

Oct. 18, 1938.

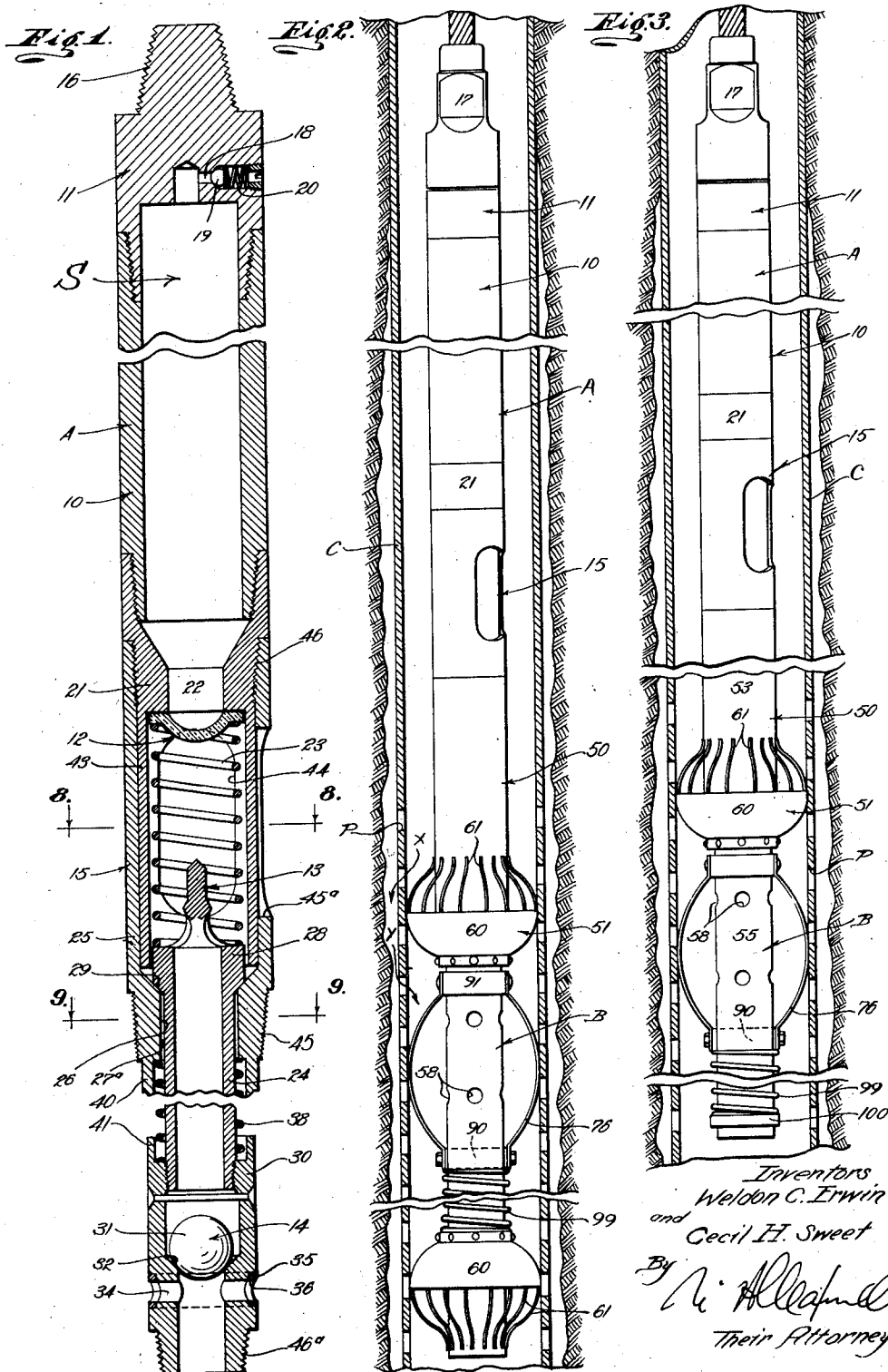
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2,133,383

WELL TOOL

Original Filed Dec. 20, 1932

3 Sheets-Sheet 1



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WELL TOOL

Original Filed Dec. 20, 1932

3 Sheets-Sheet 2

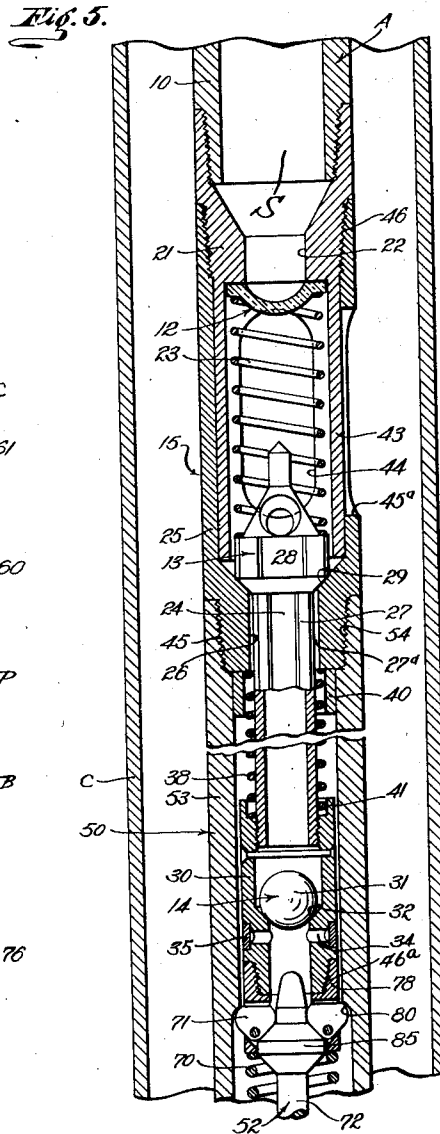
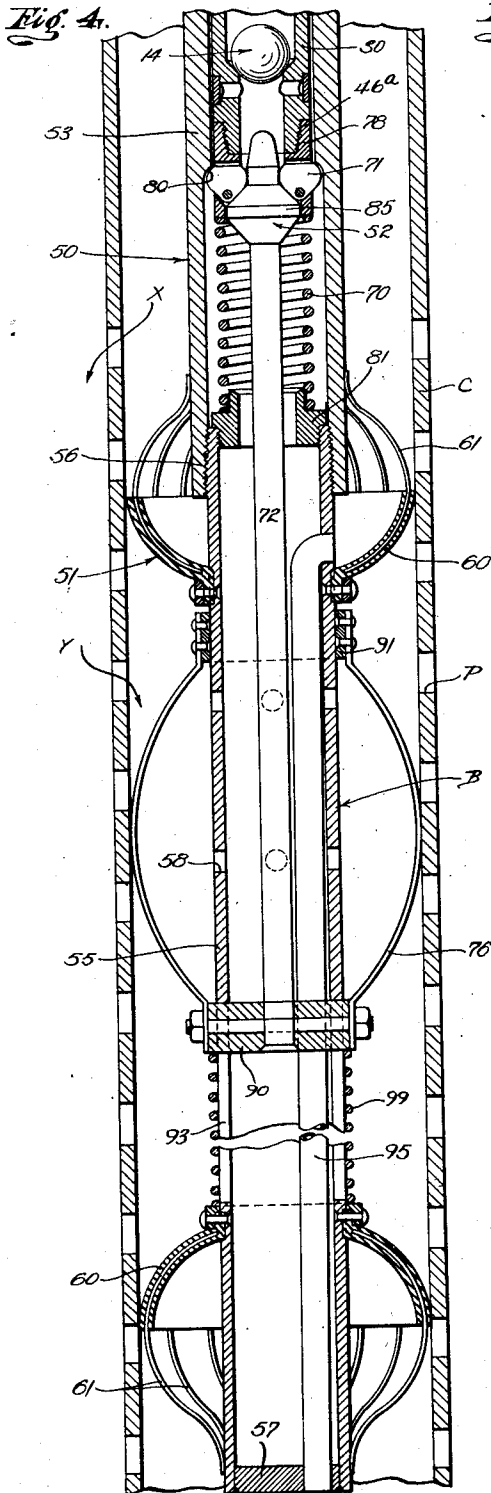
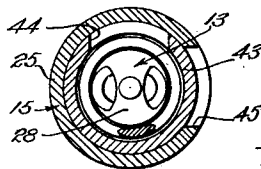


Fig. 8.



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WELL TOOL

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3 Sheets-Sheet 3

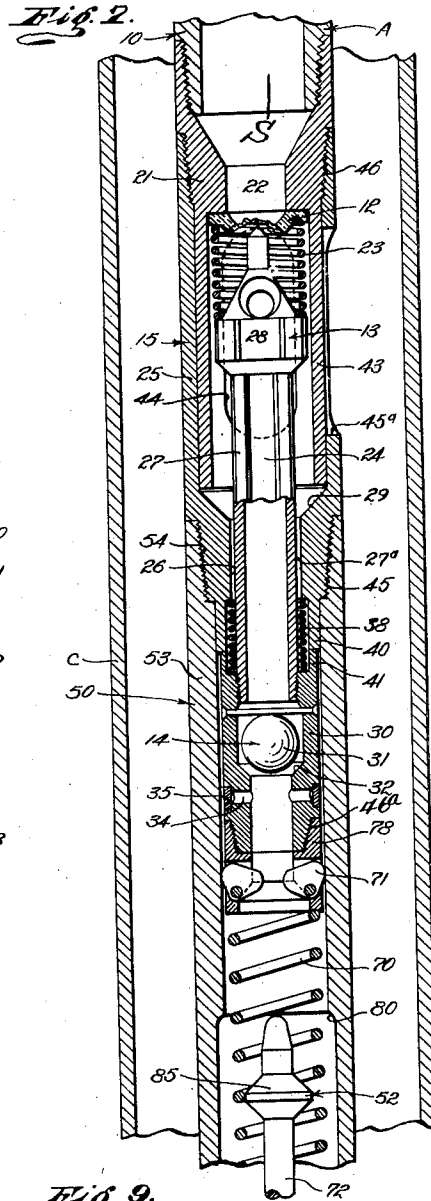
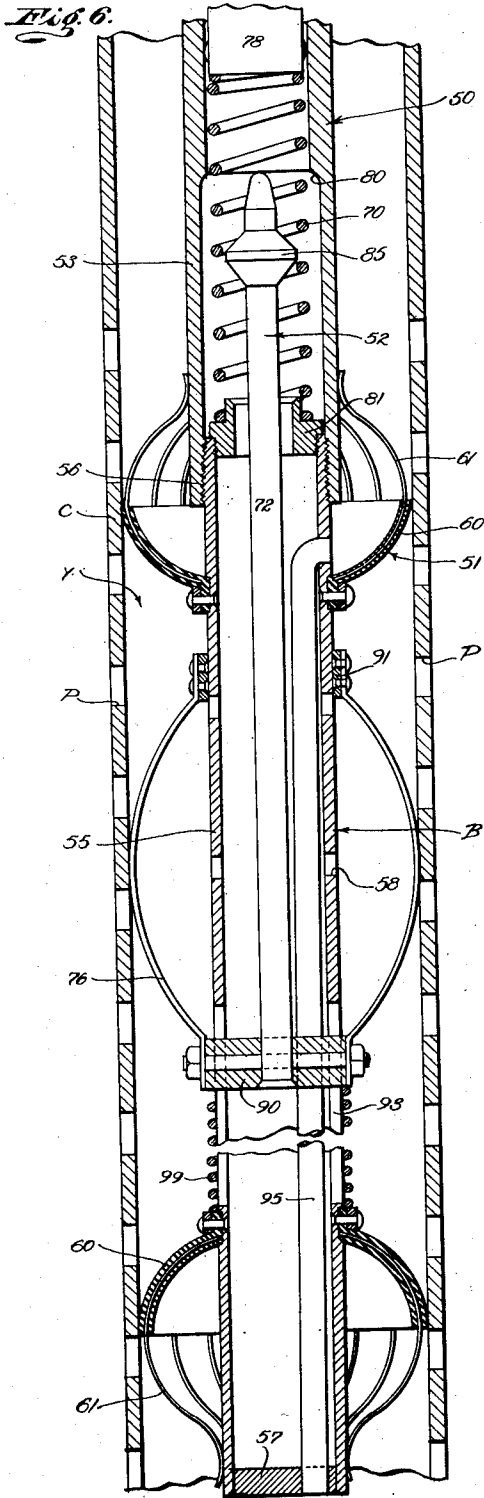
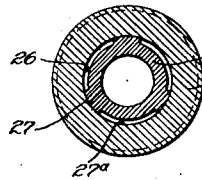


Fig. 9.



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UNITED STATES PATENT OFFICE

2,133,383

WELL TOOL

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Application December 20, 1932, Serial No. 648,072
Renewed July 12, 1938

40 Claims. (Cl. 166—19)

This invention relates to a well tool, and has particular reference to a well tool of general utility for performing cleaning operations in wells, it being a general object of this invention to provide a simple, practical well tool operable to perform various well cleaning operations such as bailing, certain classes of fishing, perforation cleaning, etc.

It is a general object of this invention to provide a well cleaning device, the action of which can be controlled or localized to effect the desired cleaning action at any desired point or in any desired direction in a well. Well cleaning operations, such as we have mentioned, constitute the movement or circulation of material in the well, and a removal of the material moved, to clear the well parts. In the case of the usual bailing operation, the material is moved upwardly into the bailer and is removed from the well in the bailer. In the case of cleaning perforations, such as occur in the casing set at the producing zone of a well, circulation is induced through the perforations, to free them of material which, unless removed, operates to retard or restrict the flow of fluid into the well. The last mentioned cleaning operation involves lateral movement or circulation of material in the well.

The tool of the present invention is capable of operation as a bailer and is equipped with a control by which the cleaning or bailing action can be localized and utilized to effect lateral flow or flushing of parts, such for instance, as perforations occurring in a well casing.

An object of the present invention is to provide a well tool in the nature of a bailer involving novel features of construction, arrangement, and functioning of parts. The bailer of the present invention is of the type employing a hydrostatic head of fluid in the well to effect loading or charging of the bailer, and in the preferred construction, the bailer employs a frangible sealing member which closes the bailer until such time as it is desired to effect loading. A feature of the invention is the novel, simple and effective control for the frangible sealing member.

A further object of the present invention is to provide a control for a bailer, or the like, whereby the action of the bailer can be localized or confined to a particular point or region, which control is in the form of an attachment that can be readily removed from the bailer in the event that it is desired to employ the bailer independently of the control.

Another object of this invention is to provide a well tool employing a combination of bailer and

control device for the bailer in which these parts are readily separable and are in the nature of complete individual units.

A further object of this invention is to provide a control for a bailer, or the like, involving means for localizing the action of the bailer and means for effecting operation of the bailer control.

A further object of the present invention is to provide novel features of arrangement and formation of parts in a control for a bailer, or the like, such, for instance, as the arrangement of packing elements in such device, the actuating means for the bailer control, etc.

The various objects and features of the invention including those above mentioned will be best and more fully understood from the following detailed description of typical forms and applications of the invention, throughout which description reference will be had to the accompanying drawings, in which:

Fig. 1 is a longitudinal detailed sectional view illustrating the bailer section of the tool provided by this invention, showing the chamber of the bailer sealed, and the control for the bailer in the unactuated position. Fig. 2 is a more or less diagrammatic view illustrating one form of the tool embodying the present invention located in a well provided with a perforated casing, the device of the present invention being shown in elevation, while the well and well casing are shown in longitudinal section. Fig. 3 is a view similar to Fig. 2 illustrating another form of device embodying the invention. Fig. 4 is an enlarged longitudinal detailed sectional view of the control device provided by the present invention, being the form of control device illustrated in Fig. 2, and showing the control device located in a perforated well casing and with the parts in position in which they occur as the control device is being lowered into the well. Fig. 5 is a longitudinal detailed sectional view of the tool provided by this invention taken at the connection between the bailer section and the control section, showing the control of the bailer in the unactuated position. Fig. 6 is a view similar to Fig. 4 showing the control section of the tool in the actuated position, the actuating means of the control section having been released to operate the control of the bailer. Fig. 7 is a view similar to Fig. 5 showing the control of the bailer actuated by the actuating means of the control section. Fig. 8 is a detailed transverse sectional view taken as indicated by line 8—8 on Fig. 1, and Fig. 9 is a

detailed transverse sectional view taken as indicated by line 9—9 on Fig. 1.

The tool provided by this invention is primarily intended to be employed in performing cleaning operations in wells such as oil wells, and for the purpose of example, we have set forth in this disclosure, forms of the invention particularly designed to perform two common well cleaning operations, namely, bailing and perforation cleaning. Undesirable matter, such as, sand and heavy fluids that do not flow readily, accumulate in wells and must be removed, this operation usually being performed by devices known as bailers. Further, it is common practice to finish a well at the producing zone with perforated casing, designed to admit oil into the well without admitting other material from the formation through which the well is formed. In many instances, the perforations in the casing are comparatively small, and the materials present are such that the perforations become more or less clogged, making it necessary to clean them. Although various means have been proposed for cleaning perforations, it is generally found most effective to perform this operation by flushing the perforations, for instance, by circulating fluid through them to wash them clean.

The tool provided by the present invention is preferably of sectional construction, in which case it includes an upper or bailer section A and a lower or control section B. In accordance with the preferred form of the invention, the two sections of the tool are readily separable, and in accordance with the broader aspects of the invention, the sections are made so that the two sections are not dependent one on the other, that is, the bailer section is constructed as a complete and self-contained unit operable as a bailer, while the control section is a unitary structure applicable to bailers of various designs and constructions. The bailer section of the tool, although capable of being constructed in various manners, is preferably of a type and construction adapted to utilize the hydrostatic head of fluid in the well to effect loading. This type of bailer is preferred, as with this type of bailer, it is possible to get a very violent and effective cleaning action.

The bailer construction illustrated in the drawings includes, generally, an elongate tubular body 10, a cap 11, closing the upper end of the body 10, a closure 12 for the lower end of the body, opening means 13 for the closure, check means or foot-valve 14 operable to freely admit material into the bailer but not from the bailer, means 15 for effecting discharge of material from the bailer, and various other parts, the details and functions of which will be hereinafter described.

The body 10 of the bailer is preferably in the form of a comparatively long tubular structure formed of one or more sections of sufficient weight to withstand comparatively high crushing pressure. In practice, the body 10 may be formed of one or more sections of heavy tubing or tubular stock. The cap provided on the upper end of the body 10 is preferably screw-threaded to the body and provides an adapter or fitting by which the tool may be connected to an operating line, or the like. The cap is also provided with an opening 18 connecting the interior or charge-receiving chamber S of the bailer body 10 with the exterior of the tool, which opening is normally closed by a valve 19 held seated by a spring 20. The valve 19 acts as a check valve adapted to allow the escape of pressure

from the upper end of the bailer body, but to prevent fluid from entering the bailer body.

The closure 12 for the lower end of the bailer body is preferably in the form of a frangible sealing disc formed of glass, a readily frangible metal, or other suitable material. The disc 12 is preferably carried by a cage 21 attached to the lower end of the body 10 to form an extension on the body. The cage has a central opening 22 longitudinal through it, the lower end of the opening being closed by the sealing disc 12. The sealing disc may be advantageously made of concavo-convex form, and arranged with its convex side downward as shown in the drawings. This formation and arrangement permits the use of a comparatively light or thin sealing disc. In practice, any suitable means may be employed to retain the sealing disc in engagement with the cage 21. In the particular case illustrated in the drawings, a helical spring 23 arranged under compression operates to hold the disc up against the bottom of the cage 21, and in practice, a suitable gasket, or the like, is interposed between the disc and the cage to make a tight joint.

The operating or opening means 13 provided for fracturing the disc 12 is in the form of a plunger or dart mounted to be movable upwardly, so that its upper end or head, which may be pointed or otherwise suitably shaped, is movable into contact with the disc 12 to fracture it. In the particular construction illustrated, the plunger comprises a tubular main portion or stem 24 guided in the lower end of a sleeve extension 25 which may broadly be considered a part of body 10 and which extends downwardly from the cage 21 to a point a considerable distance below the seal 12. The stem 24 has spaced longitudinal ribs 27 that fit the opening 26 in the sleeve 25, leaving a space 27^a between the sleeve and stem to admit fluid into the bailer. The stem 24 is provided at its upper end with an enlargement or head 28, which, when the control is unactuated, seats down against a seat 29 provided in the lower portion of the sleeve 25. In the construction illustrated, the spring 23 acting to hold the seal against the cage 21, acts downwardly against the head 28 to normally yieldingly hold or aid in holding the head 28 against the seat 29. The stem 24 of the means 13 is comparatively long, and projects well below the lower end of the sleeve 25 which is the lowermost part of the bailer, and is rigid with the body 10.

The check means 14 is in the nature of a check valve designed to allow free flow of fluid into the bailer, but to prevent or check free flow of fluid from the bailer. The means 14 as illustrated in the drawings, is in the nature of a ball check valve applied to the lower end of the tubular stem 24 of the means 13. The valve as illustrated, includes a cage 30 screw threaded to the lower end of the stem 24, and a ball valve 31 in the cage. The cage has a longitudinal opening extending through it and communicating with the opening through part 24. The ball valve 31 cooperates with a seat 32 in the cage to allow free flow of fluid upwardly into the bailer, but to check downward flow of fluid from the bailer.

In accordance with the invention, lateral openings 34 are provided in the cage immediately below the valve so that when the bailer is actuated, fluid not only moves upwardly into the bailer, but also laterally into the bailer. A control sleeve 35 may surround the cage 30 at the openings 34, which sleeve is rotatable on the

cage and is provided with openings 36 adapted to register with the openings 34 when it is desired that the openings 34 be open. When it is desired to close the openings 34, the sleeve 35 is rotated to a position where it covers the openings 34. When the openings 34 are used the lower end of the stem may be closed by means of a suitable plug.

In practice, a helical spring 38 may be provided around the stem 24 between the lower end of the sleeve 25 and the upper end of the cage 30 to normally yieldingly hold the means 13 in the unactuated position, thus supplementing or taking the place of the spring 23. In order to prevent the control 13 from being over-actuated or moved upwardly to a point where it overstrains the springs 23 and 38 or otherwise damages the tool, stops are provided on the parts, for instance, a stop extension 40 extends downwardly a suitable distance from the lower end of the sleeve 25, and a corresponding stop extension 41 projects upwardly from the upper end of the cage 31. The adjoining ends of the stops 40 and 41 cooperate to limit the upward movement of the means 13.

The means 15 provided for discharging the bailer includes a tubular extension 43 on the lower end of the cage 21 which extension slidably fits the interior of the sleeve 25. The extension 43 has an opening 44 adapted to register with an opening 45^a in the sleeve 25, upon the sleeve being rotated to a pre-determined position. The sleeve 25 is screw-threaded to the cage 21 at 46, and is adapted to be rotated to bring the openings 44 and 45^a into register. It is to be understood that when the tool is lowered into the well, the openings 44 and 45^a are out of register, so that the bailer is completely closed. It is significant that the discharge means 40 is below the seal 12, thus avoiding any danger of leak occurring in the tool prior to the tool being actuated to receive its charge.

After the load is discharged, the new disc may be installed by inserting it through the registering openings 44 and 45^a, the closure thus being put in operative condition for the next cleaning operation.

The bailer described above is made or designed for reception of the control section B, and to this end, a threaded part 45 is provided on the lower end of the sleeve 25, and a threaded part 46^a is provided on the lower end of the cage 30. These threaded parts receive parts of the control section B in the manner hereinafter described.

The control section B of the tool is designed to be employed when it is desired to localize or specifically direct the action of the bailer for a particular purpose, as, for instance, when it is desired to clean the perforations of a well casing. The control section B of the tool includes, generally, an elongate tubular body 50, packing means 51 carried on the body, and actuating means 52 adapted to actuate the control or means 13 of the bailer. The upper part 53 of the body 50 is provided with a threaded part 54 to cooperate with the threaded part 45 of the bailer, and when the threaded parts 45 and 54 are in engagement as shown in Figs. 5 and 7 of the drawings, the body of the control section B becomes continuous with the body of the bailer A. The lower portion 55 of the body is threaded to the upper portion 53 at 56, and is preferably in the form of an elongate tubular part closed at its lower end by plug 57, or the like, and is

provided with suitable lateral openings 58. Broadly considered, body portions 50, 55, or either of them, may be considered as parts of body 10.

The packing means 51 of the control may be varied considerably without departing from the spirit of the present invention, for instance, the packing means may include two spaced packers on the body 50, as shown in Figs. 2, 4 and 6 of the drawings, or it may include a single packer on the body 50 as shown in Fig. 3 of the drawings. In the form of the invention shown in Figs. 2, 4 and 6 of the drawings, there are two spaced packing elements on the body 50, one located above the openings 58 in the body part 55 and the other located below the openings 58 in the body part 55. The packing elements may be of any suitable form or construction capable of forming a substantially tight joint or connection between the body of the control section B and the inner wall of a casing C, or the like. Throughout the drawings, we have shown a typical or common form of packing suitable for a tool of this character, which packing includes a cup-like body 60 of rubber, or the like, reinforced and protected by a cage of ribs 61, formed of wire or like elements. In the form of control under consideration, the upper packing element is faced so that the cup part 60 faces upwardly while in the lower element, the cup part faces downwardly. With this arrangement the packing elements are effective in preventing fluid passing upwardly or downwardly between the casing and body 50 to the space between the packing elements. The cup parts 60 and ribs 61 of the packing elements are formed so that the packing elements have a certain flexibility enabling them to accommodate themselves to irregularities in the casing C during the movement of the tool into and out of the well.

The actuating means included in the control section B of the tool is provided for actuating the control and the bailer section A of the tool. The actuating means includes generally, a spring 70 set under compression and adapted to be released to operate the means 13 of the bailer, one or more latch elements 71 for holding the spring against operation by the spring, a control rod, or releasing member 72 for the latch elements, and one or more casing engaging springs or the like 76 which may be considered as radially movable or expansive means operatively connected with the rod 72. The latches 71 are carried in a holder 78 to be screw-threaded to the lower end of the cage 30 in the manner clearly illustrated in Figs. 6 and 7 of the drawings. The latches are carried by the holder 78 to be movable laterally, and when the rod 72 is in engagement with the latches, they are held outwardly to cooperate with a stop shoulder 80 formed in the body portion 53. When the latches 71 are in engagement with the shoulder 80 the control means 13 of the bailer is held in the down or unactuated position. The spring 70 which provides the power for operating the means 13 of the bailer is normally arranged under compression between a seat 81 provided in the body 50 of the control section B and the holder 78. The spring being under compression, normally tends to urge the means 13 of the bailer upwardly to position to fracture the seal 12.

The rod 72 extends upwardly into the holder 78 and behind the latch members 71, and is provided with an enlargement 85 which engages the holder 78 to limit upward movement of the rod

relative to the holder and latches. The rod 72 extends downwardly to a point below the uppermost packing element, for instance, to a point between the two packing elements where it is provided with a cross arm 90 which carries the springs 76. The springs or wall drag elements 76 are bowed outwardly to normally frictionally engage the interior of the casing C, the upper ends of the springs being attached to a ring 91 slidable on the body part 55. The arm 90 extends outwardly through diametrically opposite longitudinal slots 93 in the body part 55, as clearly shown in Figs. 4 and 6 of the drawings. The parts just described are normally held in an up position where the rod 72 is held up between the latches 71 by a spring 99 arranged under compression between the cross arm 90 and the lower packer which is fixed on the body part 55.

It is desirable to neutralize the pressure around the tool above and below the two packers or packing elements, and therefore we have provided a fluid passage or bypass connection 95 between the lower end or plug 57 of the control section B and a point above the uppermost packer.

The form of the invention illustrated in Fig. 3 of the drawings is substantially the same as that just described and shown in Fig. 2, except that the lowermost packer is eliminated and the spring 99 which normally holds the rod in the up position relative to the holder 78 and latches 71 acts against a stop collar 100 instead of against the lower packer.

In operation, when it is desired to operate the tool as a bailer the control section B is detached and the tool is run into the well in the condition shown in Fig. 1 of the drawings, the body of the bailer having been sealed at atmospheric pressure. When the cage 30 on the lower end of the means 13 strikes an obstruction or the bottom of the well bore, the bailer is actuated by the body 10, and its connected parts, continuing to move downwardly, while the means 13 remain stationary until the upper end of the means 13 engages and fractures the seal 12. The fluid pressure in the well thereupon acts to force fluid into chamber S, the fluid passing upwardly through the cage 30, the stem 24, extension 43, opening 22 and then into the chamber. When the bailer becomes loaded, and when it is moved upwardly in the course of being withdrawn from the well, the parts are positioned as shown in Fig. 1 so that the head 28 cooperates with the seat 29 to prevent discharge of fluid through the opening 26, and the valve 31 cooperates with the seat 32 to prevent the discharge of fluid through the cage 31. The bailer when thus loaded in the well is loaded under a high pressure. Air trapped in the body 10 is allowed to escape from chamber S and thus relieve excessive pressure in the body by passing it through the opening 18 past the valve 19.

When the bailer has been removed from the well it can be discharged by rotating the sleeve 25 to bring the openings 44 and 45^a into register, or it may be set down on the cage 30, causing the head 28 to be lifted from the seat 29, whereupon fluid will discharge through opening 26. During this operation, the stops 40 and 41 cooperate to limit the upward movement of the means 13 in the tool.

When a control section B is employed on the bailer, its body is threaded to the part 45, while its latch holder 78 is threaded to the lower end of the cage 30. The tool is lowered into the well with the parts positioned as shown in Figs. 4 and 5, in which case the rod 72 is behind the latches

71 to hold them out and in engagement with the shoulder 80 so that the spring 70 cannot move the means 13 of the bailer. When the tool has reached the desired point in the well, for instance, when it is in a perforated section of the casing C as illustrated in Fig. 4, the tool is moved upwardly, effecting relative movement between the rod 72 and the latch carrier 78, the rod being held against upward movement by the springs 76 engaging the inner wall of the casing. As soon as the rod 72 passes from behind the latches 71, the spring 70 operates to move the means 13 upwardly, fracturing the seal 12, whereupon fluid flows through the openings 58 in the body part 55 upwardly through the body 50, and into the bailer as hereinabove described. The flow of fluid from the control section B into chamber S of the bailer A will be obvious from a consideration of Fig. 7 of the drawings. The hydrostatic head of fluid on the outside of the casing C will cause a rapid and flushing flow of fluid through the perforations P occurring in the casing C between the packing elements of the body 50. In some instances, the flushing action just described will result in fluid from within the casing C above the uppermost packer flowing outwardly through perforations P as indicated by arrows X, and then inwardly between the perforations P between the packers as indicated by arrows Y. It will thus be seen that the tool may under certain conditions, effect flushing of the perforations P in both directions, some of the perforations being flushed outwardly and others inwardly.

When the form of the invention illustrated in Fig. 3 is employed, the release or control of the tool is the same as hereinabove described, and the flushing action is substantially the same as that described, this action being illustrated by the arrows appearing on Fig. 3 of the drawings.

Having described only typical preferred forms of our invention, we do not wish to limit ourselves to the specific details set forth, but wish to reserve to ourselves any changes or variations that may appear to those skilled in the art or fall within the scope of the following claims.

Having described our invention, we claim:

1. A well cleaner including a body having a charge-receiving chamber with an inlet, a closure for the inlet, the body having a tubular portion extending below the inlet, a tubular stem movable upwardly through the bore of said portion to open the chamber inlet, means forming a fluid-tight joint between the stem and portion when the stem is in its lowermost position with relation to the portion, and a foot-valve in the stem bore.

2. In a tool adapted to be lowered through a well-casing and having a body provided with a charge-receiving chamber and an inlet therefor, an element actuatable to control fluid-flow through said inlet into said chamber, an operating member shiftable upwardly with relation to the body to actuate said element and normally tending to shift in that direction, releasable holding means normally holding said operating member from shifting upwardly, a releasing member movable with respect to the body and said holding means, means for moving the releasing member and including an element movable radially outwardly into engagement with the well-casing to resist upward movement with respect thereto, said releasing member being operable upon movement in a predetermined direction with relation to the body to release the holding means and thereby allow upward move-

ment of the operating member and being movable in that direction by virtue of withdrawal movement of the body with the casing-engaging element resisting upward movement and a

5 downward seating valve for the chamber and effective to retain a charge therein after it has been admitted through the opened inlet.

3. In a well tool adapted to be lowered through a well-casing and having a body provided with a charge-receiving chamber and an inlet therefor, a closure for the inlet, an operating member movable upwardly with respect to the body to open the chamber inlet, means tending to move the member upwardly, releasable holding means normally holding said operating member from upward movement, a releasing member movable downwardly with respect to the body to release said operating member for upward movement and having an element engageable with the well-casing, and a downwardly seating valve for the chamber and effective to retain a charge therein after it has been admitted through the opened inlet.

4. In a tool adapted to be lowered through a well-casing and having a body provided with a charge-receiving chamber and an inlet therefor, an element actuatable to control fluid-flow through said inlet into said chamber, an operating member shiftable upwardly with relation to the body to actuate said element, a spring tending to shift said operating member upwardly, releasable holding means normally holding said operating member from shifting upwardly, a releasing member movable with respect to the body and said holding means, means for moving the releasing member and including an element movable radially outwardly into engagement with the well-casing to resist upward movement with respect thereto, said releasing member being operable upon movement in a predetermined direction with relation to the body to release the holding means and thereby allow upward movement of the operating member and being movable in that direction by virtue of withdrawal movement of the body with the casing-engaging element resisting upward movement, and a downwardly seating valve for the chamber and effective to retain a charge therein after it has been admitted through the opened inlet.

5. A well cleaner including a body member adapted to be lowered to a predetermined depth within a well-pipe, said body member having a charge-receiving chamber with an inlet opening thereto, a closure for said inlet, means for opening the chamber inlet, a spring normally tending to operate said opening means, releasable holding means controlling the action of the spring, including a connecting member releasably connecting the said holding means and the body, and a control for the holding means including a part engaging the connecting member to hold it in operating position and movable relative to the body, and means associated with the said part for engaging the well pipe whereby the body may be moved with respect to the said part to move the said part and the connecting member out of engagement.

6. A well cleaner including a body having a charge-receiving chamber with a normally closed inlet, means for opening the inlet, releasable means holding said means against operation, and a control for the holding means including a member mounted for movement with respect to the holding means and normally maintaining the holding means operative, and a part asso-

ciated with the member for engaging the well pipe to resist movement relative to the well pipe whereby the cleaner may be moved to release the holding means from the member.

7. A well cleaner including a body having a charge-receiving chamber with a normally closed inlet, means for opening the inlet, releasable means holding said means against operation, including an element movable with the opening means and adapted to have releasable cooperation with the body to hold the opening means against operation, and a control for the holding means, said control including a member movable with respect to the body and normally holding the element in cooperation with the body, and means associated with the control member adapted to have movement resistant engagement with the well pipe.

8. In a well cleaner, a body having a chamber with an inlet opening, a frangible closure for the inlet opening, a downwardly facing seat on the body around the opening, and spring means holding the closure upwardly on the seat.

9. In a well cleaner, a body having a chamber with an inlet opening, a frangible closure for the inlet opening, a member movable into opening engagement with the closure, and a spring holding the closure in the closing position and yieldingly holding the member against such movement.

10. In a bailer for bailing deep wells under pressure, the combination of a casing having an air-tight chamber and having an annular shoulder formed therein below the chamber, a frangible disc seating on said shoulder from the lower side, means set in the casing below the disc for holding the same upon its seat, a valve seat in the form of a bushing, a dart passing through the bushing, a valve on the dart to come upon the valve seat, said dart having its lower end projecting below the lower end of the casing and operating when the bailer is dropped upon the bottom of the well, to force the dart upwardly and break the disc thereby effecting the charging of the bailer through the action of the well pressure at the well bottom, said valve operating to retain the charge under pressure.

11. In a bailer for bailing deep wells under pressure, the combination of a casing having an air-tight chamber and having an annular shoulder formed therein below the chamber, a frangible disc seating on said shoulder from the lower side, means set in the casing below the disc for holding the same upon its seat, a valve seat in the form of a bushing, a dart passing through the bushing, a valve on the dart to come upon the valve seat, said dart having its lower end projecting below the lower end of the casing and operating when the bailer is dropped upon the bottom of the well, to force the dart upwardly and break the disc thereby effecting the charging of the bailer through the action of the well pressure at the well bottom, said valve operating to retain the charge under pressure, said casing having a discharge port at the side thereof, above the valve and below the frangible disc, a movable closure for the discharge port mounted on the casing, said discharge port enabling the frangible disc to be passed into the casing to place the same on said annular shoulder.

12. In a bailer for bailing deep wells under pressure, the combination of a casing having an air-tight chamber, a frangible member mounted in the bailer for sealing the lower end of the air chamber, said casing having a valve seat below

the air chamber, a dart with a valve normally resting on said seat, said dart having its lower end projecting at the lower end of the casing and operating when the bailer is dropped upon the

bottom of the well to force the dart relatively upwardly to break the frangible member and thereby effect the charging of the bailer through the action of the well pressure, said valve operating to retain the charge under pressure.

13. A well cleaner including a body having a charge-receiving chamber with an inlet, a closure for the inlet, the body having a tubular portion extending below the inlet, a tubular stem movable upwardly through the bore of said portion to open the chamber inlet, means forming a fluid-tight joint between the stem and portion when the stem is in its lowermost position with relation to the portion, there being intake openings through the portion below the inlet, an external wall-packer on the body above the intake openings, and a downwardly seating valve for the chamber and effective to retain a charge therein after it has been admitted through the opened inlet.

14. In a well tool adapted to be lowered through a well-casing and having a charge-receiving chamber with an inlet, a frangible closure for the inlet, a dart movable upwardly with relation to the body to break the closure, means tending to move the dart upwardly, releasable holding means for holding the dart against upward movement, a releasing member movable with respect to the body and said holding means, means for moving the releasing member and including an element engaging the well-casing to resist upward movement with respect thereto, said releasing member being operable upon movement in a predetermined direction with relation to the body to release the holding means and thereby allow upward movement of the operating member and being movable in that direction by virtue of withdrawal movement of the body with the casing-engaging element resisting upward movement, and a downwardly seating valve for the chamber and effective to retain a charge therein after it has been admitted through the opened inlet.

15. In a well tool of the character described, a hollow body, there being a transverse opening through the body wall, and a closure for the body-bore, said closure being insertible through said opening into operating position within said bore.

16. In a well tool of the character described, a hollow body, there being a transverse opening through the body wall, a seat in the body-bore adjacent the opening, and a closure for the body bore insertible through said opening into cooperating relation with said seat.

17. A well cleaner including a body having a charge-receiving chamber with an inlet, a closure for the inlet, the body having a tubular portion extending below the inlet, a stem movable upwardly through the bore of said portion to open the chamber, means spaced below the inlet and forming a fluid-tight joint between the stem and portion when the stem is in its lowermost position with relation to the portion, there being a transverse opening through the portion wall between said closure and said means, and means shiftable to and from a position closing said opening.

18. In a bailer for bailing wells under pressure, the combination of a casing having an air tight chamber with an inlet, a frangible disc below the chamber and closing the inlet, a valve seat below

the disc, a dart passing through the valve seat, a valve on the dart to come upon the valve seat, said dart having its lower end projecting below the lower end of the casing and operating, when the bailer is dropped upon the bottom of the well, to force the dart upwardly and break the disc thereby effecting the charging of the bailer through the action of well pressure at the well bottom, said valve operating to retain the charge under pressure.

19. A well cleaner including a body having a charge-receiving chamber with an inlet, a closure for the inlet, the body having a tubular portion extending below the inlet, means in the bore of said portion and movable upwardly to open the inlet, and a downwardly seating valve on said means and below the inlet.

20. A well cleaner including a body having a charge receiving chamber with an inlet, a frangible disc for the inlet, the body having a tubular portion extending below the inlet, means in the bore of said portion and movable upwardly to break the disc, and a downwardly seating valve on said means and below the inlet.

21. In a well tool adapted to be lowered through a well-casing and having a body provided with a charge-receiving chamber and an inlet therefor, a frangible closure for the inlet, a member movable with respect to the body to break the closure, and releasable holding means adapted to hold said member from upward movement and releasable to permit such movement of the member by virtue of withdrawal movement of the tool.

22. In a well tool adapted to be lowered through a well-casing and having a body provided with a charge-receiving chamber and an inlet therefor, a frangible closure for the inlet, and a member movable with respect to the body to break the closure, and controlled by withdrawal movement of the tool.

23. In a well tool adapted to be lowered through a well-casing and having a body provided with a charge-receiving chamber and an inlet therefor, a frangible closure for the inlet, a member movable with respect to the body to break the closure, a spring for so moving the member, and releasable holding means adapted to hold said member from upward movement and releasable to permit such movement of the member by virtue of withdrawal movement of the tool.

24. A well cleaner including a body having a charge-receiving chamber with a normally closed inlet, a vertically movable element for opening the inlet, a wall-drag element vertically movable with respect to the body adapted by its relative vertical movement in one direction to effect said inlet opening movement of the first named element, the wall drag element having further free vertical movement independent of the inlet opening element which carries it out of movement-effecting relation to said inlet opening element.

25. A well cleaner including a body having a charge-receiving chamber with a normally closed inlet, a vertically movable element for opening the inlet, a well-drag element vertically movable with respect to the body adapted, after a limited amount of non-effective movement, by its relative vertical movement in one direction to effect said inlet opening movement of the first named element, the wall drag element having further free vertical movement independent of the inlet opening element which carries it out of movement-effecting relation to said inlet opening element.

26. A well cleaner including a body having a charge-receiving chamber with a normally closed inlet, a vertically movable plunger within the body for opening the inlet, a wall-drag element vertically movable with respect to the body adapted by its relative vertical movement in one direction to effect said inlet opening movement of said plunger, the wall drag element having further free vertical movement independent of the plunger which carries it out of movement-effecting relation to said plunger.

27. A well cleaner including a body having a charge-receiving chamber with a normally closed inlet, a vertically movable element for opening the inlet, a wall-drag element downwardly movable with respect to the body adapted by its relative downward movement to effect said inlet opening movement of the first named element, the wall drag element having further free downward movement independent of the inlet opening element which carries it out of movement-effecting relation to said inlet opening element.

28. A well cleaner including a body having a charge-receiving chamber with a normally closed inlet, a vertically movable plunger within the body and acting to open the inlet by virtue of its vertical motion, and a wall drag element movable downwardly with respect to the body and adapted by said downward movement to effect said inlet-opening movement of said plunger.

29. A well cleaner including a body having a charge-receiving chamber with a normally closed inlet, a vertically movable plunger within the body and acting to open the inlet by virtue of its vertical motion, and a wall drag element vertically movable with respect to the body and independently vertically movable with relation to the inlet opening element and adapted by said downward movement to effect said inlet-opening movement of said plunger.

30. In a differential pressure well cleaner, a casing including a closed substantially air-tight low pressure chamber having an inlet, means for closing said inlet, operating means attached to said cleaner and extending to the surface of the well for lowering the cleaner in the well pipe, and means including an element engaging the interior of the well pipe automatically operable after the descent of the cleaner is stopped at the desired depth in the well and said operating means then moved upwardly, for opening said inlet to draw a charge into said casing by suction.

31. In a differential pressure well cleaner for cleaning the perforations in a well pipe, a casing including a closed substantially air-tight low pressure chamber having an inlet, means for closing said inlet, operating means attached to said cleaner and extending to the surface of the well for lowering the cleaner therein, means including an element engaging the interior of the well pipe automatically operable when the descent of the cleaner is stopped at the desired depth in the well, and the operating means then moved upwardly, for opening said inlet to draw a charge into said casing by differential pressure, and means carried by said casing for localizing the application of differential pressure to the perforations in a particular area of the well pipe.

32. In a differential pressure well cleaner, a casing including a closed substantially air-tight low pressure chamber having an inlet, means for closing said inlet, operating means attached to said cleaner and extending to the surface of the well for lowering the cleaner in the well pipe, means including an element engaging the interior

of the well pipe automatically operable when the descent of the cleaner is stopped at the desired depth in the well, and the operating means then moved upwardly, for opening said inlet to draw a charge into said casing by differential pressure, and means for retaining the charge in said casing when the cleaner is elevated from the well.

33. In a differential pressure well cleaner, a casing including a closed substantially air-tight low pressure chamber having an inlet, means for closing said inlet, operating means attached to said cleaner and extending to the surface of the well for lowering the cleaner in the well pipe, and means automatically operable when the descent of the cleaner is stopped at the desired depth in the well, and the operating means then moved upwardly, for opening said inlet to draw a charge into said casing by differential pressure, said automatically operable means including a member equipped with means to maintain it relatively stationary with respect to the well pipe during said upward movement of the operating means.

34. In a differential pressure well cleaner, a casing including a closed substantially air-tight low pressure chamber having an inlet, means for closing said inlet, operating means attached to said cleaner and extending to the surface of the well for lowering the cleaner in the well pipe, and means automatically operable when the descent of the cleaner is stopped at the desired depth in the well, and the operating means then moved upwardly, for opening said inlet to draw a charge into said casing by differential pressure, said automatically operable means including a member equipped with a wall drag element engaging the interior wall of the well pipe to maintain said member relatively stationary with respect to the well pipe during said upward movement of the operating means.

35. In a differential pressure well cleaner, a casing including a closed substantially air-tight low pressure chamber having an inlet, means for closing said inlet, operating means attached to said cleaner and extending to the surface of the well for lowering the cleaner in the well, and means automatically operable when the descent of the cleaner is stopped at the desired depth in the well, and the operating means then moved upwardly, for opening said inlet to draw a charge into said casing by differential pressure, said automatically operable means including a member which moves with the casing during the upward movement of the operating means, and a second member provided with means to maintain it relatively stationary with respect to the well pipe during said upward movement of the operating means.

36. In a differential pressure well cleaner adapted to be lowered into a well on a flexible operating line, a casing including a closed substantially air-tight low pressure chamber having an inlet, means for closing said inlet, and means operable by virtue of raising the operating line for opening said inlet to draw a charge into said chamber by differential pressure, said last-named means including a member adapted to be moved upwardly by initial upward movement of the operating line, and another member movable vertically with relation to the first member and adapted to remain, during such initial upward line movement, substantially in the position to which it was lowered prior to the initial upward movement.

37. In a differential pressure well cleaner adapted to be lowered into a well on a flexible

operating line, a casing including a closed substantially air-tight low pressure chamber having an inlet, means for closing said inlet, said cleaner including parts adapted for relative movement
 5 with respect to one another after the descent of the cleaner is stopped at the desired depth in the well, and the operating line moved upwardly, the relative movement of said parts being adapted to automatically open said inlet to draw a charge
 10 into said casing by differential pressure.

38. In a differential pressure well cleaner, a casing including a closed substantially air-tight low pressure chamber having an inlet, means for closing said inlet, operating means attached to
 15 said cleaner and extending to the surface of the well for lowering the cleaner in the well pipe, means for automatically opening said inlet after the descent of the cleaner is stopped at the desired depth in the well, and the operating means
 20 then moved upwardly, to draw a charge into said casing by differential pressure, said opening means comprising a part of the cleaner including an element engaging the interior of the well pipe
 25 when said operating means is moved upwardly after the cleaner has reached the desired depth in the well.

39. In a differential pressure well cleaner for cleaning the perforations in a well pipe, a casing
 30 including a closed substantially air-tight low pressure chamber having an inlet, means for closing

said inlet, operating means attached to said cleaner and extending to the surface of the well for lowering the cleaner therein, said cleaner including parts adapted for relative movement with
 5 respect to one another after the descent of the cleaner is stopped at the desired depth in the well, and the operating means moved upwardly, the relative movement of said parts being adapted to automatically open said inlet to draw a charge
 10 into said casing by differential pressure, and means carried by said casing for localizing the application of differential pressure to the perforations in a particular area of the well pipe.

40. In a differential pressure well cleaner, a casing including a closed substantially air-tight
 15 low pressure chamber having an inlet, means for closing said inlet, operating means attached to said cleaner and extending to the surface of the well for lowering the cleaner in the well pipe, said cleaner including parts adapted for relative move-
 20 ment with respect to one another after the descent of the cleaner is stopped at the desired depth in the well, and the operating means moved upwardly, the relative movement of said parts being adapted to automatically open said inlet to
 25 draw a charge into said casing by differential pressure, and means for retaining the charge in said casing when the cleaner is elevated from the well.

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