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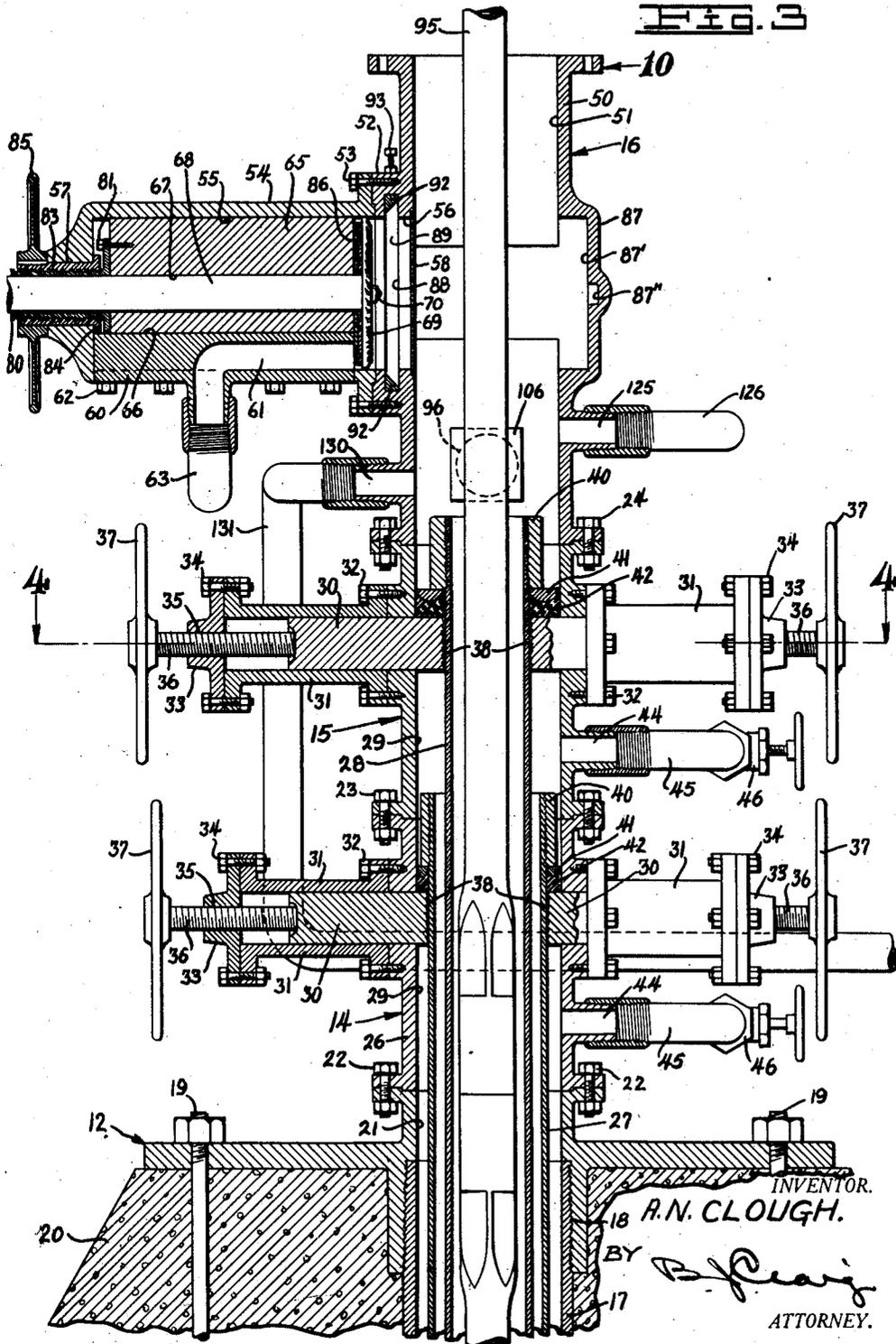
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CONTROL DEVICE FOR OIL OR GAS WELLS

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# UNITED STATES PATENT OFFICE

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## CONTROL DEVICE FOR OIL OR GAS WELLS

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This invention relates to control devices for oil or gas wells.

The general object of the invention is to provide an improved device for use with a "blown-out" well which is adapted to effectively shut off the flow.

Another object of the invention is to provide means for shutting off a well and for directing and controlling the flow from the well after it has been shut off.

A further object of the invention is to provide a device of the class described including a cutting means which is adapted to cut through casing, drill tubing, sucker rod, or any other elements which may be in the well to provide a passageway for the shut off valve.

Another object of the invention is to provide novel means for gripping and supporting a string of tools or sucker rod after it has been cut in two.

A further object of the invention is to provide a device of the class described having an improved gate adapted to close the valve passage so that the cutting tool may be removed for repairs.

Another object of the invention is to provide a device of the class described including means for supporting a plurality of well casings and means for directing the flow of fluid from the various casings.

A further object of the invention is to provide an improved emergency blow out shut-off which is adapted to be clamped around a well casing and which includes means for cutting through the various casings and a string of tools and means for stopping the flow of fluid in the well.

Other objects and the advantages of this invention will be apparent from the following description taken in connection with the accompanying drawings wherein:

Fig. 1 is a side elevation of my improved device positioned on a well and showing the operating installation.

Fig. 2 is a section taken on line 2—2 of Fig. 1 showing a fragmentary elevation of another side of the device.

Fig. 3 is an enlarged central vertical section through the device.

Fig. 4 is a section taken on line 4—4 of Fig.

3 showing a set of casing supporting and gripping jaws.

Fig. 5 is a fragmentary section similar to Fig. 3 showing the shut-off valve in a closed position.

Fig. 6 is a section taken on line 6—6 of Fig. 5.

Fig. 7 is a fragmentary section through the shut-off unit showing the closure gate.

Fig. 8 is a section taken on line 8—8 of Fig. 5.

Fig. 9 is a section taken on line 9—9 of Fig. 8.

Fig. 10 is a central vertical section through a modified form of shut-off valve.

Fig. 11 is a section taken on line 11—11 of Fig. 10.

Fig. 12 is a section similar to Fig. 10 showing the shut-off valve closed, and

Fig. 13 is a section taken on line 13—13 of Fig. 10.

Referring to the drawings by reference characters I have indicated my improved device generally at 10. As shown this device comprises a base 12, casing supporting units 14 and 15 and a shut-off unit 16.

The base 12 is adapted to be secured to the outer casing 17 of the well as by screw threaded engagement as indicated at 18 and is preferably anchored as by bolts 19 to a cement foundation 20. The base includes a central aperture 21 approximately the same size as the interior of the casing 17.

The casing supporting unit 14 is shown as removably secured to the base 12 by bolts 22 and the casing supporting unit 15 is shown as removably secured to the unit 14 by bolts 23 and the shut-off unit 16 is shown as removably secured to the unit 15 by bolts 24.

The units 14 and 15 are similar in construction and are interchangeable and although I have shown only two of these units for supporting casings 27 and 28, similar units may be added for each additional string of casing used in a well. As shown the units 14 and 15 include a body portion 26 having a central aperture 29 therein which is preferably of the same size as the aperture 21 in the base 12. For supporting casings I provide a pair of oppositely disposed jaws 30 in

each unit which are shown as positioned in opposed housings 31 secured to the body portions 26 by bolts 32 and provided with caps 33 secured thereto by bolts 34 and provided with a central screw threaded aperture 35.

For moving the jaws 30 into engagement with the casings I provide screw threaded rods 36 positioned in the threaded apertures 35 of the caps 33 and provided with a hand wheel 37.

As shown in Fig. 4 the casing engaging ends of the jaws 30 are shaped to fit the casing and are preferably provided with gripping teeth as indicated at 38 in Fig. 3. The upper ends of the casings 27 and 28 are each provided with an enlarged collar 40 which is adapted to engage a metal ring 41 seated on a resilient packing ring 42 which is supported on the jaws 30, thus the weight of the casing causes the ring 41 to flatten the resilient packing ring and cause it to tightly engage the inner wall of the aperture 29 and the outer wall of the casing thereby providing a fluid tight seal between the casing and the supporting unit.

Each of the casing supporting units 14 and 15 is preferably provided with an outlet 44 having a pipe 45 connected thereto for directing the flow of fluid from the interior of the casing therebelow. As shown in Fig. 2 each of the pipes 45 is preferably provided with a control valve 46 and a one-way check valve 47.

The shut-off unit 16 includes a body portion 50 having a central aperture 51 therein which is preferably of the same size as the aperture 29 in the units 14 and 15 and the aperture 21 in the base 12. Thus it will be seen that the entire device 10 is provided with a central aperture approximately the same size as the interior of the outer well casing 17, thereby providing an unobstructed passageway through the device for handling the various inner casings.

Secured to an enlarged boss 52 as by bolts 53 I provide a shut-off valve housing 54 having a bore or recess 55 therein which communicates at one end with an aperture 56 in the body portion 16. The opposite end of the valve housing is closed and provided with an aperture 57 which communicates with the recess 55. For normally closing the aperture 56 to prevent refuse from entering the valve housing during normal operation of the well I provide a metal seal 58 which may be secured to the body 16 as by welding or in any other suitable manner.

As shown in Fig. 6 the recess 55 is circular in cross section and a conduit plate 60 having a square conduit 61 thereon which extends up into the recess 55 is secured to the valve housing 54 as by bolts 62. The conduit 61 is preferably connected to a pipe 63 for directing the flow of fluid therefrom and as shown in Fig. 1 the pipe 63 includes a con-

trol valve 64 and may include a check valve 64'.

Positioned in the recess 55 of the valve housing 54 I provide a shut-off valve 65 having a recess 66 therein positioned over the conduit plate 60 and a central aperture 67 having a shaft 68 positioned therein. As clearly shown in Figs. 6 and 8 the outside diameter of the shut-off valve 65 is greater than the diameter of the aperture 51. The inner end of the shaft 68 has a cutting tool 69 secured thereto which is adapted to cut an aperture the same size as the diameter of the shut-off valve 65 and includes a reduced pilot cutter 70.

For rotating the shaft 68 and the cutter 70 I have shown in Fig. 1 a steam turbine indicated generally at 71 and connected by a pipe 72 including a throttle or control valve 72' to a steam generating boiler 73 located a suitable distance from the well.

For operating the cutter 69 by hand I provide a gear 74 on the shaft 68 which meshes with a gear 75 of a power jack indicated generally at 76 and shown as including a hand wheel 78. The gear 75 of the power jack is preferably movable into and out of engagement with the gear 74 as indicated in Fig. 1. The conduit plate 60 also acts as a key to prevent turning of the valve 65 when the shaft 68 is rotated.

For feeding the cutter towards the work I provide a screw threaded sleeve 80 surrounding the shaft 68 and secured to the shut-off valve 65 as by bolts 81. Surrounding the sleeve 80 and in screw threaded engagement therewith and positioned in the aperture 57 of the housing 54 I provide a spool 83 having an enlarged flange 84 adjacent its inner end and having a hand wheel 85 secured and keyed to its outer end. It will thus be seen that upon rotation of the hand wheel 85 in one direction the spool 83 will be revolved and will cause the sleeve 80 to move towards the aperture 51 thereby moving the shut-off valve 65 and the cutter 69.

For reducing the friction between the cutter 69 and the end of the shut-off valve 65 I preferably provide a suitable anti-friction bearing 86.

Opposite the aperture 56 I provide an enlarged portion 87 in the body portion 50 in which is provided a circular recess 87' of the same diameter as the cutter 69 and the valve 65 and of sufficient depth to house the cutter 69, the bearing 86 and a portion of the valve 65 when the valve is closed as shown in Fig. 5. The enlargement 87 also includes a recess 87'' of a size to house the pilot cutter 70 when the valve 65 is closed.

In the boss 52 I provide a slot 88 which has a height greater than that of the aperture 56 and is closed at one end and open at the opposite end. A gate or valve 89 is positioned in the slot 88 and is provided with bevelled

upper and lower surfaces as indicated at 90 which are adapted to engage similarly bevelled tapered surfaces 91 of upper and lower inserts 92, which are fitted in the slot 88 as clearly shown in Fig. 7. Threaded set screws 93 are provided in the enlarged portion or boss 52 which are adapted to engage the upper insert 92 which is movable and when the gate 89 is closed are adapted to be moved downward thereby forcing the upper insert downwardly against the upper bevelled surface 90 of the gate which in conjunction with the bottom bevelled surface 90 thereof and the bevelled surface 91 of the lower insert will wedge the gate 89 into tight engagement with the front wall of the slot 88 thereby tightly closing the aperture 56.

For gripping and supporting a string of tools as indicated at 95 I provide a pair of opposed plungers 96 mounted in housings 97 and apertures 98 in the body portion 50. The housings 97 are shown as secured to the body portion by bolts 99 and are provided with caps 100 secured to the housings by bolts 101. The caps 100 include a screw threaded aperture 102 in which screw threaded pipes 103 are positioned. As clearly shown in Fig. 8 the inner ends of the plungers 96 are bevelled as at 104 and include a reduced boss 105.

A slip 106 is secured to the boss 105 of each of the plungers as by a rod 107. The rear faces of the slips are bevelled to conform to the bevel 104 of the plungers 96. As shown in Fig. 9 the gripping faces of the slips 106 are shaped to conform to the shape of the string of tools 95 and are provided with gripping teeth as indicated at 108 in Fig. 8. For preventing turning of the plungers 96 I preferably provide keys 109 in the housings 97 and keyways 110 in the plungers.

For actuating the plungers 96 to cause them to grip the string of tools 95 I have shown a hydraulic means in Fig. 1. In this hydraulic actuating means the pipes 103 communicate with the lower portion of a tank 112 having a fluid such as oil therein, and a float 113 which is adapted to provide a chamber above the oil. The upper portion of the tank 112 is connected by a pipe 114 to the steam generating boiler 73 and includes a control valve 115 and a check valve 116 and an exhaust valve 117 is provided on the tank 112. Thus it will be seen that when steam is let into the chamber above the float the pressure of the steam will force the float downward and force the fluid in the tank 112 under pressure through the pipes 103 into the piston housings 97 thereby forcing the pistons 96 to move toward each other and grip the string of tools 95. Suitable packing such as indicated at 118 is preferably provided on the pistons 96 to prevent the fluid from passing between the pistons and packing such as indicated at 119 is preferably secured to the caps 100 to prevent the

fluid from passing out between the pipes 103 and the caps.

A hand wheel 120 is secured to each of the pipes 103 by which the pipes 103 may be rotated to move the pistons into engagement with the string of tools 95 in case the hydraulic actuating means is out of order or the pipes 103 may be brought into engagement with the pistons 96 to hold them in engagement with the string of tools after the hydraulic means has actuated them and it is desired to relieve the hydraulic means.

An outlet 125 is preferably provided on the body portion 50 and connected to a pipe 126 which is adapted to convey fluid from the unit 16 and is shown in Fig. 2 as including a control valve 127 and a check valve 128 similar to those on the pipes 45. The pipes 45, the pipe 63 and the pipe 126 may extend to a suitable storage reservoir (not shown).

An inlet 130 is preferably provided on the body portion 50 and connected to a pipe 131 which includes a control valve 132 and communicate with a mud pump 133.

When my improved device 10 is installed in a well as shown in Fig. 1 and the well blows out the pistons 96 are immediately actuated either by the hydraulic means or by the hand means to grip the string of tools in the well. Then the cutter 69 is rotated either by the steam turbine 71 or by means of the hand power jack 78 and fed towards the central aperture 51 by the hand wheel 85. The gate 89 is normally open so that it will not interfere with the cutter 69. As the cutter is fed forward it cuts through the seal 58 and then engages and cuts through the string of tools 95 whereupon the cutter need not be rotated further but the cutter and shut-off valve 65 is continued to be fed forward until the cutter, the bearing and the end of the shut-off valve is positioned in the recess 87' as shown in Fig. 5.

When the shut-off valve 65 is in this position the fluid passes out through the conduit 61 into the pipe 63 and may also be conveyed out through the outlet 125 and the pipe 126. If so desired mud may be pumped through the pipe 131 and through the inlet 130 into the well.

By providing the gate 89 the cutter 70 may be backed out, the gate 89 closed and clamped in position, the valve housing 54 removed and a new cutter secured to the shaft 68 should the cutter 70 become dull or damaged before the cutting operation is finished.

In Figs. 10, 11 and 12 I have indicated generally at 140 a modified form of my device. This modification is adapted for use as an emergency outfit on a well which blows out and is not provided with my device 10.

As shown the device 140 includes a body portion 142 formed in two halves and adapted to be secured together as by bolts 143 and provided with a central aperture 144. The

body portion 142 is also shown as including a lower flange 144' and an upper flange 144''.

Secured to an enlarged portion 145 as by bolts 146 I provide a shut-off valve housing 5 147 having a recess 148 therein which communicates at one end with an aperture 149 in the body portion 142. The opposite end of the valve housing is closed and provided with an aperture 150 which communicates with the 10 recess 148. As clearly shown in Fig. 11 the recess 148 is circular in cross section and a plate 152 having a conduit 153 thereon which extends up into the recess 148 is secured to the under side of the valve housing 147 as by 15 bolts 154. A similar plate 156 having a conduit 157 thereon which extends down into the recess 148, is secured to the top of the valve housing 147 as by bolts 158. The conduit 153 is preferably connected to a pipe 159 and the conduit 157 is connected to a pipe 20 160 for directing the flow of fluid from conduits 153 and 157.

Positioned in the recess 148 of the valve housing I provide a shut-off valve 162 having 25 a recess 163 therein positioned around the conduit 153 and a recess 164 positioned around the conduit 157. As shown the bottom wall of the conduit 153 is spaced from the plate 152 and the upper wall of the conduit 157 is 30 spaced from the plate 156, thus it will be seen the conduits 153 and 157 will telescope in the recesses 163 and 164 of the valve 162.

An aperture 165 is provided in the under side of the valve 162 and communicates with 35 the valve recess 163 and within the valve body I provide recesses 166 which form communicating passageways between the recess 163 and the recess 164. As clearly shown in Fig. 11 the outside diameter of the valve 162 is 40 greater than the diameter of the recess 144 in the body portion 142 and includes a central aperture 168 in which a shaft 169 is positioned.

A cutting tool 170 is secured on the inner 45 end of the shaft 169 and is adapted to cut an aperture the same size as the diameter of the valve 162 and includes a pilot cutter 171.

For rotating the shaft 169 and the cutter 50 170 I secure a hand wheel 173 adjacent the outer end of the shaft 169. If desired the shaft 169 may be connected to a power operating means such as the steam turbine shown in conjunction with the device 10. The conduits 153 and 157 also act as keys to prevent 55 turning of the valve 162 when the shaft 169 is rotated.

For feeding the cutter 170 towards the work I provide a screw threaded sleeve 175 60 surrounding the shaft 169 and secured to the valve 162 as by bolts 176. Positioned in the aperture 150 and in screw threaded engagement with the sleeve 175 I provide a spool 177 having an enlarged flange 178 adjacent its inner end and having a hand wheel 179 se- 65 cured adjacent its outer end. It will thus

be seen that upon rotation of the hand wheel 179 in one direction the spool 177 will be revolved and cause the sleeve 175 to move towards the aperture 144 thereby moving the valve 162 and the cutter 171. For reducing 70 the friction between the cutter and the end of the shut-off valve 162 I preferably provide an anti-friction bearing 180.

Opposite the aperture 149 I provide an enlarged portion 181 in the body portion 142 75 in which is provided a circular recess 182 of the same diameter as the cutter 170 and the valve 162 and of sufficient depth to house the cutter, the bearing and a portion of the valve when the valve is in a closed position as 80 shown in Fig. 12. The enlargement 181 also includes a recess 183 of a size sufficient to house the pilot cutter 171.

In the enlarged portion 145 I provide a slot 185 similar to the slot 88. This slot 185 is 85 closed at one end and open at the opposite end like the slot 88. A gate 186 similar to the gate 89 of the device 10 and shown in detail in Fig. 7 is positioned in the slot 185 and includes bevelled upper and lower edges 90 which are adapted to engage similarly bevelled surfaces of upper and lower inserts 187 similar to the inserts 92 of the device 10. Threaded set screws 188 are provided in the 95 enlarged portion 145 which are adapted to engage the upper insert 187 and when the gate is closed are adapted to be moved downward to thereby force the upper insert 187 downward against the bevelled upper 100 edge of the gate 186 which in conjunction with the bottom bevelled edge of the gate and the bevelled surface of the lower insert will wedge the gate into tight engagement with the front wall of the slot 185 and thereby 105 tightly close the aperture 149.

Below the valve housing 147 and at approximately right angles thereto I provide an enlarged boss portion 195 on each side of the body portion 142 and secure thereto as by 110 bolts 196 housings 197 and 198. The housings 197 and 198 are each provided with a recess 199 and apertures 200 are provided in the body portion 142 and are adapted to align with the recesses 199. The outer end 115 of the recess 199 in the housing 198 is closed and a screw threaded aperture 201 is provided in the housing 197 which communicates with the recess 199 therein.

Within the recess 199 of the housing 197 I 120 provide a rod 202 which is of a smaller diameter than that of any drill rod in the well, having cutting teeth 203 at its forward end and provided with a shaft 204 at its opposite end. The shaft 204 is positioned in an 125 externally screw threaded sleeve 205 which is positioned in the threaded aperture 201.

A key 205' is provided in the housing and a keyway 205'' is provided in the sleeve 205 to prevent rotation of the sleeve. A hand wheel 206 is secured to the free end of the shaft 204 130

for rotating the shaft and a hand wheel 207 is positioned on the sleeve 205 and is in screw threaded engagement therewith and abuts the end of the housing 197. Upon rotation of the hand wheel 207 in one direction it will move the rod 202 toward the housing 198. It will be understood that instead of the hand wheels 206 and 207 power operated means may be provided for rotating the shaft 204 and the sleeve 205.

When it is desired to install my emergency device 140 on a well which has blown out it is desirable to tunnel below the surface of the ground a suitable distance which may be about twenty or thirty feet to expose the outer casing. The valve housing 147 and its associated parts is removed from the body portion 142 and the two halves of the body portion 142 are separated. The two halves of the body portion are then placed around the outer well casing indicated at 190 and secured together with the bolts 143 thereby tightly clamping the body portion 142 to the outer casing 190. The valve housing 147 and its associated parts are then secured to the body portion 142 with the bolts 146. A foundation may then be provided under the bottom flange 144' and braces may be provided which extend from the upper flange 144' to the roof of the tunnel.

After the device has been secured to the outer casing 190 the shaft 204 is rotated, thus rotating the rod cutting bar 202 and the hand wheel 207 is rotated to feed the bar 202 towards the housing 198. As the cutter is rotated and advances it cuts through the outer casing 190, the inner casings 191 and 192 and the drill tubing 193. After the cutting bar 202 has gone through the casings and the drill tubing, part of the bar 202 will be positioned in the recess 199 of the housing 198 and part in the recess 199 of the housing 197, thus it will be seen that the bar 202 will support the inner casings 191 and 192 and the drill tubing 193 and prevent them from dropping down into the well.

The cutter 170 is then rotated by the hand wheel 173 and fed towards the casing 190 by the hand wheel 179. As the cutter is thus fed it will cut an aperture through the casing 190 of the same size as the valve 162 and will cut similar apertures through any other inner casings such as indicated at 191 and 192 and through the string of tools 193 until the cutter has cut through the opposite side of the outer casing 190 and the cutter, bearing, and the end of the valve is positioned in the recess 182 as shown in Fig. 12.

When the shut-off valve 162 is in this position the fluid in the inner casing 192 enters the valve recesses 163 and 164, through the aperture 165 and passes through the conduits 153 and 157 to the pipes 159 and 160 whence it may be conveyed to suitable storage tanks.

Referring to Fig. 12 it will be seen that by

making the inlet aperture 165 with an area approximating the area of the interior of the casing 192 the valve 162 prevents the fluid in the inner casing 192 from backing up into the other casings 190 and 191 as it would tend to do as the greatest pressure is usually in the inner casing.

By providing the gate 186 the cutter 170 may be backed into the recess 148, the gate closed, the valve housing 147 removed and a new cutter 170 secured to the shaft 169 should the cutter 170 become dull or damaged before the cutting operation is finished.

From the foregoing description it will be apparent that I have provided a novel means for shutting off a blowing well which is simple in construction and highly efficient in use.

Having thus described my invention, I claim:

1. In a shut-off device including a body portion having a main and a lateral aperture therein, a valve housing removably secured to said body portion, a recess in said valve housing in alignment with the lateral aperture of said body portion, a conduit in said valve housing extending into said recess, the axis of said conduit being parallel to the axis of said valve housing recess, a valve in said housing and a recess in said valve adapted to receive said conduit.

2. In a shut-off device, a body portion having a bore, said body portion having an aperture communicating with said bore, a valve housing, a recess in said valve housing, a valve in said recess, a cutting tool, means to rotate said cutting tool to cut an aperture to receive said valve, means to move said valve across said bore, said valve when moved across said bore being adapted to restrict passage of fluid through said bore, and means on said valve coacting with means on said valve housing to direct fluid to one side of said valve and out of said device.

3. In a shut-off device, a body portion, an aperture in said body portion, another aperture in said body portion at approximately right angles to and communicating with said first aperture, said body portion comprising a plurality of sections secured together, a valve housing secured to said body portion, a recess in said valve housing, a valve and a cutting tool is said recess, said cutting tool being adapted to cut an aperture to receive said valve, means to rotate said cutting tool, means to move said valve towards and across said first aperture, said valve when moved across said first aperture being adapted to restrict passage of fluid through said first aperture, and means on said valve coacting with means on said valve housing adapted to direct fluid from one side of said valve out of said device.

4. In a shut-off device, a body portion, a valve housing secured to said body portion, a

- recess in said valve housing, a valve in said recess, a shaft, a cutting tool secured to said shaft and rotatable relative to said valve, said cutting tool being adapted to cut an aperture to receive said valve, means to rotate said cutting tool, means to move said valve towards and across said aperture, said valve when moved across said aperture being adapted to restrict passage of fluid through said aperture.
5. In a shut-off device for a well, a body portion, an aperture in said body portion, another aperture in said body portion communicating with said first aperture, said body portion comprising a plurality of sections removably secured together, a valve housing secured to said body portion, a recess in said valve housing aligning with said second aperture, a valve in said recess, a cutting tool associated with said valve, said cutting tool being adapted to cut an aperture to receive said valve, said valve being adapted to restrict passage of fluid through said first aperture, and a cutting tool disposed below said valve, said last mentioned tool being adapted to pierce a casing in said well.
6. In a shut-off device, a body portion, an aperture in said body portion, another aperture in said body portion at approximately right angles to and communicating with said first aperture, said body portion comprising a plurality of sections removably secured together, a valve housing secured to said body portion, a recess in said valve housing aligning with said second aperture, a valve in said recess, a shaft positioned in said valve, a cutting tool secured to said shaft adjacent the end of said valve which is disposed towards said second aperture, said cutting tool being adapted to cut an aperture to receive said valve, means to rotate said cutting tool and means to feed said cutting tool and said valve towards and across said first aperture, said valve when moved across said first aperture being adapted to restrict passage of fluid through said first aperture, and means on said valve coacting with means on said valve housing adapted to direct fluid from one side of said valve out of said device, a pair of opposed housings on said body portion, a recess in each of said housings and apertures in said body portion aligning with said recesses, a rod positioned in said recess of one of said housings, cutting teeth on one end of said rod, a reduced shaft extending from the opposite end of said rod, means to rotate said shaft and means to feed said rod towards said opposite housing.
7. In a shut-off device including a body portion having a main and a lateral aperture therein, a valve housing removably secured to said body portion, a recess in said valve housing in alignment with the lateral aperture of said body portion, a conduit in said valve housing extending into said recess, the axis of said conduit being parallel to the axis of said valve housing recess, a valve in said housing and a recess in said valve adapted to receive said conduit, a gate associated with said body portion, said gate being movable across said lateral aperture to restrict passage therethrough.
8. In a shut-off device including a body portion having a main and a lateral aperture therein, a valve housing on said body portion, a recess in said valve housing in alignment with said lateral aperture of said body portion, a conduit in said valve housing extending into said recess, a valve in said housing and a recess in said valve adapted to receive said conduit.
- In testimony whereof, I hereunto affix my signature.
- ALFRED N. CLOUGH.

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