ABSTRACT

Apparatus operable from the surface for blocking off (i.e., plugging) one of the two pipes of a manifolded underground piping arrangement. A spring-loaded expansible pipe plug is triggered to its sealing position by removing a pin from the plug. By using one tool, such a plug may be inserted from the surface into an underground vertically extending pipe, following which the pin may be removed to trigger the plug to its sealing position; by using a different tool, such a plug may be inserted from the surface into an underground side (horizontally extending) pipe, following which the pin may be removed to trigger the plug to its sealing position.

4 Claims, 6 Drawing Figures
FIG. 1.

FIG. 2.

FIG. 3.
ONDERGROUND PIPING MODIFICATION APPARATUS

This invention relates to apparatus for the modification of installed underground piping, and more particularly to apparatus for modification from the surface of underground piping installed, e.g., at service stations.

At the present time, there is being used rather extensively a multigrade fuel dispensing apparatus which can be adjusted to dispense, selectively, solely a "hi" gasoline (referring to a relatively high-octane liquid fuel component), solely a "lo" gasoline (referring to a relatively low-octane liquid fuel component), or a blend of these "hi" and "lo" gasoline components or constituents. An apparatus of this type is disclosed in my U.S. Pat. No. 2,880,908.

Both of the aforementioned liquid fuel components contain, as an additive, a lead alkyl octane improver compound (known in the art as simply "lead"), although the proportions of "lead" ordinarily differ in the two different liquid fuel components.

It has been announced that some automobiles will be provided with exhaust emission control equipment (such as a catalytic converter or a catalytic muffler on the automobile exhaust) which requires a lead-free or substantially lead-free fuel exclusively, which is to say an unleaded or non-leaded fuel. To satisfy the demand for a lead-free or "clear" fuel in a way which prevents any contamination of the non-leaded fuel by lead, and which effectively forestalls the dispensing of leaded fuel into automobiles equipped as above described, as well as in a way which is economically attractive from a manufacturing standpoint, a "three-product" service station dispensing scheme could be utilized. In the present context, a so-called "three-product" scheme would involve, as the first and second products, the aforementioned "lo" and "hi" liquid fuel components, both containing lead, which would be dispensed at the service station through a blending-type dispensing apparatus such as disclosed in my aforementioned patent. The third product would involve a lead-free or non-leaded ("clear") motor fuel (gasoline), which would be dispensed at the service station through a conventional, single-product dispenser or dispensing apparatus. To carry this "three-product" scheme into effect, it would be necessary to convert all of the presently existing "two-product" service stations (meaning those stations which presently dispense "lo" and "hi" liquid fuel components through blending-type dispensing apparatus) to "three-product" stations.

Ordinarily, and quite typically, "two-product" stations utilizing blending-type dispensing apparatus as described are equipped with three underground tanks for gasoline storage, two of these being utilized for the "lo" fuel component and the third, for the "hi" fuel component. For "two-product" operation, the fill pipes of the two "lo" gasoline tanks are manifolded together, and the suction pipes (for pumping gasoline out of the tanks) are connected together in a siphon arrangement. For conversion to a "three-product" scheme, it would be feasible to cut off the interconnections (the manifold fill pipes, and the siphon-suction arrangement) between the two tanks used previously for "lo" gasoline storage, and then to use one of these two tanks for "lo" gasoline storage and the other for non-leaded or "clear" gasoline storage. Of course, it might be possible to dig down to the various underground lines involved and then install conventional (e.g., welded) pipe plugs at the appropriate locations, but this would be so costly as to be uneconomic and impractical.

An object of this invention is to provide a pipe plug for underground pipes which can be installed in such pipes from the surface, thus rendering excavation unnecessary.

Another object is to provide a pipe plug which can be first manipulated into a desired position in an underground pipe and then operated to a sealing position, all from the surface.

A further object is to provide a novel remotely operable, triggerable pipe plug.

A still further object is to provide, in combination with a remotely operable pipe plug, a tool whereby the plug may be installed in an underground pipe from the surface.

Yet another object is to provide, in combination with a remotely operable pipe plug, a tool whereby the plug may, all from the surface, be first moved to a desired position in an underground pipe and then triggered to a sealing position.

An additional object is to provide a remotely operable pipe plug which can be installed underground in either a horizontally extending or a vertically extending pipe.

Still another object is to provide, for use with a remotely operable pipe plug, a pair of tools for installation of the plug in an underground pipe, one of the tools enabling installation of the plug in a horizontally extending pipe and the other enabling installation of the plug in a vertically extending pipe.

A detailed description of the invention follows, taken in conjunction with the accompanying drawings, wherein:

FIG. 1 is a longitudinal sectional view of a pipe plug according to this invention;
FIG. 2 is a sectional view similar to FIG. 1 but showing the plug assembled with one form of installation tool;
FIG. 3 is an end view of the FIG. 2 arrangement, partly in section;
FIG. 4 is a partial view similar to FIG. 2 but showing the parts in a different position;
FIG. 5 is a partial longitudinal sectional view of the plug assembled with another form of installation tool; and
FIG. 6 is an end view of the FIG. 5 arrangement.

Refer first to FIG. 1, which illustrates the internal construction of a spring-loaded plug according to this invention. The plug is based upon a hollow sealing member 1 made of a suitable synthetic elastomeric material such as the material known as Neoprene. Member 1 is a three-dimensional figure having the shape of a flattened ellipsoid, or a pancake, with two oppositely disposed substantially flat walls joined by a continuous arcuate side wall; in longitudinal cross-section (as in FIG. 1) member 1 appears "obround," while in transverse cross-section (taken at 90° to FIG. 1) it would appear circular. The axis of member 1 is taken to extend perpendicularly to the substantially flat walls thereof.

A shaft 2, threaded at one end, passes axially through member 1, via aligned clearance holes provided in such member. A flat washer 3 is rigidly secured to shaft 2 and bears against one of the flat walls of member 1;
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3, washer 3 is mounted on a reduced-diameter end portion of shaft 2 (opposite the threaded end thereof) which provides a shoulder, and then the end of the shaft is peened over (riveted) at 4 against the outer face of the washer 3. A similar flat washer 5 is slidably mounted on shaft 2 and bears against the other flat wall of member 1. It may be seen that when washer 5 is moved from the position illustrated toward washer 3 (i.e., when washer 5 is moved toward the left in FIG. 1), member 1 will be compressed (flattened) between the washers 3 and 5, causing the siphon line to expand radially outwardly; the arcuate side wall of this member can then form a seal at the inner wall of a pipe within which the plug is located. Such pipe will then be plugged, since the member 1 is continuous and imperforate.

A sleeve 6, one end of which engages that face of washer 5 opposite to member 1, is slidably mounted on shaft 2. Sleeve 6 has therein an enlarged bore 7 which provides an annular space between shaft 2 and the inner wall of sleeve 6, and in this annular space there is positioned a strong compression spring (coiled spring) 8, which provides the spring loading for the plug now being described. One end of spring 8 bears against the lefthand end (adjacent washer 5) of sleeve 6, and the other end of this spring bears against a nut 9 threaded onto the threaded end of shaft 2.

A triggering pin 10 is adapted to pass through a pair of aligned transversely extending apertures in nut 9, and also through a pair of aligned transversely extending apertures in the surrounding sleeve 6, one of the apertures in sleeve 6 actually being formed as a slot 11 which extends inwardly from the outer or right-hand end of sleeve 6. The pin 10, when in position in the plug described, locks the sleeve 6 to nut 9 (and also shaft 2), preventing any relative movement (in the longitudinal direction of shaft 2) of the sleeve and nut and maintaining the spring 8 in its cocked position. When triggering pin 10 is withdrawn from the plug assembly, sleeve 6 is free to move longitudinally of shaft 2, under the urging of spring 8. The force of spring 8 then pushes sleeve 6 and washer 5 toward the left in FIG. 1, compressing member 1 and expanding it radially outwardly to its sealing position within a pipe. This pushing of sleeve 6 and washer 5 toward the left might be considered as being combined with a pushing, by spring 8, of nut 9, shaft 2, and washer 3 toward the right in FIG. 1, which latter also acts to compress member 1 by moving the washers 3 and 5 toward each other.

The triggering pin 10 is straight for the major portion of its length, but near one end it has a 90° bend which makes it more or less L-shaped, and near the end of this 90° leg it has therein a small-diameter transversely extending aperture 12.

Sleeve 6 has near the pin 10 end thereof, a U-shaped circumferential groove 13 to provide for later removal of the plug, after it has been installed, should such become necessary.

In a typical underground installation of storage tanks at a service station, for the pump suction the two manifolled tanks (previously both used for the storage of "lo" gasoline, and which are to be separated or isolated from each other according to this invention, so that one of them can be used for a third product, a "clear" or non-leaded gasoline) are connected together, below the surface, by a 1½ inch diameter siphon line. This siphon line extends in a substantially horizontal direction, and at least one end is threaded into the side opening of a tee one of whose "straight-through" openings is connected to a vertically extending suction stub which extends vertically downwardly into a tank and the other of whose "straight-through" openings is connected to a pipe which extends upwardly to the surface. The procedure then would be to lower the plug assembly of FIG. 1 downwardly from the surface through the pipe, manipulate it into position in the horizontally extending siphon line, and then trigger the plug in its expanded or sealing position by removal of the pin 10, so as to seal off or plug the siphon connection between the two tanks.

For the filling of the two manifolled tanks, they are typically connected together by a three-inch diameter fill manifold (again extending substantially horizontally, below the surface), which at its ends is threaded into the side openings of respective tees. One of the "straight-through" openings of each tee is connected to a corresponding fill tube which extends vertically downwardly into the respective tank, and the other "straight-through" opening of each tee is connected to a corresponding fill pipe which extends upwardly to the surface. Similarly, the procedure here would be to lower the plug assembly of FIG. 1 downwardly from the surface through the fill pipe, manipulate it into position in the horizontally extending fill manifold, and then trigger the plug into its expanded or sealing position by removal of the pin 10, so as to seal off or plug the fill manifold connection between the two tanks.

According to this invention, a tool is provided, to be used with the plug assembly previously described, for carrying out the above procedures. Exactly similar tools are used for the two cases, viz. siphon line and fill manifold, although the tools, as well as the plugs, would of course be of different sizes for the two cases, since the siphon line is ordinarily ½ inches in diameter, while the fill manifold is ordinarily three inches in diameter. The plug installation tool will now be described.

It is desired to be pointed out that the installation tool to be first described is employed for installation of the plug in a horizontally extending or side pipe (siphon line, or fill manifold). If it is desired to install the plug in a vertically extending pipe (fill tube, or suction stub), a tool of somewhat different construction would be employed; this latter tool will be described later.

Refer now for details to FIGS. 2 and 3, which show the pipe plug previously described mounted in one embodiment of an installation or insertion tool according to the invention. Actually, FIGS. 2 and 3 illustrate the parts in a position they would occupy during an intermediate stage of the plug installation.

A short straight metal bar 14, which can act as a handle, is fixedly secured (as by being threaded, and then cemented in place by an epoxy resin) to the upper end of a pipe 15 sufficiently long to extend from the surface down to the horizontally extending subterranean pipe (siphon line, or fill manifold) which is to be plugged or blocked off. By way of example, the pipe 15 may be 54 inches long. The handle 14 extends at a right angle to the axis of pipe 15. A pair of oppositely disposed and outwardly extending pivot pins 16 are threadedly secured to pipe 15, each in a respective one of a pair of tapped aligned apertures 17 which are provided in pipe 15 near the opposite end thereof, the apertures 17 being each located at 90° with respect to the direction of handle 14. A link 18 is pivotally attached to each re-
spective pin 16, the pivotal attachments being at one end of the respective links. The links 18 provide a swingable connection between pipe 15 and a block denoted generally by numeral 19, which acts as a plug-receiving and -supporting member. At their respective ends, links 18 are pivotally attached to each of a respective stud 20, which studs are threaded into respective tapped, aligned apertures 21 provided in block 19 near one end thereof, apertures 21 being parallel to apertures 17.

Block 19 has therein, approximately centrally thereof, a cylindrical bore 22 whose axis is at a right angle to the common axis of apertures 21 and which is sized to receive therein the sleeve 6 of the pipe plug previously described.

The sleeve 6, since it in effect extends outwardly from the pipe plug assembly, may be through of as constituting a shank portion for such plug.

A push rod 23 is mounted for sliding movement within pipe 15. A portion of rod 23, at the upper end thereof, is bent at 90° to the length of the rod to form a handle 24. Rod 23 has therein, a little distince above the lower end thereof, a transversely extended tapped hole 25, adapted to receive a screw 26 whose head fits within a slot 27 which is formed in pipe 15 and which extends upwardly from the lower end of the latter. On the side of rod 23 toward handle 24, this rod has a flattened portion 28 (to provide clearance) which extends upwardly for some distance from the lower end thereof. A similarly flattened portion 29 is formed on the opposite side of rod 23, but portion 29 is considerably shorter in length than is portion 28. As a result, the lower end of rod 23 is of considerably smaller cross-section than is the main portion of this push rod.

At its flattened lower end, push rod 23 has a transverse hole 30 (extending in the same direction as handle 24) which is adapted to receive the bent end of triggering pin 10. After this end of pin 10 is inserted through hole 30, a safety wire (not shown) is inserted through the aperture 12, to prevent this end of the pin from falling out of the rod 23 during installation of the plug.

The block 19 has therein a pair of aligned apertures which are adapted to receive the ends of the pin 10, whereby to fasten the plug assembly in position in block 19 of the installation tool. An aperture 31 in block 19 receives the free (straight) end of pin 10, while an aperture 32 is adapted to receive the pin near its bent end. Aperture 32 is located at the end of a slot 33 which is cut through the wall of block 19 (into bore 22) and which extends inwardly from one end of the block. Slot 33 enables sleeve 6 of the plug to be inserted into bore 22 of block 19 without removing pin 10 from the plug; when pin 10 reaches the inner end of slot 33, the straight end of pin 10 is inserted into block aperture 31.

The pipe plug can be assembled with the installation tool most readily when the parts are placed in the position of FIGS. 2 and 3. With push rod 23 inserted in pipe 15 and pushed downwardly so that its hole 30 is positioned below block 19, the pipe plug assembly with its pin 10 is inserted into bore 22 of the block and the straight end of pin 10 is pushed into aperture 31 of block 19. Then, the bent end of pin 10 is inserted through hole 30 and the safety wire applied through aperture 12.

When the plug has been assembled in the installation tool as described, the plug is swung around (by means of the links 18) until shaft 2 and sleeve 6 are parallel to the axis of push rod 23 and pipe 15. This is the position illustrated in FIG. 4, and is the position occupied by the parts during the descent through the vertical pipe (four-inch fill pipe, or three-inch siphon-suction access pipe) downwardly from the surface. In this latter position, it may be noted that the maximum diameter of the plug-plus-tool is determined by the diameters of parts 1, 3, and 5. The plug-plus-tool combination is inserted into the vertical pipe and is pushed downwardly therein by means of the handle 14, on pipe 15. The upper end of slot 27 comes into contact with screw 26 and forces push rod 23 to move downwardly along with pipe 15, block 19, and the pipe plug.

When the location of the underground tee has been reached (at which location it is desired to plug the side or horizontally extending pipe), the tool is oriented at the surface so that the handles 14 and 24 extend in the (known) direction of the side pipe which is to be plugged. Then, handle 24 is moved downwardly relative to handle 14 (e.g., by squeezing these handles together). This causes push rod 23 to move downwardly in pipe 15, swinging (rotating bodily) the pipe plug 90° clockwise (as viewed in FIG. 2) until shaft 2 and sleeve 6 extend at a right angle to rod 23 and pipe 15, as shown in FIG. 2.

Then, by moving the handles 14 and 24 laterally and bodily, the pipe 15 and rod 23 may be inclined within the vertical pipe to move the plug into the horizontally extending pipe, from the tee.

When the plug has been properly positioned in the horizontally extending pipe, handles 24 and 14 are again squeezed together, to move handle 24 downwardly relative to handle 14. The parts now in the positions illustrated in FIG. 2, push rod 23 moves downwardly to pull triggering pin 10 downwardly along with it (the pin 10 at this time extending vertically, parallel to push rod 23). Triggering pin 10 is removed from the pipe plug, resulting in the triggering of the pipe plug to its sealing position (in the manner previously described).

When the pin 10 has been removed from the pipe plug, the installation tool (including, of course, the block 19, which is attached to pipe 15 by means of links 18), with the pin 10, may be withdrawn to the surface. Remote installation of the pipe plug (in a horizontally extending subterranean pipe, from the surface) is now complete.

When it is desired to install the pipe plug of this invention in a subterranean vertical pipe, rather than in a side or horizontally extending pipe, as previously described, a different type of installation tool is utilized. Refer now to FIG. 5, which illustrates such a different type tool. Elements the same as those previously described are denoted by the same reference numerals, while similar elements bear prime designations. A pipe 15', which has an operating handle (not shown) at its upper or surface end, has slidably mounted therein a cylindrical push rod 23', which also has an operating handle at its upper or surface end. The handle for pipe 15' may be similar to handle 14, described above, while the handle for rod 23' may be similar to handle 24, previously described.

A plug-receiving and supporting member 34 has a pair of opposite and coaxial shoulders 35 and 36, the
shoulder 35 at the upper end of member 34 providing for the seating of the lower end of pipe 15' thereagainst and the shoulder 36 at the lower end of member 34 providing for the seating of the upper end of the plug sleeve 6 thereagainst. Member 34 has a pair of spaced integral outwardly extending abutments 37—37 at one side thereof, and on these abutments a bell crank 38 is pivotally mounted at 42, for pivotal movement in a plane passing through the axis of rod 23' and pipe 15'. The lower end of push rod 23' bears against one end 39 of the bell crank, and the other end of the bell crank is provided with a hook 40 over the shank of which the bent end of the pipe plug triggering pin 10 is adapted to fit. The member 34 has a hole 41 in its wall, for receiving the straight end of the pin 10. This helps to retain the pipe plug in position in member 34, as the tool plus plug is lowered down through the vertical pipe, for installation of the plug.

FIG. 5 illustrates the parts in a position they would occupy during the descent through the vertical pipe (which may be thought of as a standpipe), down to the vertical pipe to be plugged. When the plug reaches its sealing position in the vertical pipe to be plugged, push rod 23' is caused to move downwardly with respect to pipe 15', as by squeezing together the handles for the pipe and the push rod. Movement of push rod 23' downwardly causes the bell crank 38 to pivot about point 42 in the counterclockwise direction in FIG. 5, moving the hook end 40 of this bell crank essentially horizontally and withdrawing the triggering pin 10 from the pipe plug, in a substantially horizontal direction. The removal of the triggering pin from the pipe plug triggers the pipe plug to its sealing position (in the manner previously described). Installation of the pipe plug in a vertical pipe is then complete, and the tool 15', 23', 34, 38 may be withdrawn to the surface.

The invention claimed is:

1. In combination, a spring-loaded pipe plug adapted to be installed in an underground pipe for plugging the same, said plug being expansible by the spring to a pipe-sealing position upon operation of a mechanically operable triggering means; an installation tool for said plug comprising an elongated rigid member adapted to be passed downwardly from the surface through a pipe, a plug-receiving and supporting member attached to the lower end of said elongated member, said plug-receiving and supporting member being adapted to receive therein a shank provided on said plug, and an elongated element operable from the surface for operating said triggering means, said element being operatively coupled to said elongated member.

2. Combination according to claim 1, wherein said triggering means comprises a pin removable from said plug to trigger said plug to its pipe-sealing position, and wherein said element is operable from the surface to remove said pin.

3. Combination according to claim 1, wherein said elongated member comprises a pipe, and wherein said element comprises a rod mounted within said pipe and slidable with respect thereto to operate said triggering means.

4. Combination according to claim 1, wherein said elongated member comprises a pipe, wherein said element comprises a rod mounted within said pipe, and wherein said triggering means comprises a pin removable from said plug to trigger said plug to its pipe-sealing position; said rod being slid within said pipe from the surface in order to remove said pin.

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