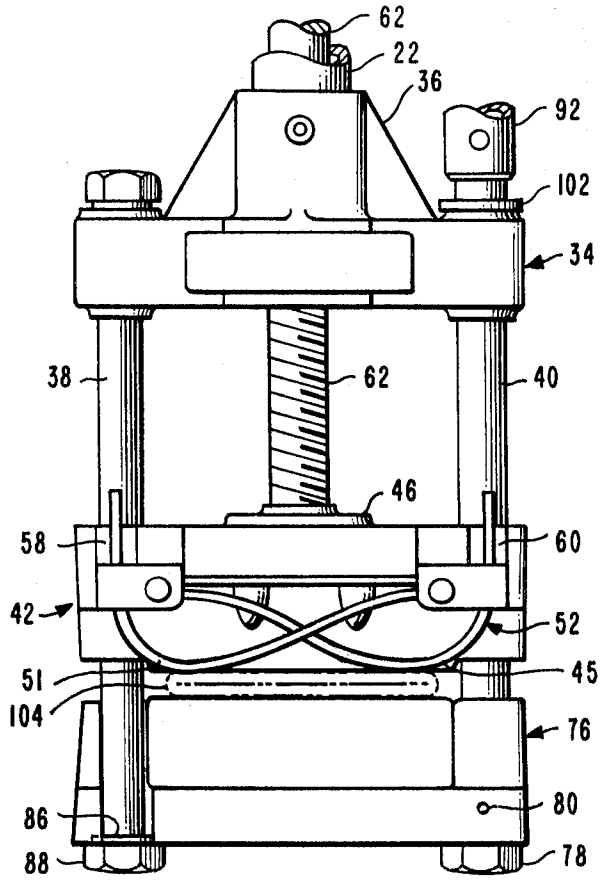


FIG. — 13

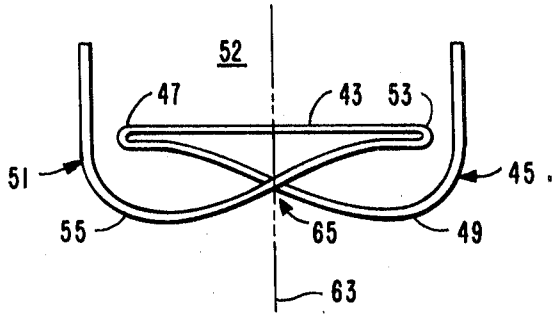


FIG. — 14

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SHUTOFF TOOL FOR PLASTIC PIPE

This invention relates generally to pipe closure tools for temporarily shutting off the flow of liquid or gas through a pipeline by squeezing the line closed. More particularly the invention relates to a closure tool which may be operated from a location remote from the immediate area of the pipeline and which automatically centers and squares itself on the pipeline.

In the distribution of liquid and gas by means of a pipeline situations sometimes occur which make it necessary to squeeze closed a section of pipe to temporarily shut off the flow therethrough so that repairs may be made. Also expensive emergency shutoff valves in a pipeline distribution system may be replaced with sections of pliable pipe such as polyethylene plastic pipe, thereby allowing temporary shutoff to be accomplished by squeezing these plastic pipe sections closed. Heretofore there have been a number of tools adapted for shutting off the flow of fluids through a pipe by means of squeezing the pipe shut, such as those described in U.S. Pat. Nos. 3,260,098 and 3,301,035. Although these prior art tools have been satisfactory in many respects, they have a limitation in that their use requires the operator to be located directly at the pipe for installing and centering the tool on the pipe. Generally if shutoff tools are not properly aligned, laterally and axially on the pipe, incomplete closure may result and the pipe section may be permanently damaged. Since in many installations the pipelines are laid 2 or 3 feet below the surface of the ground or the street, it would be convenient if the shutoff operation could be accomplished by an operator located on the surface of the ground. This surface controlled operation is particularly important in gas pipeline installations where, for example, leaking gas could make it hazardous for an operator to descend into the hole or tunnel surrounding the pipe section to be squeezed shut.

Therefore it is one of the principal objects of the subject invention to provide a pipe shutoff tool, for temporarily shutting off the flow of fluid or gas in plastic pipelines, which may be installed onto the pipe by a remotely located operator.

It is another object of the invention to provide a pipe closure tool which automatically aligns itself in the correct position on a pipeline so that a section of plastic pipe may be completely squeezed shut without damage to the pipe section.

It is a still further object of the invention to provide a pipe closure tool which incorporates a unique spring aligning device for automatically squaring and centering the tool on the pipe.

It is a further object of the invention to provide a pipe closure tool of the type described which may be conveniently and efficiently employed to shut off the flow of fluid or gas in a pipeline installed beneath the surface of the ground, by an operator located above ground level.

It is a further object of the invention to provide a pipe closure tool of the type described which is economical to manufacture and convenient and efficient to use.

The above and other objects and advantages of the invention will become more fully apparent from the following description considered in conjunction with the accompanying drawings, wherein:

FIG. 1 is a partially cutaway front plan view of a shutoff tool for plastic pipe in accordance with the principles of the subject invention.

FIG. 2 is an enlarged fragmentary front plan view of the handle assembly of the shutoff tool of FIG. 1.

FIG. 3 is an enlarged fragmentary side plan view of the handle assembly of the shutoff tool of FIG. 1.

FIG. 4 is a top plan view of the T-head section of the handle assembly.

FIG. 5 is a transverse cross-sectional view taken on the line 5–5 of FIG. 3.

FIG. 6 is an enlarged front plan view of the closure assembly section of the shutoff tool of FIG. 1.

FIG. 7 is a side plan view of the closure assembly section shown in FIG. 6.

FIG. 8 is a longitudinal cross-sectional view taken on the line 8–8 of FIG. 6.

FIG. 9 is a front plan view of the closure assembly section with a lower die block in an open position adapted for initially positioning the tool on a pipe section shown in phantom.

FIG. 10 is a bottom view of the closure assembly shown in FIG. 9, depicting the lower die block in the open position.

FIG. 11 is a front plan view of the closure assembly installed around and partially compressing a pipe section shown in phantom.

FIG. 12 is a bottom view of the closure assembly shown in FIG. 11, depicting the lower die member in a closed and locked position.

FIG. 13 is a front plan view of the closure assembly installed around and completely compressing a section of pipe.

FIG. 14 is a front view of a spring device adapted for automatically centering the shutoff tool laterally and axially on the pipe section to be squeezed shut.

In the embodiment of the invention chosen for the purpose of illustration, a shutoff tool for plastic pipe, indicated generally by numeral 16, comprises a handle assembly 18 and a closure assembly 20. Handle assembly 18 includes a T-head 26 having horizontal arms into which are rigidly mounted bars 28 and 30. A leg 32 of T-head 26 receives interiorly thereof a torque tube 22 and the end of torque tube 22, remote from T-head 26, is received in a socket 36 of a clamp head or header 34. An elongated screw 62 is mounted interiorly of and coaxially with torque tube 22 and projects above the T-head 26 and below the clamp head 34. Closure assembly 20 includes the clamp head 34. A first guide rod 38 is received in a bore formed in a first side of clamp head 34 and is rigidly attached thereto. A second guide rod 40 is rotatably and slidably mounted in a bore formed in a second side of the clamp head 34 and extends parallel to the first guide rod 38. The elongated screw 62 is provided with a tool receivable head 64 positioned in an easily accessible location at the top of handle assembly 18. A sleeve bearing 33 is removably mounted in an upper portion of the leg 32 and serves to rotatably mount the upper end of elongated screw 62. A lower die positioning assembly is indicated generally by reference numeral 24, and extends between the handle assembly 18 and the closure assembly 20.

An upper die block 42 is slidably mounted on and between guide rods 38 and 40 and has a truncated V-shaped pipe squeezing die face 44. A pressure plate 46 is rigidly attached to upper die block 42 by a plurality of bolts 48 which are threaded into the pressure plate 46 through means of a plurality of access ports 50 (see FIGS. 8 and 10). A spring 52 is operatively positioned on the upper die block 42. The spring 52 is retained in operative position on the front surface of the upper die block 42 by means of pins 54 and 56. A first free end 51 of spring 52 is received in a channel 58 formed in the front surface of the upper die block 42; and a second free end 45 of spring 52 is received in a channel 60 also formed in the front surface of the upper die block 42. As seen best in FIG. 14, the spring 52 has a straight central section 43 with a first end portion bent back on itself to form a U-shaped bend 47. From the bend 47 the first end portion extends diagonally, relative to section 43, and terminates in an arcuately shaped section 49. A second end portion 51 of the spring 52 is similarly shaped to form a U-shaped bend 53 and an arcuately shaped section 55. It is important to note that the spring 52 is symmetrical about a centerline 63 and that the end portions 45 and 51 cross on the centerline 63 so as to form a pipe receiving cradle 65 between the arcuate sections 49 and 55. Also it is important to note that the pins 54, 56 are so located on the upper die block 42 that when the spring 52 is mounted therebetween the centerline 63 of the spring 52 is superimposed on the transverse centerline of the die face 44. In the absence of forces applied to the spring 52 the first and second end portions 45 and 51 extend below the face 44 of the die block 42. The end portions 45 and 51 of the spring 52 are free to ride longitudinally in channels 60 and 58, respectively, and are retained laterally by

cover tabs 59, 57, respectively. A spring 61, which may be identical to the spring 52 just described, is mounted on the back surface of the upper die block 42 between pins 54 and 56 in an identical manner to that described for spring 52.

The elongated screw 62 is threadedly engaged within the socket 36 of the clamp head 34. The end section of the screw 62 extending below the clamp head 34, is tapered to form a bearing surface 68 adapted for rotatably engaging a mating bearing surface 70 formed on the pressure plate 46 (see FIG. 8). The lowermost tip of the screw 62 is of a reduced diameter and threaded, whereby pressure plate 46 may be rotatably mounted to the screw 62 by means of a retaining nut 72 disposed in a chamber 74 formed in the top surface of the upper die block 42. A threaded steel insert 35 is pressed into the lower socket of header 34 and engages the threads of screw 62. Therefore the screw 62 is mounted so as to urge the upper die block 42 up or down the length of the guide rods 38 and 40 in response to rotation of the tool receivable head 64, in a manner similar to the mode of operation of a rotary jack.

A first side of a lower die block 76 is rigidly mounted at a lower end of guide rod 40, adjacent to an endnut 78, by a pin 80. The lower die block 76 has formed thereon a truncated V-shaped pipe squeezing die face 81 adapted for mating with die face 44 of upper die block 42. A second side of the lower die block 76 has a longitudinal slot of a generally semicircular cross section formed therein so that the slot 82 is alignable with and adapted for encompassing the first guide rod 38. As seen best in FIG. 10, a countersunk recess 84 is formed in the bottom surface of the lower die block 76 surrounding the slot 82. Countersunk recess 84 is adapted for fitting over and engaging an annular shoulder 86 which protrudes upwardly from a nut 88 mounted to the bottom end of the guide rod 38.

The upper end of the guide rod 40 projects through and above the clamp head 34 and is rigidly attached to a positioning rod 90 by means of a sleeve 92 pinned to the upper end of guide rod 40 and to the lower end of positioning rod 90. The upper end of the positioning rod 90 is pinned to a sleeve 94 which encompasses and is supported by a cylindrical stud member 96 projecting downwardly from the arm 98 carried on T-head 26 of the handle assembly 18. The length of stud member 96 is selected so that there is a space 97 within sleeve 94 between the lower end of stud member 96 and the upper end of positioning rod 90.

A lever 100 is laterally attached to the sleeve 94 and in response to an upwardly directed force applied to the lever 100 lower die block 76 may be lifted so that countersunk recess 84 clears the shoulder 86 formed on nut 88. After the lower die block 76 has been lifted free of engagement from the shoulder 86, rotation of lever 100 provides a corresponding rotation of the lower die block 76 whereby it may be positioned into and out of engagement with guide rod 38. The upper end of guide rod 40, above the clamp head 34 and below the sleeve 92, carries a shoulder 102. When pressure is applied to the lower die block 76, during the operation of squeezing shut a section of pipe, the length of the guide rod 40 extending below the bottom surface of the clamp head 34 is restrained by the shoulder 102 to be equal to the corresponding length of the guide rod 38.

As stated previously one of the primary advantages of the novel shutoff tool 16, in accordance with the principles of the subject invention, is to allow an operator located on the surface of the ground above a pipeline to squeeze close a section of pipe so as to shut off the flow of fluid or gas through the pipeline. To accomplish this the operator first lifts up on lever 100 so that countersunk recess 84, formed in the lower surface of the lower die block 76, clears the protruding shoulder 86, formed on the lower end of the guide rod 38; thereby unlocking the lower die block 76 from the guide rod 38. Next lever 100 is rotated approximately 90° so that lower die block 76 is positioned approximately normal to the upper die block 42 and to the clamp head 34 (see FIGS. 9 and 10). The tool may now be positioned so that the upper surface of a pipe 104 is received in the cradles formed by springs 52 and 61 mounted on the front and rear surfaces respectively of the upper die block 42. The pipe 104 is preferably a resilient deformable pipe such as polyethylene plastic pipe, for example. The lower die block 76 may then be closed and locked onto the guide rod 38 by the reverse procedure to that described relative to swinging the lower die block to the open position. In the locked position the countersunk recess 84 is engaged by the shoulder 86 and the die is retained securely in the closed position until the lever 100 is again raised.

It is appreciated that when a workman is positioning the tool 16 on a section of pipe located in a hole beneath the surface of the street or the ground, it would be extremely difficult to manually center the tool laterally on the pipe and to axially square the tool along the run of the pipe. If the tool is not properly centered on the pipe and is not squarely aligned with the run of the pipe, the pipe when squeezed may press against one of the guide rods 38 or 40 causing incomplete shutoff or damage to the pipe. In accordance with the principles of the subject invention the tool 16 is automatically centered laterally and axially on the pipe section 104 by the action of springs 52 and 61. During the initial movement of the upper die block 42 towards the pipe 104, the springs 52 and 61 exert forces upon the pipe 104 resulting in the tool 16 being centered and squared on the pipe. The operation of the spring devices will be explained with reference to spring 52, it being understood that spring 61 operates in a similar manner. As the upper die block 42 moves down towards the pipe section 104, first end section 45 and second end section 51 are compressed by the engagement between the end sections and the pipe section 104. As a result of this engagement the end sections 45 and 51 are flexed and caused to move longitudinally in the channels 58 and 60, formed on upper die block 42. This flexure of the first and second end sections 45 and 51 produces forces between the pipe section 104 and the spring 52. Unless the lateral components of these forces are equal and opposing, the tool will reposition itself on the pipe until the forces are equalized. Such equalization of forces will result only when the pipe is centered on the centerline 63 of the spring 52. Spring 61 will interact with the pipe section 104 in similar manner so that the rear surface of the upper die block 42 will be centered on the pipe. Therefore with the front and rear surfaces of the upper die block 42 centered on the pipe, the shutoff tool 16 will be aligned squarely along the axial run of the pipe section 104. As the upper die block 42 continues to move downwardly towards the pipe 104 the end sections 45 and 51 of the spring 52, and the corresponding members of the spring 61, are flexed a greater amount and are further displaced upwardly in the channels 58 and 60. This greater deflection of the end sections of the springs 52 and 61 results in a greater force between the spring sections and the pipe section 104 increasing the tendency of the tool 16 to align and center itself on the pipe. During the final stage of the closure of the pipe section 104, the end sections of the springs 52 and 61 are deflected upwardly above the lower surface of the upper die face 44 so as not to interfere with the complete shutoff of the flow of fluid or gas through the pipe.

Thus there has been described a unique and novel shutoff tool for squeezing closed a section of plastic pipe so as to shut off the flow of fluid or gas in a pipeline located beneath a surface of the ground. The tool has the advantage of being completely operative from the surface of the ground above the pipeline and includes a control linkage 24 operable from the handle assembly 18, projecting above the ground level, for positioning lower die block 76 between a closed and locked position and an open or insulation position. Further the tool includes separate resilient means 52 and 61 which engage the pipe at axially displaced positions along the length of the pipe so that the tool 16 automatically centers itself laterally and axially on the pipe. It will be understood from the foregoing description that the springs 52 and 61 may be modified from the shape shown herein as long as the cradle formed by the separately responding end sections of the spring provide oppositely directed lateral force components which are balanced

out only when the tool is substantially centered on the pipe section.

While the invention has herein been shown and described in what is conceived to be the most practical and preferred embodiment, it is recognized that departures may be made therefrom within the scope of the invention, which is not to be limited to the details disclosed herein but is to be accorded the full scope of the claims so as to embrace any and all equivalent devices.

Having described the invention, what I claim as new in support of Letters Patent is:

1. A pipe shutoff tool, operable from above the surface of the ground for squeezing closed a section of plastic pipe in a pipeline located below ground level, said tool comprising:

a handle assembly;

a clamp head operatively coupled to one end of said handle assembly;

a first guide rod rigidly mounted at one end through one side of said clamp head, and having a locking device formed on the other end;

a second guide rod slidably and rotatably mounted through the opposite side of said clamp head parallel to said first guide rod;

a first die member slidably engaged on and slidably mounted between said first and second guide rods;

a second die member nonrotatably mounted to said second guide rod and adapted for releasably engaging said locking device on the other end of said first guide rod in a first position, and adapted for rotating to a second position;

means operable from the other end of said handle assembly and coupled to said clamp head and to said first die member for urging said die members together with sufficient force to collapse and close a section of plastic pipe disposed between said die members when said second die member is in said first position;

means coupled to said second guide rod and operable from the other end of said handle assembly for disengaging said second die member from said locking device and for rotating said second die member between said first and second positions.

2. The shutoff tool of claim 1 wherein said locking device includes a nut having a protruding annular shoulder; and said second die member has a slotted face adapted for engaging said first guide rod and a recess formed around said slotted face adapted for releasably engaging said shoulder.

3. A pipe shutoff tool, operable from above the surface of the ground for squeezing closed a section of plastic pipe to temporarily shut off the flow of fluid or gas in a pipeline located below ground level, said tool comprising:

a hand assembly;

a header coupled to one end of said handle assembly;

a pair of laterally spaced, parallel guide rods, a first said guide rod being rigidly mounted at one end to said header, a second said guide rod slidably and rotatably received in said header, said header extending between said guide rods, the other end of said first guide rod having a locking head thereon;

an elongated first die member slidably engaged on and extending between said guide rods, said first die member having a first elongated pipe closure die surface;

an elongated second die member rigidly mounted to said second guide rod and releasably engageable with said locking head on the other end of said first guide rod and adapted for extending between said guide rods, said second die member having a second elongated pipe closure die surface;

jack means carried by said header and coupled with said first die member and operable to shift said first die member into and out of engagement with said second die member, said jack means being operable from the other end of said handle assembly; and

a control linkage extending from the other end of said handle assembly to said second guide rod and adapted to disengage said second die member from said locking head and rotate said second die member out of and into engaging alignment with said first die member, said control linkage being operable from the other end of said handle assembly.

4. The shutoff tool of claim 3 further comprising separate spring devices mounted on the front and rear surfaces of said first die member, each of said separate spring devices having first and second end sections crossing substantially at the lateral center of said first elongated pipe closure die surface, each said end section terminating in an arcuate loop extending below the first pipe closure die surface in the absence of pressure applied thereto, said first and second end sections defining a concave cradle adapted for receiving the pipe therein.

5. A self-aligning shutoff tool for squeezing closed a resilient, deformable pipe, said tool comprising:

opposed die members movably mounted on said tool and adapted to receive and squeeze said pipe therebetween;

means for urging said die members together; and

resilient means for axially and laterally aligning said tool on said pipe;

said resilient means including a plurality of separate resilient means spaced apart from and independent of one another;

each of said separate resilient means comprising a spring having first and second end sections crossing substantially on the centerline of said die members parallel to the direction of movement of said die members, said end sections forming a cradle centered at the point of crossing and adapted for receiving said pipe therein;

whereby said tool is axially and laterally centered on said pipe in response to forces produced by said first and second end sections.

6. A self-aligning shutoff tool for squeezing closed a section of plastic pipe to temporarily shut off the flow of fluid or gas in a pipeline, said tool comprising;

first and second die members each having a pipe closure surface formed thereon;

means for mounting said first and second die members with said pipe closure surfaces aligned in a mating relationship and with at least one of said die members movable towards the other die member;

means, engaging said mounting means and said movable die member, for urging said die members together with sufficient force to collapse and close a section of plastic pipe disposed between said pipe closure surfaces; and

resilient means attached to one of said die members for aligning said tool on said pipe;

said resilient means including at least one spring device attached to one of said die members, said spring device having first and second end sections crossing substantially at the lateral center of said pipe closure surfaces, each said end section terminating in an arcuate loop extending beyond the closure surface of said one die member in the absence of pressure applied thereto, said first and second end sections defining a concave cradle centered at the point of crossing and adapted for receiving said pipe therein;

whereby during the initial closure phase of said movable die member said spring device aligns said tool on the pipe, and during the final closure phase of the movable die member said first and second end sections are deflected even with said closure surface of said one die member.

7. The tool of claim 6, wherein a separate spring device is attached to the front and rear surfaces of said one die member, and the first and second end sections of each spring device are slidably mounted on said one die member, whereby said spring devices axially and laterally center said tool on said pipe during the initial closure phase of said movable die member, and said spring devices deflect even with the closure surface of said one die member during the final closure phase of the movable die member.