Aug. 10, 1965 W. M. KELLY 3,199,597

DUMP BAILER

Filed May 9, 1961 2 Sheets-Sheet 1

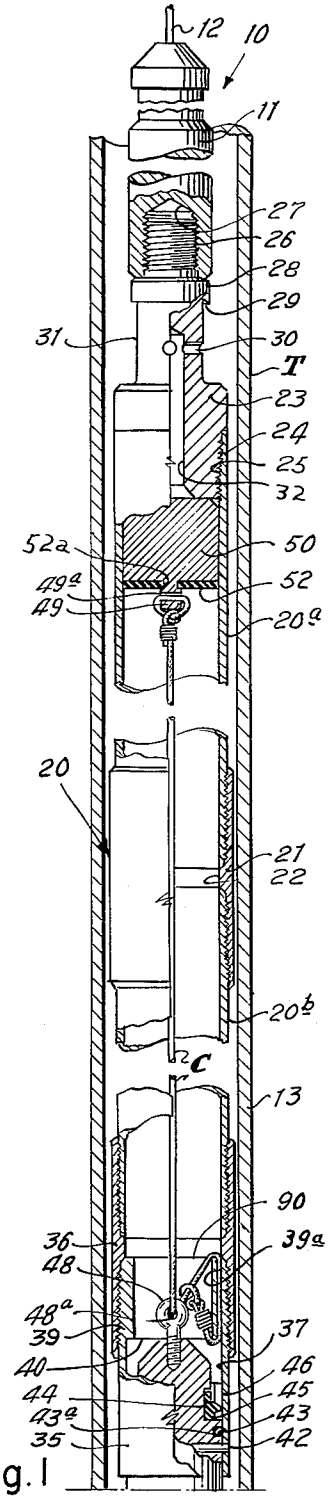


Fig. 1

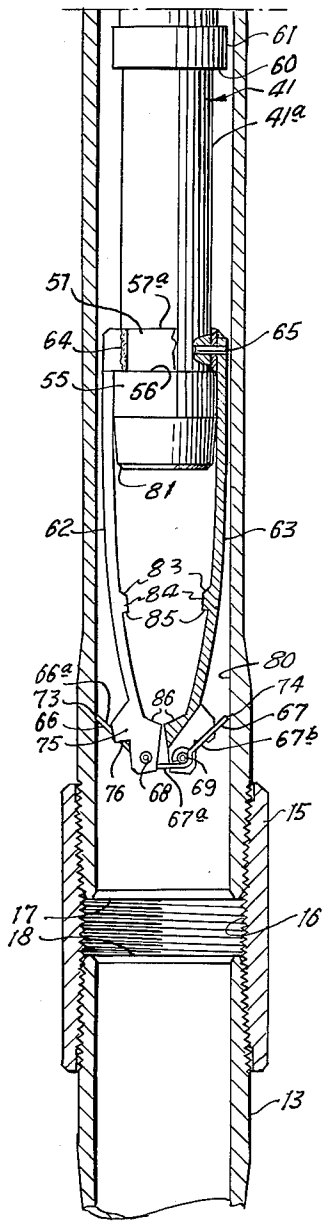


Fig. 2

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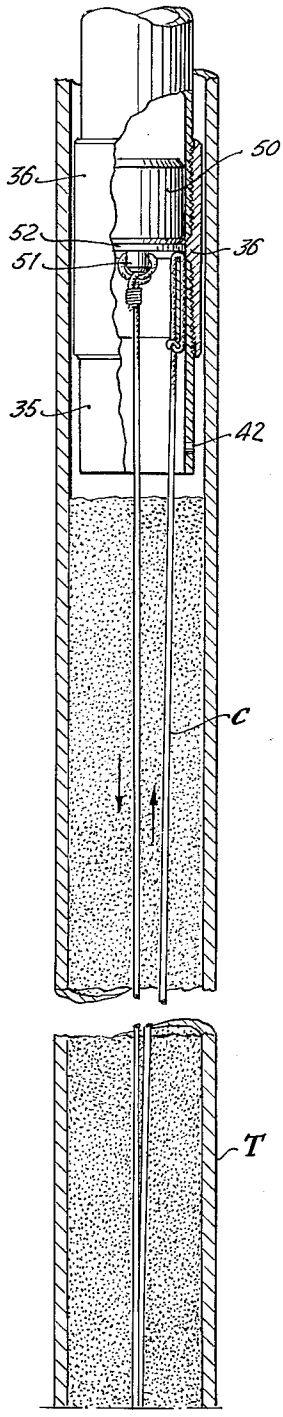


Fig. 3

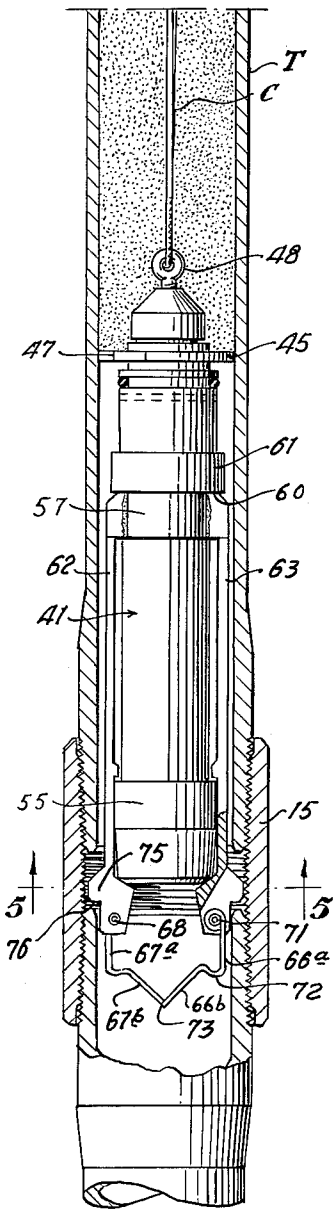


Fig. 4

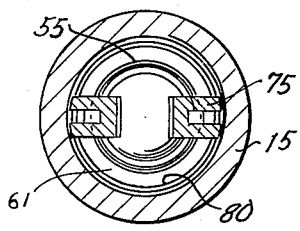


Fig. 5

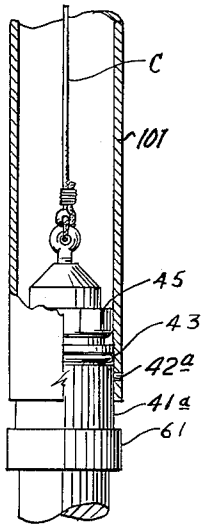


Fig. 6

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DUMP BAILER

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Filed May 9, 1961, Ser. No. 108,777

7 Claims. (Cl. 166—117)

This invention relates to well tools and more particularly to a load carrying device, such as a dump bailer, for use in flow conductors, such as well tubing or the like.

An object of this invention is to provide a new and improved load carrying device.

Another object is to provide a new and improved dump bailer for carrying a load of material into a flow conductor, such as a well tubing, which is adapted to dump all of its load in one slug at a predetermined location therein thereby preventing the contamination of the material by fluids in the tubing or the lodging of the material in the tubing at places other than the desired location.

Still another object is to provide a new and improved load carrying device for use in tubing, which may be caused to dump its load at a particular location in the well tubing and support it at such location to prevent its gravitating down the well bore.

Still another object is to provide a dump bailer for use in a flow conductor, such as well tubing, which may be caused to expel its contents at a rate proportional to the rate of withdrawal of the bailer from the tubing.

A further object is to provide a dump bailer for use in well tubing, or the like, which is provided with a stop mechanism for stopping the bailer at a particular location in the tubing after which the bailer may be separated from its stop mechanism and withdrawn from the tubing while discharging its contents at the particular tubing location.

A still further object it to provide a device for use in well flow conductors, such as well tubing, which may be caused to discharge its contents at a particular location in the tubing and which is provided with means engageable with the conduit for supporting the discharged contents at the particular location in the tubing.

Additional objects and advantages of the invention will be readily apparent from the reading of the following description of a device constructed in accordance with the invention, and with reference to the accompanying drawings thereof, wherein:

FIGURE 1 is an elevational view, partly in longitudinal section, of the upper portion of a device embodying the invention suspended in a string of well tubing;

FIGURE 2 is a view, similar to FIGURE 1, being a continuation thereof, showing the lower portions of the device;

FIGURE 3 is an elevational view partly in longitudinal section, of the upper portions of the device of FIGURE 1 as it appears after the device has expelled a load of material at a fixed location in the well tubing;

FIGURE 4 is a view similar to FIGURE 3, being a continuation thereof;

FIGURE 5 is a sectional view taken along the line 5—5 of FIGURE 4; and

FIGURE 6 is a fragmentary elevational view, partly in longitudinal section, of the lower portion of a modified form of the device.

Referring particularly to FIGURES 1 and 2 of the drawings, the dump bailer **10**, embodying the invention, is shown suspended on a conventional running tool **11** in a well tubing string T by means of a conventional line running and pulling mechanism (not shown) which includes a flexible steel line **12** to which the running tool **11** is secured. The tubing sections **13** are fastened together by threaded couplings **15**. The coupling is internally threaded throughout its inner bore for connection to the externally threaded ends of the tubing sections which are spaced at the couplings to form a recess **16** defined by the upper and lower ends **17** and **18** of tubing sections joined by such coupling.

The dump bailer comprises a barrel **20**, made of one or more sections, such as the tubular sections **20***a* and **20***b*, which are fastened together by a threaded coupling **21**.

The upper end of the barrel is closed by a top sub **23** which is threaded into the upper end portion of the upper barrel section **20***a*. The upper end portion **26** of the top sub is threaded in the socket **27** at the lower end of the running tool **11**. An external flange **28** formed on the sub adjacent the threaded end portion **26** provides a downwardly facing shoulder **29** which may be engaged by a fishing tool to permit the bailer to be removed from the tubing in the event that the dump bailer should become disconnected from the running tool as by disengagement of the thread or by breakage of end portion **26**. A plurality of radially extending lateral ports **30** in an intermediate portion **31** of the sub provide communication between the exterior of the sub and a central downwardly opening bore **32** of the sub.

A bottom sub **35** is secured to the lower end of the lower barrel section **20***b* by means of a threaded coupling **36**. The bottom sub has a central bore **37** and an internal annular flange **39** which provides an internal downwardly facing annular shoulder **40**.

A mandrel **41***a* of a stop **41** is releasably secured to the sub **35** by means of a shear pin **42** which extends through a suitable lateral aperture in the wall of the sub **35** into a lateral bore in the upper end portion of the mandrel telescoped in the bottom sub. An O-ring **43** is disposed within an external annular groove **43***a* of the bottom sub to seal between the mandrel and the bottom sub. Another external annular groove **44** of the bottom sub located above the annular groove **43***a*, has a resilient sealing element **45** having an external flange **46**. The flange normally extends radially outwardly of the resilient element but is held in the retracted position within the bore **37** of the bottom sub **35**, as shown in FIGURE 1, when the mandrel is telescoped in the sub **35**. A plurality of radial slits **47** in the flange **46** facilitate its folding upwardly within the sub.

An eye bolt **48**, which is screwed into the extreme upper end of the mandrel **41***a* has an eye **48***a* through which extends the cord or flexible element C, one of whose ends is fastened to the inner flange **39** of the bottom sub. The cord is attached to the flange by passing its end successively through the eye of the eyebolt and a small diameter longitudinal bore **39***a* formed in the flange **39** and tieing its end to the portion of the cord which extends between the eyebolt and the flange **39**, as shown in FIGURE 1. The cord C extends upwardly from the eyebolt through the bore of the barrel **20** and has its upper end tied to the downwardly directed projection **49** of a piston **50** slidably disposed within the barrel. The projection has a bore **49***a* extending therethrough for receiving the cord C to facilitate tieing of the cord thereto. A resilient element **52** secured to the underside of the piston **50**, engages the internal surfaces of the barrel to wipe these surfaces when the piston is moved longitudinally downwardly therethrough. The resilient wiper **52** has a central aperture **52***a* through which the piston projection may be passed when fitting the wiper to the piston.

The stop **41** is substantially identical to the stop disclosed in the patent to C. M. Schwab, U.S. Pat. No. 2,908,333, except that the mandrel of the patented device, which corresponds to the mandrel **41***a*, is provided with a flow passage extending therethrough.

The lower end portion of the stop mandrel **41***a* has an

external annular flange or locking portion 55 which provides an upwardly facing stop shoulder 56 which engages the lower end of a collar 57 to limit its downward movement on the stop. The collar 57 is slidable on the stop mandrel between a lower position wherein its lower edge engages the shoulder 56, as shown in FIGURE 2, and an upper position, shown in FIGURE 4, wherein it engages the downwardly facing shoulder 60 provided by an external flange 61 of the mandrel.

A pair of resilient collet fingers 62 and 63 are secured, as by a weld 64, to the exterior of the collar 57 in diametrically opposed positions thereon and extend downwardly below the stop mandrel when the collar is in its lowermost position on the mandrel. The collet fingers and collar are releasably held in their lowermost positions on the stop mandrel by a shear pin 65 which extends through suitable aligned bores in the collet fingers, the collar and the mandrel.

The lower ends of the collet fingers are held in the retracted positions illustrated in FIGURE 2 by means of release wires 66 and 67 which engage the inner wall of the tubing and the fastening pins 68 and 69 on the collet fingers 62 and 63, respectively. Each of the release wires comprises two substantially straight portions, such as 66*a* and 66*b* of the wire 66, which extend angularly relative to one another. The wire 67 has similar portions 67*a* and 67*b*. An eye 71 formed at one end of the wire 66 is disposed about the fastening pin 69 and the bend of the wire at the junction of the straight portions is slightly curved to form a hook 72 which engages pin 68, as shown in FIGURE 2, when the end 73 of the wire engages the tubing wall. It will thus be seen that when the release wire 66 is disposed as described, the collet finger 62 will be held in the retracted positions illustrated in FIGURE 2 wherein they do not engage the tubing. The release wire 67 is disposed similarly relative to the fastening pins with its end 74 in engagement with the tubing and similarly causes the other collet finger 63 to be held in retracted position. The outwardly extending locking bosses or dogs 75 adjacent the lower end of each collet finger is thus held out of engagement with the tubing wall.

In assembling the dump bailer, preparatory to lowering into a well, a cord C is threaded through the bore 39*a* of the lower sub 35 and tied thereto. The lower sub is then attached to the barrel and the cord run through the eye-bolt of the stop mandrel and then through the barrel 20. The mandrel 41*a* is then secured to the lower end of the bailer barrel by inserting the shear pin 42 as shown. The barrel is then filled with a load of material, such as cement slurry, which is to be discharged at a desired location into the well tubing. The other end of the cord C is then secured to the piston 50 which is inserted in the barrel bore above the material in the barrel. The length of the cord should be such that a small amount of slack is provided therein when the piston is in place within the barrel above the load. The top sub 23 is then connected to the upper end of the barrel and to the running tool 11. The bailer may then be lowered into the well tubing by means of the flexible member or line 12.

As the dump bailer is lowered into the tubing string, the extreme outer ends 73 and 74 of the resilient release wires glide along the inner wall of the tubing. After the device has been lowered below the desired location in the tubing, it is then lifted. During this upward movement, the extreme outer ends of the release wires bite into the inner wall of the tubing and, as the device moves upwardly, the hooked portions of the wires become disengaged from the fastening pins 68 and 69, thus allowing the wires to disengage from the tubing wall and dangle freely from the fastening pins. With the restraining action of the wires on the collet fingers thus removed, the lower ends of the collet fingers are released and permitted to spring outwardly whereupon their bosses 75 will engage the tubing. The device is subsequently lowered until the outwardly projecting bosses enter into the first coupling recess 16 encountered, at which time the lower end portions of the collet fingers will further expand to move their bosses 75 into the recess. The downwardly facing shoulders 76 of the dogs will then engage the upper end 18 of the lower tubing section at such coupling recess to arrest the downward movement of the device in the tubing.

Downward jars are then imparted to the device by the means of the flexible line running tools to cause the pin 65 to shear and free the stop mandrel for downward movement relative to the collet fingers. As the mandrel moves downwardly, the beveled shoulder 81 on the lower end thereof contacts the downwardly and inwardly inclined surfaces 83 of inner lock bosses 84 of the collet fingers. The camming engagement of the beveled shoulder of the mandrel with the surfaces 83 causes the intermediate portions of the collet fingers to flex outwardly and permit the external lock flange 55 of the mandrel to pass downwardly therebetween. After the enlarged mandrel portion is moved past the lock bosses 84, the intermediate portions of the collet fingers spring back inwardly and prevent any subsequent upward movement of the enlarged portion of the mandrel due to the engagement of their abrupt downwardly facing shoulders 85 with the upwardly facing shoulder 56 of the external flange 55. Downward movement of the mandrel relative to the collet fingers is limited by the external flange 61 of the mandrel whose downwardly facing shoulder 60 abuts the upper end surface 57*a* of the slidable collars 57 when the mandrel moves downwardly a predetermined distance relative to the collet fingers. In addition to the shoulder 60, downwardly and inwardly inclined shoulder 86 at the lower end of the collet fingers are adapted to be engaged by the downwardly and inwardly inclined surface 81 at the lower end of the mandrel when the mandrel is disposed with its enlarged portion below the lock bosses 84. Thus, the enlarged portion of the mandrel is locked in position between the lock bosses 84 and the lower ends of the collet fingers and also locks the lower ends of the collet fingers against inward movement to maintain the outer bosses 75 of the collet fingers in their expanded locking positions within the recess 16.

When in this locked position within the tubing, the stop 41 cannot readily be removed therefrom. If desired, however, it may be possible to retrieve the stop by engaging the upper end of the mandrel 41*a* with a fishing tool and applying upward impacts sufficient to cause shearing of the inner lock bosses 84 or otherwise destroying the effectiveness of the collet fingers so that it might be removed from the well. Alternatively, the stop mechanism may be fabricated of materials which are readily dissolvable by acids so that it may be eliminated from the well.

When the bailer is locked in place against downward movement at the desired location in the well tubing it may be operated to discharge the material carried in its barrel into the tubing. Downward impacts are imparted once more to the device by means of the flexible line tools to cause the shear pin 42 which secures the stop mandrel to the lower sub 35 to fail. The shearing of the pin permits the bailer to be moved upwardly away from the mandrel 41*a* of the stop. As the lower sub 35 is withdrawn from its telescoped position about the upper end of the mandrel, the resilient element 45 of the stop mandrel is freed to flex back to its normal position, as shown in FIGURE 4, in which its outwardly extending flange extends radially outwardly to contact the inner surfaces of the tubing to bridge or close the annular space between the tubing and the stop mandrel. The resilient element although flexible, has sufficient stiffness and strength normally to support the load of material, such as cement slurry, carried in the bailer barrel.

Further lifting of the bailer relative to the mandrel will cause the cord C to become taut at about the time

the bottom sub 35 clears the upper end of the mandrel. The slack provided in the cord C when the apparatus is assembled, as previously described, thus serves the purpose of delaying movement of the piston in the barrel and consequently delays the displacement of the material from the barrel until the bottom sub 35 has cleared the mandrel and the resilient element 45 is in proper bridging position within the tubing. Continued upward movement of the bailer barrel will then draw the cord C through the eye 48*a* of the eyebolt 48, as shown in FIGURE 4, thus pulling the piston through the barrel as the barrel is lifted upwardly. It will therefore be apparent that the piston movement relative to the barrel is twice as rapid as the upward movement of the barrel relative to the stop mandrel. The two to one ratio of these relative movements is particularly desirable since the per-foot volume of the bailer barrel is normally about half that of the tubing in which it is normally used with the result that the fill-up rate of the material in the tubing, or the rate at which it piles upwardly therein is substantially equal to the rate at which the bailer barrel is lifted through the tubing. Thus, the cement or other material is discharged from the bailer at the very location in the tubing where it is needed, without being contaminated or mixed with well fluids.

It will be noted that as the piston 50 is pulled through the bailer barrel, the resilient wiper 52 affixed to the underside of the piston wipes the inner wall of the bailer barrel to assure complete removal of the contents. The upper end of the bottom sub 35 has an upper annular shoulder 90 extending into the barrel which limits the downward movement of the piston relative to the bailer barrel. As shown in FIGURE 3, when the piston is at its lower limit of movement relative to the barrel with the undersurface of the wiper element abutting the cord C, the piston wiper has moved completely through the barrel from its original position in the upper end thereof. Also, the cord C is at the limit of its movement through the eyebolt. A further upward pull exerted on the bailer by means of the line 12 and running tool will now break the cord C so that the bailer is completely released from the stop 41 and may be withdrawn upwardly from the tubing. If the material discharged by the bailer is a cement slurry, an effective plug will be formed at the desired location in the tubing as the setting or hardening of the cement takes place.

It should be noted that if it be desirable, one end of the cord C could be anchored directly to the eyebolt 48 instead of to the bottom sub 35. The bailer contents, however, would be displaced, as the bailer is moved upward relative to the stop, at one-half the rate which occurs when the cord is secured to the sub 35. Thus, the bailer contents would be displaced from the barrel throughout a longer span of the tubing as the bailer moves upwardly and would completely empty when the barrel is substantially higher in the tubing relative to the resilient bridging element 45. In this arrangement of the cord, the material displaced from the bailer would be required to gravitate downwardly through the well fluids, which may result in its becoming contaminated or diluted.

In those situations where it suffices to anchor the cord C directly to the stop mandrel or eyebolt 35, a less complex and more economical form of bailer could be used as in the modified form of the device illustrated in FIGURE 6. In this embodiment of the device, the bailer barrel is in the form of a plain tube 101 which has an aperture for receiving a shear pin 42*a* of the stop mandrel. A lower sub, such as the sub 35 is not required and is not provided since the cord C is connected directly to the eyebolt of the stop mandrel. The rest of the device including the stop is identical with that of the device illustrated in FIGURES 1 to 4.

It will thus be seen that a dump bailer has been described and illustrated which may be operated to discharge a load of material in a particular location in a conduit by means other than gravity.

It will further be seen that the dump bailer not only discharges its contents but also supports the discharged contents at the particular location in the flow conductor.

It will further be seen that a load carrying device is disclosed herein for use in well tubing, or the like, which may be caused to discharge its contents at a particular location in the tubing at a rate which is approximately equal to the fill-up rate of the tubing or at a rate which exceeds the fill-up rate of the tubing.

It will further be seen that the displacement of the piston of the dump bailer relative to the barrel will cause the discharge of a load of material, such as cement slurry, in a single slug without such material being diluted or mixed with other materials so that the cement will harden to form a strong and durable plug.

The foregoing description of the invention is explanatory only, and changes in the details of the construction illustrated may be made by those skilled in the art, within the scope of the appended claims, without departing from the spirit of the invention.

What is claimed and desired to be secured by Letters Patent is:

1. A well tool for carrying and discharging materials in a flow conductor comprising: a barrel adapted to pass through said flow conductor; anchoring means having a closure means thereon disposed in the lower end of said barrel to close said lower end thereof, said anchoring means being operable in response to predetermined movements of said barrel in said flow conductor to anchor said closure means in said flow conductor; means for releasably connecting said anchoring means to said barrel whereby said barrel is separable from said anchoring means upon longitudinal movement of said barrel relative to said anchoring means thereby opening said lower end of said barrel; said barrel being movable longitudinally of said flow conductor away from said anchoring means and closure means after said anchoring means has been anchored in said flow conductor; a piston slidably mounted in said barrel; and operator means connecting said piston to said barrel and movably engageable with said anchoring means, said operator means moving said piston through said barrel toward the open end thereof at a rate in excess of the rate of movement of said barrel away from said anchoring means upon movement of said barrel away from said anchoring means to discharge the contents of said barrel below said piston through said open lower end at a rate exceeding the rate of movement of said barrel in said flow conductor away from said anchoring means.

2. A well tool including: container means for transporting material through a well conductor; closure means releasably closing the lower end of said container means; anchoring means carried by said closure means and engagable with the well flow conductor to be anchored therein in response to predetermined longitudinal movement of said container means in said flow conductor; said container means being movable longitudinally of said well conductor away from said anchoring means after said anchoring means has been anchored in said well flow conductor; positive displacement means carried in said container means and movable therein from an upper position to a lower position for discharging material from within said container means upon such movement; and operator means operatively connecting said displacement means to said container means and movably engageable with said anchoring means for moving said displacement means in response to movement of said container means relative to said anchoring means whereby, when said container means is detached from said closure means and moved upwardly in said flow conductor, said operator means moves said positive displacement means in said container means at a rate in excess of the rate of movement of said container means with respect to said closure means

and anchoring means whereby said displacement means discharge materials from said container means at a rate in excess of the rate at which said container means is moved upwardly in said flow conductor away from said closure means and anchoring means.

3. A well tool including: container means for transporting material through a well flow conductor in one longitudinal direction therein; closure means for one end of said container means and releasably secured to said container means; anchoring means connected with said closure means and engageable with the flow conductor to be anchored therein in response to predetermined longitudinal movements of said container means in said flow conductor; said container means being movable longitudinally of said well conductor away from said anchoring means after said anchoring means has been anchored in said well flow conductor; positive displacement means carried by said container means for discharging material from said container means and including operator means operatively connecting said displacement means to said container means and movably engageable with said anchoring means for moving said displacement means in said container means to discharge the materials from said container means upon movement of said container means away from said anchoring means after said anchoring means has been anchored in said flow conductor, said operator means moving said displacement means in said container means at a rate in excess of the rate at which the container means is moved away from said anchoring means to force the materials from the container means at a rate in excess of the rate of movement of the container means; and seal means operatively associated with said anchoring means and initially held inoperative by engagement with said container means and releasable from said engagement with said container means for expansion into engagement with said well flow conductor for forming a seal across the bore of said well flow conductor upon movement of said container means away from said anchoring means, whereby the material discharged from said container means will be prevented from passing downwardly of said conductor past said seal.

4. A well tool for carrying and discharging materials in a flow conductor comprising: an elongate tubular barrel adapted to pass through a flow conductor; closure means detachably secured to said barrel at its lower end to close such lower end of said barrel; anchoring means operatively connected with said closure means and operable in response to longitudinal movements of said barrel in said flow conductor to anchor said closure means in said flow conductor; seal means on said closure means initially held in inoperative non-sealing position in said barrel and expansible upon release from engagement by said barrel to engage the flow conductor to close the bore of the same; said closure means being detchable from said barrel upon longitudinal movement of said barrel relative to said anchoring means after said anchoring means has been anchored in said flow conductor to release said barrel from connection with said closure means and to release said seal means from engagement by said barrel, thereby opening said lower end of said barrel; said barrel being movable upwardly away from said anchoring means and said closure means after said anchoring means has been anchored in said flow conductor and released from connection with said barrel; a piston slidably mounted in said barrel initially disposed at the upper end of said barrel; and operating means for connecting said piston to said barrel and movably engageable with said anchoring means whereby upon movement of said barrel away from said anchoring means said operating means causes said piston to move through said barrel at a rate in excess of the rate of movement of said barrel away from said anchoring means to positively discharge the contents of said barrel through said open lower end thereof.

5. A well tool for carrying and discharging materials in a flow conductor comprising: an elongate barrel adapted to pass through said flow conductor and having means at its upper end for connection with a flexible line operating mechanism for movement of said barrel through said flow conductor; closure means secured to the opposite end of said barrel for closing said opposite end of said barrel; means releasably connecting said closure means to said barrel; anchoring means connected to said closure means, said anchoring means being operable in response to predetermined longitudinal movements of said barrel in said flow conductor to engage said conductor to anchor said closure means in said flow conductor against upward movement therein, said barrel being movable longitudinally in said conductor upwardly away from said anchoring means when said anchoring means in anchored in said conductor; said connecting means being releasable to permit said barrel to be separated from said closure means and said anchoring means upon such upward longitudinal movement of said barrel relative to said anchoring means after said anchoring means have been moved to anchoring engagement with said flow conductor, such movement of the barrel upwardly away from said anchoring means moving said closure means out of said opposite end of said barrel to open the same; said closure means including an initially inoperative flexible seal member held in inoperative position by engagement within said barrel while said closure means is secured to said barrel and expansible into engagement with the bore wall of the flow conductor upon movement of said closure means out of said barrel to close the bore of the flow conductor at the anchoring means; a piston slidably mounted in said barrel and initially disposed in said barrel adjacent said one end thereof and adapted to be moved from said one end toward said opposite end of said barrel; actuating means connecting said piston to said barrel and movably engageable with said anchoring means whereby upon movement of said barrel away from said anchoring means such actuating means moves the piston through the barrel at a rate in excess of the rate of movement of the barrel away from said anchoring means to discharge the contents of the barrel through said opposite end at a rate in excess of the rate of movement of the barrel in the flow conductor.

6. A well tool for carrying and discharging materials in a flow conductor comprising: a barrel adapted to pass through said flow conductor; anchoring means having a closure means thereon disposed in the lower end of said barrel to close said lower end thereof, said anchoring means being operable in response to predetermined movements of said barrel in said flow conductor to anchor said closure means in said flow conductor; means releasably connecting said anchoring means to said barrel whereby said barrel is separable from said anchoring means upon longitudinal movement of said barrel relative to said anchoring means thereby opening said lower end of said barrel; said barrel being movable longitudinally of said flow conductor away from said anchoring means and closure means after said anchoring means has been anchored in said flow conductor; a piston slidably mounted in said barrel; and operator means connecting said piston to said anchoring means and to said barrel, whereby upon movement of said barrel away from said anchoring means said operator means causes said piston to move through said barrel at a rate in excess of the rate of movement of said barrel away from said anchoring means and discharge the contents of said barrel through said open lower end, the rate of longitudinal discharge of materials from said barrel exceeding the rate of movement of said barrel in said flow conductor away from said anchoring means, said operator means connecting said piston with said anchoring means comprising an elongate flexible member connected at one end to said barrel and having a slidable connection with said anchoring means and having its other end connected with said piston, whereby movement of said barrel away from said anchoring means causes said piston to move through said barrel at a rate sub-

stantially twice the rate of movement of said barrel away from said anchoring means, such movements of said piston discharging material from said barrel at a rate substantially twice the rate of movement of said barrel.

7. A well tool for carrying and discharging materials in a flow conductor comprising: an elongate barrel adapted to pass through said flow conductor and having means at its upper end for connecting with a flexible operating mechanism for movement of said barrel through said flow conductor; closure means secured to the opposite end of said barrel; means releasably connecting said closure means to said barrel; anchoring means connected to said closure means, said anchoring means being operable in response to predetermined longitudinal movements of said barrel in said flow conductor to engage said conductor to anchor said closure means in said flow conductor against upward movement therein, said barrel being movable longitudinally in said conductor upwardly away from said anchoring means when said anchoring means is anchored in said conductor, said connecting means being releasable to permit said barrel to be separated from said closure means and said anchoring means upon such upward longitudinal movement of said barrel relative to said anchoring means after said anchoring means have been moved to anchoring engagement with said flow conductor, such movement of the barrel upwardly away from said anchoring means moving said closure means out of said opposite end of said barrel to open the same; said closure means including an initially inoperative flexible seal member held in inoperative position by engagement within said barrel while said closure means is secured to said barrel and expansible into engagement with the bore wall of the flow conductor upon movement of said closure means out of said barrel to close the bore of the flow conductor at the anchoring means; a piston slidably mounted in said barrel and initially disposed in said barrel adjacent said one end thereof and adapted to be moved from said one end toward said opposite end of said barrel; and actuating means operatively connecting said piston to said closure means and

said anchoring means whereby upon movement of said barrel away from said anchoring means such actuating means moves the piston through the barrel at a rate in excess of the rate of movement of the barrel away from said anchoring means to discharge the contents of the barrel through said opposite end at a rate in excess of the rate of movement of the barrel in the flow conductor, said actuating means connecting said piston with said closure means comprising an elongate flexible member connected at one end to said barrel and having a slidable connection with said anchoring means and having its other end connected with said piston, whereby movement of said barrel away from said anchoring means causes said piston to move through said barrel at a rate substantially twice the rate of movement of said barrel away from said anchoring means, said actuating means being releasable from connection with said anchoring means.

References Cited by the Examiner

UNITED STATES PATENTS

1,190,024	7/16	Sitzman	166—162
1,669,001	5/28	Geake	222—392
1,732,277	10/29	Owens	15—104.05 X
2,086,409	7/37	Emery	166—117
2,109,058	2/38	Blee	166—117
2,189,445	2/40	Dale	166—117
2,537,149	1/51	McKean	15—104.16 X
2,618,344	11/52	Turechek et al.	166—117 X
2,618,345	11/52	Tucker	166—117 X
2,739,653	3/56	Haines	166—123 X
2,758,762	8/56	Medley	15—104.05 X
2,815,817	12/57	Conrad	166—117
2,856,927	10/58	Senger	222—392 X
2,908,333	10/59	Schwab	166—214
2,978,029	4/61	O'Reilly et al.	166—123 X

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