

Nov. 3, 1936.

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2,059,628

WELL TOOL CONTROL

Filed April 22, 1933

2 Sheets-Sheet 1

Fig. 1.

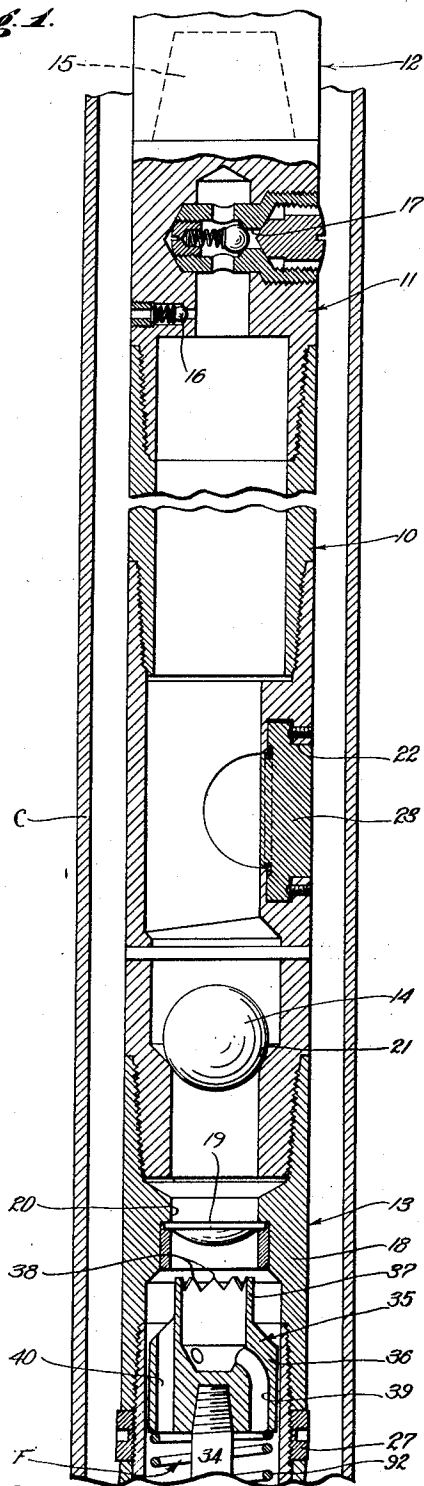
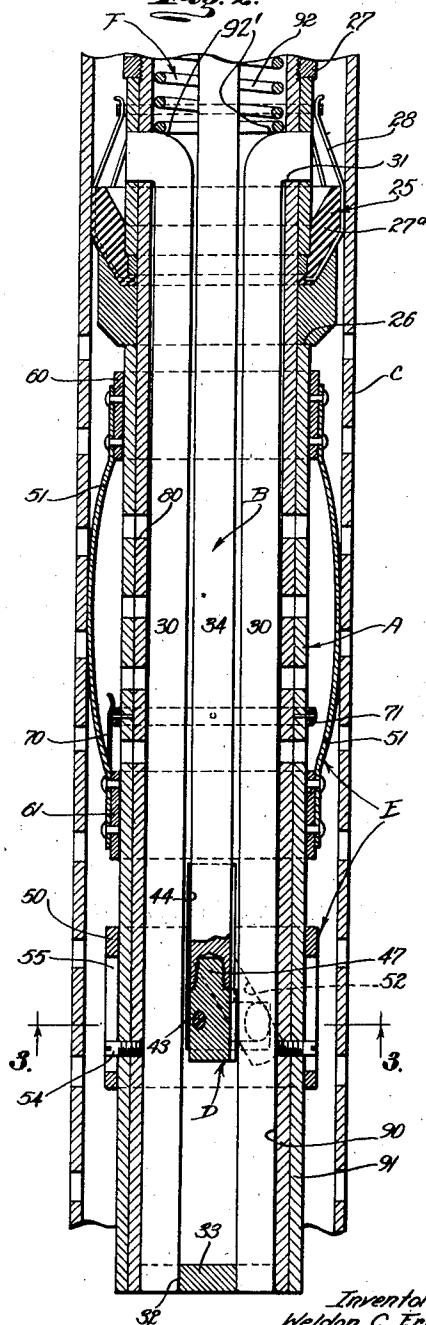


Fig. 2.



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2,059,628

WELL TOOL CONTROL

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Application April 22, 1933, Serial No. 667,438

41 Claims. (Cl. 166—19)

This invention relates to a well tool control, and relates more particularly to a control of the type known generally as a tailpiece, it being a general object of the present invention to provide a simple, practical, and dependable control useful on various well tools or devices.

Various operations in the drilling and maintenance of oil wells involve tools requiring controls. For example, tools employed in various fishing, cutting, bailing, cleaning, and like operations are commonly provided with control devices frequently referred to in the fields as tailpieces. The present invention provides a control applicable generally to well tools of the general type referred to, and particularly useful and practical as applied to bailers and/or well cleaners such as we set forth and claim in our copending application entitled Well tool, filed December 20, 1932, Serial No. 648,072, as will more particularly be pointed out later. It is to be understood that our present invention is concerned primarily with a control applicable generally to well tools, and that the present reference to particular well tools is not to be construed as limiting the scope or range of use of the invention.

It is a primary object of the present invention to provide a well tool control that is dependable in controlling the well tool, and holding it against operation until the operator deliberately operates the tool or control to release it for operation. In the case of many control devices heretofore proposed and used, accidental tripping or operation occurs in the course of running the structure into a well. With the control provided by our present invention the tool to which the control is connected can be lowered into the well rapidly, and without the exercise of great care, as the control is not subject to accidental tripping or operation as are ordinary devices of this character.

It is another object of this invention to provide a control having the characteristics above mentioned which can be dependably released or put into operation at the will of the operator, it being a feature of the invention that the control is operable by a simple lifting or upward movement of the tool when it has reached the desired point in the well. The control of the present invention includes a well engaging element establishing resistance between the tool and the well or well casing. However, the construction provided by the present invention is such that a slight "hanging up" or retarding of the tool in the course of its being lowered into the well will not trip or release the control, it being necessary for the operator to distinctly or definitely lift or move

the tool upwardly in order to effect operation.

Another object of the present invention is to provide a simple, practical and effective combination and assembly of parts in a device of the character mentioned. The structure of the present invention is simple and inexpensive of manufacture, and is free of complicated or delicate parts.

The various objects and features of the present invention will be best and more fully understood from the following detailed description of a typical form and application of the invention throughout which description reference is had to the accompanying drawings, in which:

Fig. 1 is a longitudinal detailed sectional view of the upper portion of an assembly including a well cleaner and a control embodying the present invention. Fig. 2 is a longitudinal detailed sectional view of the lower portion of the assembly. Fig. 3 is an enlarged detailed transverse sectional view taken through the control mechanism on line 3—3 on Fig. 2, and Fig. 4 is a side elevation of a portion of the control, being a view taken as indicated by line 4—4 on Fig. 3.

For the purpose of illustrating a typical application of the control provided by our invention, we have disclosed it applied to or in combination with a well cleaning tool or device, as such device presents a construction and operating condition well suited to making clear the nature and mode of operation of the device of our invention. In setting forth the control in combination with a well cleaner, certain features of construction and formation of parts are presented which make the construction suited to a well cleaner, and which may vary in detail and features of design in applying the control to a well tool of device other than a cleaner.

The well cleaner illustrated in the drawings includes generally a tubular body 10, a cap or head section 11 closing the upper end of the body 10, and providing means for connecting the tool with lowering and raising member 12, a closure section 13 at the lower end of the body, a check valve 14 at the lower end portion of the body, and various other parts and features of construction incidental to those mentioned.

The tubular body 10 corresponds generally to the tubular body of a well cleaner or bailer, and is therefore an element of considerable length, and may in practice be formed of several parts or sections suitably joined.

The cap 11 acts as a closure for the upper end of the material receiving chamber in body 10, and in the particular construction illustrated is in

the nature of a plug screw threaded into the upper end of the body 10 and provided at its upper end with a tapered pin 15 adapted to receive the member 12. It is to be understood that the member 12 may be any suitable member or part. For instance, it may be a rope socket at the lower end of a line, or it may be a coupling element at the lower end of a string of pipe or tubing. The cap 11 is shown provided with an escape valve 16 adapted to allow fluid to escape from the upper portion of the body upon an excessive pressure developing in the body, and with a suitably controlled opening 17 adapted to admit air or other fluid into the body in the course of unloading the cleaner.

The closure section 13 is provided at the lower end of the body 10, and includes a tubular part 18 attached to the lower section of the body 10 to form an extension or continuation thereof. A closure member in the form of a closure disc 19 is provided in the opening 20 formed through the part 18, and acts to close the lower end of the cleaner against the admission of fluid. The closure disc 19 is formed of fragile material such as glass, bakelite, or other material or composition adapted to be broken by a punch or the like.

The check valve 14 is located in the lower portion of the body 10 to cooperate with a seat 21 in the lower section of the body 10. Check valve 14 illustrated is in the form of a ball valve operable to allow free flow of fluid upwardly into the body 10 and to check discharge of fluid from the lower end of the body 10. A discharge or unloading opening 22 is provided in one side of the body 10 immediately above the valve 14. The opening 22 is provided with a removable closure 23 adapted to be removed when it is desired to unload the device.

The parts thus far described constitute the essential or principal parts characteristic of a well bailer and are more fully set forth and claimed in our copending application Serial #667,439—Well bailer, filed April 22, 1933, and wherein the showing of corresponding parts is substantially the same as in this application. The structure to which the control of this invention is applied is made particularly useful as a well cleaner operable to clean perforations in a well casing C, or the like, by the use of a packer 25 arranged in combination with parts thus far described. In the particular arrangement illustrated the packer 25 operates to pack between the casing C and the assembly formed by the parts above described and the control of the present invention. In the particular arrangement illustrated the packer is not applied directly to the parts thus far described, but is carried by a part which will be hereinafter described as a part of the control of the present invention. It will be apparent, however, that the packer 25 is primarily an element of the cleaner, and the portion of the control device hereinafter described which carries the packer may, for the purpose mentioned, be considered a part or extension of the parts that we have described.

In our copending application Serial #648,072, mentioned in the fore-part of this specification, we have shown and broadly claimed an arrangement wherein releasable means are adapted to hold the inlet opening 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, together with an

element associated with the member for engaging the well pipe to resist movement relative thereto whereby the cleaner may be moved to release the holding means. We have also shown and claimed a spring associated with such mechanism and operable to open the closure when the holding means is released. In that application, the holding means is illustrated as embodying latches mounted on the closure-opening means, which are normally maintained in holding position by a control member entered between the latches, and movable from between the latches by reason of withdrawal movement of the cleaner, the control member having a portion which frictionally engages the well pipe to bring about this result.

The control device provided by the present invention includes, generally, a body A, an operating member B, means F for operating member B, holding means D in connection with the operating member, and releasing means E for the holding means. The body A is adaptable to be attached to the cleaner or tool to be controlled, being in the nature of an extension or continuation of the body 10. Body A may therefore broadly be considered as a part of body 10. The operating member operatively connects the control and the tool or device to be controlled.

In the present case the member B relates the control with the closure disc 19. The holding means D is related to the operating member B and acts to normally hold the member B in a retracted or inoperative position. The releasing means E is operable to release the means D and the member B.

The body A of the control connects with or is applied to the body 10 of the cleaner to be rigid therewith. In the construction illustrated, the control is located below the cleaner, the upper end of the body A of the control being screw threaded to the part 18 of the cleaner which connects to the lower body section 10, and carries the closure disc 19. The body A forms a mounting or carrier for the other parts of the control, and in the preferred form of the invention it is tubular and of considerable length.

The packer 25, which may be considered an element of the cleaner controlled by the mechanism now being described, is shown located on the upper end portion of the body A. The packer is shown carried between an upwardly facing shoulder 26 on the body A and a collar 27 threaded on the body A immediately below its point of connection with the part 18. The particular packer illustrated includes a body 27^a of rubber or the like, shaped to normally bear outwardly against the inner wall of the casing C, which packing is protected by suitable guard elements 28 in the manner common to devices of this character.

A feature of the body structure is the provision of means for circulating fluid from the space between the body 10 and the casing above the packer 25 to the lower end of the control. The construction provided includes circulation ducts or tubes 30 which communicate with openings 31 through the wall of the body A above the packer 25, and extend downwardly through the body, and communicate with openings 32 provided in the plug 33, which closes the lower end of the body A. In the preferred construction there are two tubes 30 located diametrically opposite each other, and arranged close to the inner wall of the body A as clearly illustrated in Figs. 2 and 3 of the drawings.

The operating member B, in accordance with the broader principles of the invention, will vary depending upon other features of construction, and particularly with the device to be controlled by the structure of the present invention. In the case illustrated the operating member B is in the form of a rod 34 arranged longitudinally in the body A and provided at its upper end with a punch 35 adapted to engage and rupture the sealing disc 19. The rod 34 is located centrally in the body A, where there is no interference with the tubes 30. The punch 35 provided on the upper end of the rod 34 has an enlarged part 36 fitting more or less closely in the body A to guide the punch and the upper end of the rod. The disc engaging portion 37 of the punch is in the form of a tubular extension provided at its upper end with disc breaking parts or teeth 38. Ports 39 connect with the interior of the punch portion 37, and extend downwardly through the enlarged part 36 to provide free communication between the space in the body A below the enlargement 36 and the opening 20. Further, ports 40 are provided through the enlarged part 36 extending from the upper side of the part 36 outside of the part 37 to the underside of the part 36 as clearly shown in Fig. 1 of the drawings.

The control includes means F for operating or moving the rod 34 upwardly in the body A so that the punch engages and ruptures the sealing disc 19. In the form of the invention illustrated this rod operating means is preferably a spring means normally tending to urge or operate the rod upwardly in the body. We have illustrated a helical spring 92 arranged around the rod 34 between the lower end of the punch 35 and an abutment 92' in the body A. The abutment 92' supporting the lower end of the spring 92 is formed by the upper end portions of the circulation tubes 30 provided in the body as hereinabove described.

The holding means D operates to releasably hold the rod 34 in a retracted or down position, such as is shown in the several figures of the drawings. The means D is releasable to allow the rod 34 to operate vertically so that the punch 35 engages and ruptures the closure disc 19. In the form illustrated in the drawings the means D includes arms 43 projecting laterally from the rod 34 into openings in the body A. We have disclosed two oppositely disposed arms 43 projecting laterally from the lower end portion of the rod 34 into oppositely disposed openings in the body A. The openings in the body A are in the nature of slots formed through the wall body, each slot having a vertical or longitudinal portion 44 and a transverse or lateral portion 45 joining the lower end of the vertical portion. The arms 43 cooperate with the openings in the body so that the rod 34, to which the arms are connected, is free to move vertically relative to the body A when the arms are in the vertical portions 44 of the openings, but is held against longitudinal movement relative to the body when the arms are located in the lateral portions 45 of the openings as shown throughout the drawings. It will be apparent from the drawings that the arms are free to operate or move into and out of the lateral portions 45 of the openings. To facilitate free movement or operations of the arms 43 in the openings of the body, we prefer to provide the arms with rollers or bearing sleeves 46 mounted for free rotation on the arms 43 and fitting the openings in the body to operate freely therein. In the particular con-

struction illustrated in the drawings the arms 43 are connected to the lower end of the rod 34 by means of a pin 47 which screw threads into a suitable socket in the lower end of the rod 34. The rollers 46 provided on the arms 43 are arranged on the arms from their outer ends, and are retained in positions on the arms by retaining nuts 49.

The releasing means E provided by the present invention operates to move the arms 43 from the lateral portions 45 of the slots to the vertical portions 44 thereof upon the tool or assembly, being operated in a predetermined manner in the well or well casing C. The means E includes, generally, a part 50 shiftable relative to the body, and having cooperative engagement with the arms 43 and well engaging means, such as gripping parts 51, related to the part 50 to shift or operate it relative to the body when the tool is manipulated in a predetermined manner.

The part 50 in the preferred form of the invention is in the form of a sleeve slidably mounted on the body A. The sleeve 50 is mounted on the body for limited longitudinal movement relative thereto, and is provided with diametrically opposite openings 52, which receive the end portions of the arms 43 which project beyond the body A. The sleeve 50 is limited to a certain amount of longitudinal movement relative to the body A by means of pins 54, which project from the body A into longitudinal slots 55 provided in the sleeve 50, as clearly illustrated in Figs. 2 and 3 of the drawings. The openings 52 in the sleeve 50 are pitched or inclined, providing spiral cam-shoulders 52a and 52b, shoulders 52a serving to operate the arms 43 transversely of the tool or through the lateral portions 45 of the openings in the body A to move the arms into the lateral portions 44 of the openings as the sleeve is shifted longitudinally of the body. The openings 54 are disposed and proportioned so that the arms 43 are located in the lateral portions 45 of the body openings when the sleeve 50 is up or elevated, relative to the body, as shown throughout the drawings, but are operated through portions 45 of the body openings and the longitudinal portions 44 of the body openings upon the sleeve 50 being moved from the up or elevated portion to a down or depressed portion. The sleeve 50 in being thus related to the arms 43 provides a means (shoulders 52a) by which the arms 43 may be operated out of the lateral portions 45 of the body openings when the sleeve is operated through the gripping members 51, which are hereinafter described, and at the same time (shoulders 52b) acts as a retainer or retarding means preventing accidental movement of the arms 43 out of the lateral portions 45 of the body openings. The upper portions 52c of slots 52 register with portions 44 and open to the upper end of the sleeve, permitting arms 43 to ride upwardly beyond the end of the sleeve when the arms are released for movement through said portions 44.

Gripping parts 51 are mounted to shift or move longitudinally relative to the body A, and are designed to grip or fractionally engage the well or well casing C. In the preferred form of the invention the gripping parts are in the form of leaf springs, having their ends attached to rings 60 and 61 slidable on the body A, and their middle portions bowed outwardly to bear against the inner wall of the casing C as clearly illustrated in Fig. 2 of the drawings. The several springs or gripping parts 51, together with the

rings 60 and 61 form an assembly shiftable longitudinally on the body A. The gripping parts 51, or the assembly just referred to, is related to the sleeve 50 so that the resistance established by the parts 51 causes the sleeve 50 to be moved relative to the body upon the body A, being moved upwardly in the casing C. In the particular construction illustrated the assembly, including the gripping parts 51, engages but is not directly connected to the sleeve 50. Through this arrangement an initial movement or shifting of the parts 51 relative to the body A occurs before the sleeve 50 is moved to operate the arms 43.

In accordance with the preferred form of the invention, we provide means for normally holding the assembly including the gripping parts 51, in an up or elevated position on the body A as shown in Fig. 2. This means may include a spring finger or latch 70 projecting from one of the rings carrying the parts 51 to cooperate with an annular projection 71 on the body A. The projection 71 may be in the form of a ring suitably located, and fixed on the body A as shown in the drawings. The spring latch 70 cooperates with the projection 71 so that the assembly, including the parts 51, is normally retained in an up position on the body, and does not shift or move downwardly relative to the body until the body A is definitely moved upwardly relative to the casing C engaged by the gripping parts 51. When the assembly, including the parts 51, has shifted relatively to the body A to disengage the latch, continued movement of the body A upwardly in the casing C, will cause the lower end of the ring 61 to engage the upper end of the sleeve 50, and as such movement between the body A and the casing C continues, sleeve 50 will be moved or forced downwardly operating the arms 43 out of the parts 45 of the body openings.

The control provided by the present invention being employed in connection with a well cleaner as above described, openings are provided to admit fluid or material from the well into the device. In the form of construction illustrated, suitable inlet openings 80 are provided in the body A of the control, as clearly illustrated in Fig. 2 of the drawings. When the parts of the control are formed and related as hereinabove described, it is advantageous to form the body A of two sections as shown throughout the drawings. Referring particularly to Fig. 2 of the drawings, it will be apparent how the body A is formed by an inner tubular section 90, which extends throughout the entire length of the control, and an outer section 91 which fits over the section 90, and extends upwardly from the lower end of the control to the packer 25, where its upper end forms the shoulder 26. The body openings, which receive the pins 43, and the openings 80 are formed through both the body sections 90 and 91. The pins 54 which guide the sleeve 50 and limit its longitudinal movement on the body A extend between and connect the two sections 90 and 91 of the body.

From the foregoing description it is believed that the operation of the device will be fully and accurately understood. As the tool or cleaner, together with the control, is lowered into the well, for instance downwardly in the well casing C; the various parts are related and positioned as illustrated throughout the drawings. When the tool reaches the desired point in the casing C the operator lifts the tool so that it has a definite upward movement in the casing C. As the tool is lifted or moved upwardly in the casing C (in

other words, as initial withdrawal movement is imparted through the lowering mechanism) the assembly, including the gripping parts 51, resists such movement, and due to the frictional engagement between the members 51 and the inner wall of the casing C, it remains fixed in the casing as the other parts of the tool move upwardly. In the commencement of such operation the latch 70 is first released and then the ring or abutment 61 engages the upper end of the sleeve 50. As the operation continues the sleeve 50 is engaged and then moved by the ring 61, during which operation the arms 43 are moved out of the lateral parts 45 of the body openings into the vertical parts 44 of the body openings. Immediately upon the arms 43 moving into register with the vertical parts 44 of the body openings the spring 92 operates to move the rod 34 upwardly in the body A so that the punch 35 is moved into engagement with the closure disc 19 to rupture it. Communication is thus established between the interior of the body 10 and the well casing through the body A and the openings 80 in the body A. The body A having been introduced into the well empty and sealed by means of the closure 19 the hydrostatic head of fluid in the casing C will cause fluid and material from the casing C, and more specifically the fluid from below the packer 25, to enter and fill body 10 until the pressures inside and outside of the body are equalized. The check valve 14 then operates to close the lower end of the body 10, and thus traps a body of fluid or material in the body 10 to be withdrawn from the well with the tool. When the tool reaches the top of the well or has been removed from the well, the body 10 can be emptied or discharged by removing the closure 23 and suitably operating the control of opening 17 provided at the upper end of the body 10.

Having described only a typical form and application of the invention, we do not wish to limit ourselves to the details hereinabove set forth, but wish to reserve to ourselves any changes, modifications, or variations that may appear to those skilled in the art and fall within the scope of the claims.

Having described our invention, we claim:

1. A control for a well tool having a body and an element carried by the body and actuatable to operate the tool, said control embodying an operating member supported by and shiftable with relation to the body to actuate said element, holding means normally holding the operating member from shifting, said holding means including a member movable to a position releasing the operating member, a releasing member carried by and movable with respect to the body and said holding means, and means for moving the releasing member, said releasing member having cam-engagement with said movable holding member during movement of the releasing member in a predetermined direction relative to the body and being thereby operative to move said movable holding member to release position.
2. A control for a well tool having a body and an element carried by the body and actuatable to operate the tool, said control embodying an operating member supported by and shiftable with relation to the body to actuate said element, means tending to shift said member, holding means normally holding the operating member from shifting, said holding means including a member movable to a position releasing the operating member, a releasing member carried by and movable with respect to the body and said

holding means, and means for moving the releasing member, said releasing member having cam-engagement with said movable holding member during movement of the releasing member in a predetermined direction relative to the body and being thereby operative to move said movable holding member to release position.

3. A control for a well tool having a body and an element carried by the body and actuatable to operate the tool, said control embodying an operating member supported by and shiftable axially of the body to actuate said element, holding means normally holding the operating member from shifting, said holding means including a member movable transversely of the body to a position releasing the operating member, a releasing member movable axially of the body and with respect to said holding means, and means for moving the releasing member, said releasing member having cam-engagement with said movable holding member during movement of the releasing member in a predetermined direction relative to the body and being thereby operative to move said movable holding member to release position.

4. A control for a well tool having a body and an element carried by the body and actuatable to operate the tool, said control embodying an operating member supported by and shiftable with relation to the body to actuate said element, holding means normally holding the operating member from shifting, said holding means including a member movable to a position releasing the operating member, a releasing member embodying a sleeve on the exterior of the body and movable with respect to the body and said holding means, and means for moving the releasing member, said releasing member having cam-engagement with said movable holding member during movement of the releasing member in a predetermined direction relative to the body and being thereby operative to move said movable holding member to release position.

5. A control for a well tool having a body and an element carried by the body and actuatable to operate the tool, said control embodying an operating member supported by and shiftable with relation to the body to actuate said element, holding means normally holding the operating member from shifting, said holding means including a member movable to a position releasing the operating member, a releasing member carried by and movable with respect to the body and said holding means, means for moving the releasing member, said releasing member having cam-engagement with said movable holding member during movement of the releasing member in a predetermined direction relative to the body and being thereby operative to move said movable holding member to release position, and an abutment member carried by and movable longitudinally of the body and engageable with the releasing member when the abutment member is moved with relation to the body in one direction, said abutment member having an element connected thereto and adapted to engage a well casing.

6. A control for a well tool having a body and an element carried by the body and actuatable to operate the tool, said control embodying an operating member supported by and shiftable with relation to the body to actuate said element, holding means normally holding the operating member from shifting, said holding means including a member movable to a position releasing

the operating member, a releasing member carried by and movable with respect to the body and said holding means, means for moving the releasing member, said releasing member having cam-engagement with said movable holding member during movement of the releasing member in a predetermined direction relative to the body and being thereby operative to move said movable holding member to release position, an abutment member carried by and movable longitudinally of the body and engageable with the releasing member when the abutment member is moved with relation to the body in one direction, and means releasably holding said abutment member spaced longitudinally of the body from said releasing member and against movement in said one direction.

7. A control for a well tool having a body and an element actuatable to operate the tool, said control embodying an operating member shiftable in one direction with relation to the body to actuate said element and tending normally to shift in that direction when the tool is lowered into a well, holding means normally releasably holding the member against shifting in that direction and including a projection on said member cooperating with an opening in the body which opening has a longitudinal part to allow shifting of the projection in said one direction and a lateral part presenting a shoulder adapted to hold the projection against such movement, a releasing member shiftable carried by the body and engageable with said projection, said last named member being operative by virtue of shifting movement in one direction to move said projection from the lateral part of the opening to the longitudinal part thereof, and means for so shifting the last named member.

8. A control for a well tool having a body and an element actuatable to operate the tool, said control embodying an operating member shiftable in one direction with relation to the body to actuate said element and tending normally to shift in that direction when the tool is lowered into a well, holding means normally releasably holding the member against shifting in that direction and including a projection on said member cooperating with an opening in the body which opening has a longitudinal part to allow shifting of the projection in said one direction and a lateral part presenting a shoulder adapted to hold the projection against such movement, a releasing member shiftable carried by the body and connected with the holding means to release said operating member upon being shifted in a predetermined direction relative to the body, and means whereby said releasing member is shifted upon predetermined movement of the body in the well.

9. A control for a well tool having a body and an element actuatable to operate the tool, said control embodying an operating member shiftable in one direction with relation to the body to actuate said element and tending normally to shift in that direction when the tool is lowered into a well, holding means normally releasably holding the member against shifting in that direction and including a projection on said member cooperating with an opening in the body which opening has a longitudinal part to allow shifting of the projection in said one direction and a lateral part presenting a shoulder adapted to hold the projection against such movement, and means for moving the projection out of the lateral part of the opening and including a part

shiftable longitudinally of the body and having an angularly disposed shoulder engaging the projection, and means whereby said last mentioned part is shifted upon predetermined movement of the body in the well.

10. A control for a well tool having a body and an element actuatable to operate the tool, said control embodying an operating member shiftable in one direction with relation to the body to actuate said element and tending normally to shift in that direction when the tool is lowered into a well, holding means normally releasably holding the member against shifting in that direction and including a projection on said member cooperating with an opening in the body which opening has a longitudinal part to allow shifting of the projection in said one direction and a lateral part presenting a shoulder adapted to hold the projection against such movement, and means for moving the projection out of the lateral part of the opening and including a sleeve shiftable longitudinally of the body and having an angularly disposed opening receiving the projection, and means whereby the sleeve is shifted upon predetermined movement of the body in the well.

11. A control for a well tool having a body and an element actuatable to operate the tool, said control embodying an operating member shiftable in one direction with relation to the body to actuate said element and tending normally to shift in that direction when the tool is lowered into a well, holding means normally releasably holding the member against shifting in that direction and including a projection on said member cooperating with an opening in the body which opening has a longitudinal part to allow shifting of the projection in said one direction and a lateral part presenting a shoulder adapted to hold the projection against such movement, and means for moving the projection out of the lateral part of the opening and including a part shiftable longitudinally of the body and having an angularly disposed shoulder engaging the projection, and means whereby said last mentioned part is shifted upon predetermined movement of the body in the well, said last named means embodying an element adapted to engage a wall of the well and to coact with said last mentioned part when the body is given the predetermined movement.

12. A control for a well tool having a body and an element actuatable to operate the tool, said control embodying an operating member shiftable in one direction with relation to the body to actuate said element and tending normally to shift in that direction when the tool is lowered into a well, holding means normally releasably holding the member against shifting in that direction and including a projection on said member cooperating with an opening in the body which opening has a longitudinal part to allow shifting of the projection in said one direction and a lateral part presenting a shoulder adapted to hold the projection against such movement, and means for moving the projection out of the lateral part of the opening and including a sleeve shiftable longitudinally of the body and having an angularly disposed opening receiving the projection, and means whereby the sleeve is shifted upon predetermined movement of the body in the well, said last named means embodying an element adapted to engage a well casing and to coact with the sleeve when the body is given the predetermined movement.

13. A control for a well tool having a body and

an element actuatable to operate the tool, said control embodying an operating member shiftable in one direction with relation to the body to actuate said element and tending normally to shift in that direction when the tool is lowered into a well, holding means normally releasably holding the member against shifting in that direction and including a projection on said member cooperating with an opening in the body which opening has a longitudinal part to allow shifting of the projection in said one direction and a lateral part presenting a shoulder adapted to hold the projection against such movement, and means for moving the projection out of the lateral part of the opening and including a sleeve shiftable longitudinally of the body and having an angularly disposed opening receiving the projection, and means whereby the sleeve is shifted upon predetermined movement of the body in the well, said last named means embodying an element adapted to engage a well casing and to coact with the sleeve when the body is given the predetermined movement; said element being out of coacting relation with the sleeve until the body has been so moved a predetermined extent.

14. A control for a well tool having a body and an element actuatable to operate the tool, said control embodying an operating member shiftable in one direction with relation to the body to actuate said element and tending normally to shift in that direction when the tool is lowered into a well, holding means normally releasably holding the member against shifting in that direction and including a projection on said member cooperating with an opening in the body which opening has a longitudinal part to allow shifting of the projection in said one direction and a lateral part presenting a shoulder adapted to hold the projection against such movement, and means for moving the projection out of the lateral part of the opening and including a sleeve shiftable longitudinally of the body and having an angularly disposed opening receiving the projection, and means whereby the sleeve is shifted upon predetermined movement of the body in the well, said last named means embodying an assembly slidably mounted on the body for movement with relation to and into engagement with the sleeve when the body is given such predetermined movement, said assembly including an element adapted to engage a well casing.

15. A control for a well tool having a body and an element actuatable to operate the tool, said control embodying an operating member shiftable in one direction with relation to the body to actuate said element and tending normally to shift in that direction when the tool is lowered into a well, holding means normally releasably holding the member against shifting in that direction and including a projection on said member cooperating with an opening in the body which opening has a longitudinal part to allow shifting of the projection in said one direction and a lateral part presenting a shoulder adapted to hold the projection against such movement, and means for moving the projection out of the lateral part of the opening and including a sleeve shiftable longitudinally of the body and having an angularly disposed opening receiving the projection, means holding the sleeve against rotation on the body, and means whereby the sleeve is shifted longitudinally with respect to the body upon predetermined movement of the body in the well.

16. A control for a well tool having a body and an element actuatable to operate the tool, said control embodying an operating member shiftable in one direction with relation to the body to actuate said element and tending normally to shift in that direction when the tool is lowered into a well, holding means normally releasably holding the member against shifting in that direction and including a projection on said member cooperating with an opening in the body which opening has a longitudinal part to allow shifting of the projection in said one direction and a lateral part presenting a shoulder adapted to hold the projection against such movement, and means for moving the projection out of the lateral part of the opening and including a sleeve shiftable longitudinally of the body and having an angularly disposed opening receiving the projection, a bearing sleeve on the projection and engaging the walls of the body and sleeve openings, and means whereby the sleeve is shifted upon predetermined movement of the body in the well.

17. In combination with a well tool including a body having a charge-receiving chamber with an inlet, and a closure adapted normally to close the inlet; an operating member shiftable with relation to the body to open the inlet, holding means normally holding the operating member from shifting, a releasing member movable with respect to the body and said holding means, and means for moving the releasing member; said releasing member being operable upon movement in a predetermined direction relative to the body to release the operating member.

18. In combination with a well tool including a body having a charge-receiving chamber with an inlet, there being an opening in the body opening to the exterior thereof and in communication with said inlet, a packer on the body above said opening, and there being a circulation duct in the body opening to the exterior of the body at points above and below the packer when the inlet is closed, and a closure adapted normally to close the inlet; an operating member shiftable with relation to the body to open the inlet, holding means normally holding the operating member from shifting, a releasing member movable with respect to the body and said holding means, and means for moving the releasing member; said releasing member being operable upon movement in a predetermined direction relative to the body to release the operating member.

19. A control for a well tool including a tubular body, an operating member within the bore of the body and shiftable, for its operation, relative to the body, holding means normally holding the member against operative shift and embodying a pair of cooperating elements, one on the body and one on the operating member, and a releasing member shiftable mounted on the outside of the body and relatively movable with respect to both said cooperating elements, said releasing member cooperating with one of said elements in a manner to move it and thereby release said operating member upon shifting of said releasing member in a predetermined direction relative to the body.

20. A control for a well tool including a tubular body, an operating member within the bore of the body and shiftable, for its operation, longitudinally of the body, holding means normally holding the member against operative shift and embodying a pair of cooperating elements, one

on the body and one on the operating member, and a releasing member longitudinally shiftable on the outside of the body and relatively movable with respect to both said cooperating elements, said releasing member cooperating with one of said elements in a manner to move it and thereby release said operating member upon shifting of said releasing member in a given direction longitudinally of the body.

21. A control for a well tool including a tubular body, an operating member within the bore of the body and shiftable, for its operation, relative to the body, means tending normally to shift the operating member, holding means normally holding the member against operative shift and embodying a pair of cooperating elements, one on the body and one on the operating member, and a releasing member shiftable mounted on the outside of the body and relatively movable with respect to both said cooperating elements, said releasing member cooperating with one of said elements in a manner to move it and thereby release said operating member upon shifting of said releasing member in a predetermined direction relative to the body.

22. In combination with a well tool including a body adapted to be lowered through a well and having a charge-receiving chamber with an inlet and a closure adapted normally to close the inlet; an operating member shiftable with relation to the body to open the inlet, holding means normally holding the operating member from shifting, a releasing member movable with respect to the body and said holding means, and means for moving the releasing member, said releasing member being operable by virtue of withdrawal movement of the body to release the operating member.

23. A control for a well tool having a body and an element actuatable to operate the tool, said control embodying an operating member shiftable relative to the body to actuate said element, holding means normally releasably holding the member against operation, release means for disengaging the holding means to release the operating member for operation, said release means including a member shiftable longitudinally on the body, an assembly carried on the body and movable at times on the body for shifting the last named member, the assembly including an element adapted to engage a well casing, and releasable means normally holding the assembly from moving on the body in a manner to shift said last named member.

24. A control for a well tool having a body and an element actuatable to operate the tool, said control embodying an operating member shiftable relative to the body to actuate said element, holding means normally releasably holding the member against operation, release means for disengaging the holding means to release the operating member for operation, said release means including a sleeve shiftable longitudinally on the body, an assembly carried on the body and movable at times on the body for shifting the last named member, the assembly including a second sleeve slidable, at times, on the body, and an element on the second sleeve and adapted to engage a well casing.

25. A control for a well tool having a body and an element actuatable to operate the tool, said control embodying an operating member shiftable relative to the body to actuate said element, holding means normally releasably holding the mem-

ber against operation, release means for disengaging the holding means to release the operating member for operation, said release means including a sleeve shiftable longitudinally on the body, an assembly carried on the body and movable at times on the body for shifting the last named member, the assembly including a second sleeve slidable, at times, on the body, an element on the second sleeve and adapted to engage a well casing, and releasable holding means normally holding said second sleeve from sliding on the body.

26. A control for a well tool having a body and an element actuatable to operate the tool, said control embodying a member supported by and longitudinally and rotatably movable with respect to the body, said member being adapted, by virtue of its movement, to actuate said element, a second element extending transversely from the member, a shoulder on the body and extending transversely thereof, said shoulder being adapted to engage said transverse element, and a member movable longitudinally of the body and having a spiral cam-shoulder engaging the transverse element.

27. A control for a well tool having a body and an element actuatable to operate the tool, said control embodying a member supported by and longitudinally and rotatably movable with respect to the body, said member being adapted, by virtue of its movement, to actuate said element, a second element extending transversely from the member, a shoulder on the body and extending transversely thereof, said shoulder being adapted to engage said transverse element, and an exterior sleeve on and movable longitudinally of the body and having a spiral cam-shoulder engaging the transverse element.

28. A control for a well tool having a body and an element actuatable to operate the tool, said control embodying a member supported by and longitudinally and rotatably movable with respect to the body, said member being adapted, by virtue of its movement, to actuate said element, a second element extending transversely from the member, a shoulder on the body and extending transversely thereof, said shoulder being adapted to engage said transverse element, a second member movable longitudinally of the body and having a spiral cam-shoulder engaging the transverse element, and an abutment member movable longitudinally of the body and engageable with said second mentioned member when the abutment member is moved with relation to the body, and an element adapted to coact with the abutment member and to engage a well casing.

29. A control for a well tool having a charge-receiving chamber with an inlet and an element actuatable to control fluid-flow through said inlet, said control embodying a member operable to actuate said element and longitudinally and rotatably movable with respect to the body, a pin extending from the member, a shoulder on the body and extending transversely thereof, said shoulder being adapted to engage said pin, and a member movable longitudinally of the body and having a spiral cam-shoulder engaging the pin.

30. A control for a well tool having a charge-receiving chamber with an inlet and an element actuatable to control fluid-flow through said inlet, said control embodying a member operable to actuate said element and longitudinally and rotatably movable with respect to the body, a pin extending from the member, a shoulder on the body and extending transversely thereof, said shoulder being adapted to engage said pin, a

member movable longitudinally of the body and having a spiral cam-shoulder engaging the pin, and means carried by the body and coactible with the last named member and adapted to engage a well casing.

31. A control for a well tool having a charge-receiving chamber with an inlet and an element actuatable to control fluid-flow through said inlet, said control embodying a member operable to actuate said element and longitudinally and rotatably movable with respect to the body, a pin extending from the member, a shoulder on the body and extending transversely thereof, said shoulder being adapted to engage said pin, a member movable longitudinally of the body and having a spiral cam-shoulder engaging the pin, and an abutment member movable longitudinally of the body and engageable with the last named member when the abutment member is moved with relation to the body, said abutment member having a gripping element connected thereto and adapted to engage a well casing.

32. A control for a well tool having a body and an element supported by the body and actuatable to operate the tool, said control embodying a member supported by and longitudinally and rotatably movable with respect to the body, said member being adapted, by virtue of its longitudinal movement in one direction, to actuate said element and normally tending to move in that direction, an element extending transversely from the member, a shoulder on the body and extending transversely thereof, said shoulder being adapted to engage said transverse element releasably to hold the first mentioned member against movement in said one direction, and a member movable longitudinally of the body and having a spiral cam-shoulder engaging the transverse element, said cam-shoulder being adapted to move the transverse element from the transverse shoulder when the last named member is moved in one direction longitudinally of the body.

33. A control for a well tool having a body and an element supported by the body and actuatable to operate the tool, said control embodying a member supported by and longitudinally and rotatably movable with respect to the body, said member being adapted, by virtue of its longitudinal movement in one direction, to actuate said element, means normally tending to move said member in that direction, an element extending transversely from the member, a shoulder on the body and extending transversely thereof, said shoulder being adapted to engage said transverse element releasably to hold the first mentioned member against movement in said one direction, and a member movable longitudinally of the body and having a spiral cam-shoulder engaging the transverse element, said cam-shoulder being adapted to move the transverse element from the transverse shoulder when the last named member is moved in one direction longitudinally of the body.

34. A control for a well tool having a body and an element supported by the body and actuatable to operate the tool, said control embodying a member supported by and longitudinally and rotatably movable with respect to the body, an element extending transversely from the member, a shoulder on the body and extending transversely thereof, and a member movable longitudinally of the body and having a spiral cam-shoulder engaging one side of the transverse element and an opposing shoulder at the other side of the transverse element.

35. A control for a well tool having a body and an element supported by the body and actuatable to operate the tool, said control embodying a member supported by and longitudinally and rotatably movable with respect to the body, an element extending transversely from the member, a shoulder on the body and extending transversely thereof, and a member movable longitudinally of the body and having a spiral cam-shoulder engaging one side of the transverse element and a parallel opposing shoulder at the other side of the transverse element.

36. In combination with a well tool including a body having a charge receiving chamber with an inlet, and an openable closure for the inlet; a closure-opening member supported by and longitudinally and rotatably movable with respect to the body, said member being adapted, by virtue of its longitudinal movement, to open the closure an element extending transversely from the member and movable therewith, a shoulder on the body and extending transversely thereof, said shoulder being adapted to engage said transverse element, and a member movable longitudinally of the body and having a spiral cam-shoulder engaging the transverse element, said last named member being adapted, in its movement with respect to the body and by virtue of its cam-shoulder engagement with said transverse element, to rotate said transverse element along said transverse shoulder.

37. In combination with a well tool including a body having a charge receiving chamber with an inlet, and an openable closure for the inlet; a closure-opening member supported by and longitudinally and rotatably movable with respect to the body, said member being adapted, by virtue of its longitudinal movement, to open the closure, an element extending transversely from the member and movable therewith, a shoulder on the body and extending transversely thereof, said shoulder being adapted to engage said transverse element, and an exterior sleeve on and movable longitudinally of the body and having a spiral cam-shoulder engaging the transverse element, said sleeve being adapted, in its movement with respect to the body and by virtue of its cam-shoulder engagement with said transverse element, to rotate said transverse element along said transverse shoulder.

38. In combination with a well tool including a body adapted to be lowered through a well and having a charge receiving chamber with an inlet, and an openable closure for the inlet; a closure-opening member supported by and longitudinally and rotatably movable with respect to the body, said member being adapted, by virtue of its longitudinal movement, to open the closure, an element extending transversely from the member and movable therewith, a shoulder on the body and extending transversely thereof, said shoulder being adapted to engage said transverse element, and an exterior sleeve on and movable longitudinally of the body and having a spiral cam-shoulder engaging the transverse element, said sleeve being adapted, in its movement with respect to the body and by virtue of its cam-shoulder engagement with said transverse element, to rotate said transverse element along said transverse shoulder.

tudinal movement, to open the closure, an element extending transversely from the member and movable therewith, a shoulder on the body and extending transversely thereof, said shoulder being adapted to engage said transverse element, and a member movable longitudinally of the body and having a spiral cam-shoulder engaging the transverse element, said last named member being adapted, in its movement with respect to the body and by virtue of its cam shoulder engagement with said transverse element, to rotate said transverse element along said transverse shoulder, said last named member being so moved with respect to the body by virtue of withdrawal movement of the body.

39. A control for a well tool adapted to be lowered through a well and having a charge-receiving chamber with an inlet and an element actuatable to control fluid-flow through said inlet, said control embodying a member operable to actuate said element and longitudinally and rotatably movable with respect to the body, a pin extending from the member, a shoulder on the body and extending transversely thereof, said shoulder being adapted to engage said pin, and a member movable longitudinally of the body and having a spiral cam-shoulder engaging the pin, said last named member being so movable by virtue of withdrawal movement of the tool.

40. In combination with a well tool including a body adapted to be lowered through a well and having a charge-receiving chamber with an inlet and a closure adapted normally to close the inlet, an operating member shiftable relative to the body to open the inlet, an assembly on the body and movable at times with respect to the body for controlling the movement of the operating member with respect to the body, and releasable means normally holding the assembly from moving on the body, said holding means being released by virtue of withdrawal movement of the body.

41. In combination with a well tool including a body adapted to be lowered through a well and having a charge-receiving chamber with an inlet and a closure adapted normally to close the inlet, an operating member shiftable relative to the body to open the inlet, an assembly on the body and movable at times with respect to the body for controlling the movement of the operating member with respect to the body, and releasable resilient means normally holding the assembly from moving on the body, said holding means being released by virtue of withdrawal movement of the body.

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