

Dec. 4, 1923.

J. N. SWANSON

1,476,554

WELL

Filed July 3, 1922

4 Sheets-Sheet 1

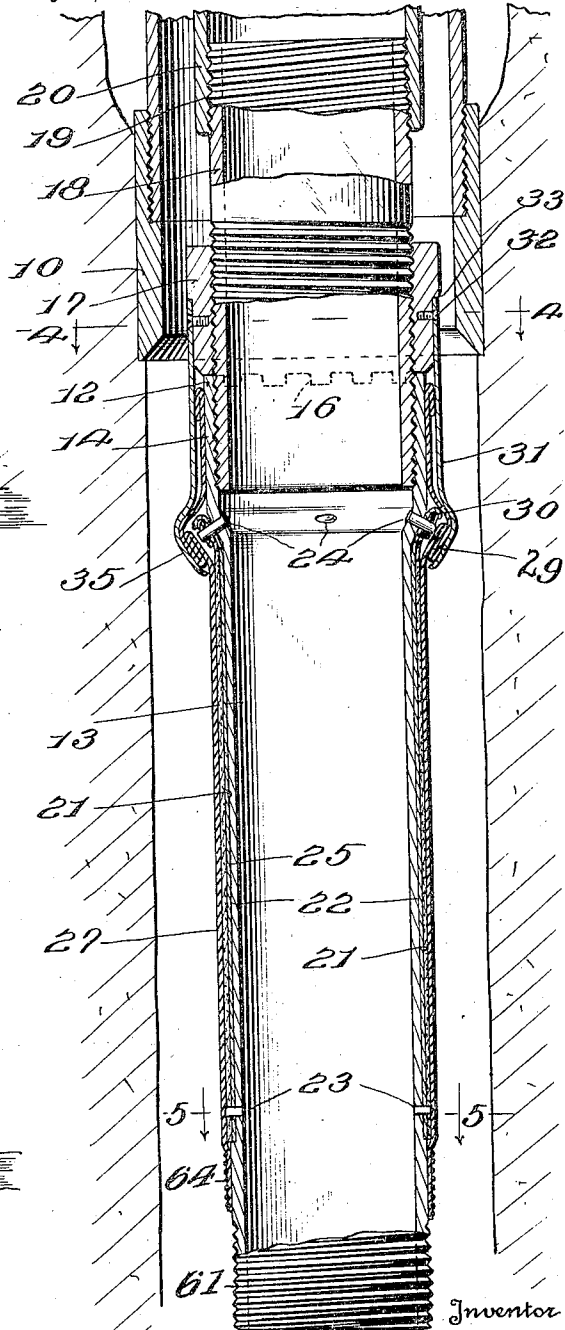
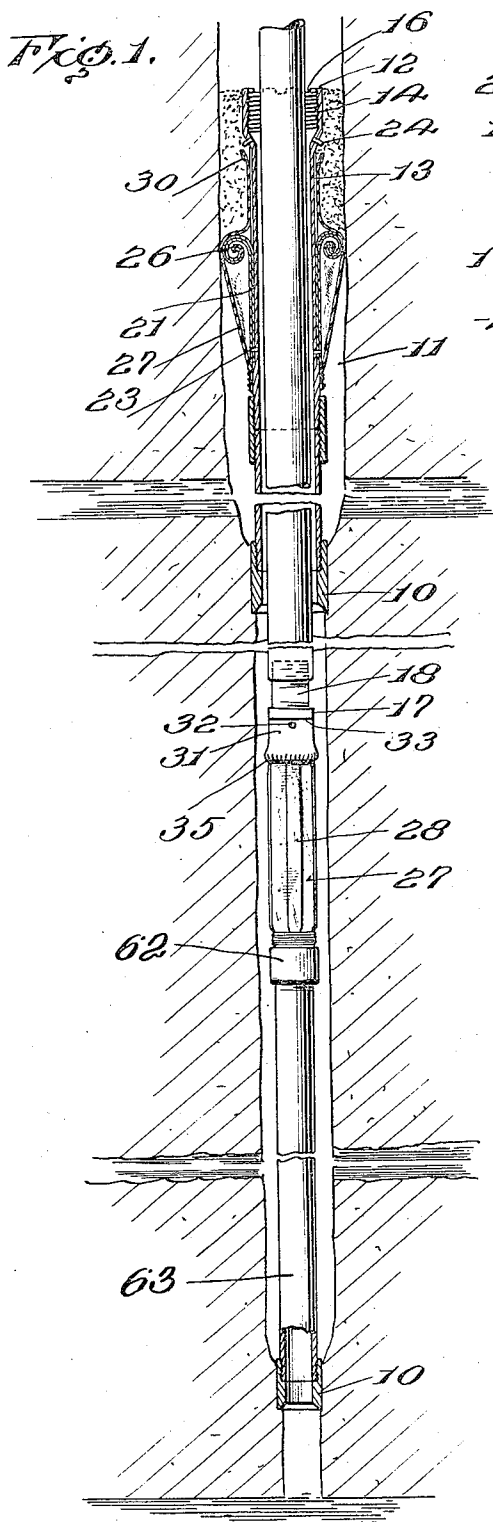


FIG. 2. J. N. Swanson

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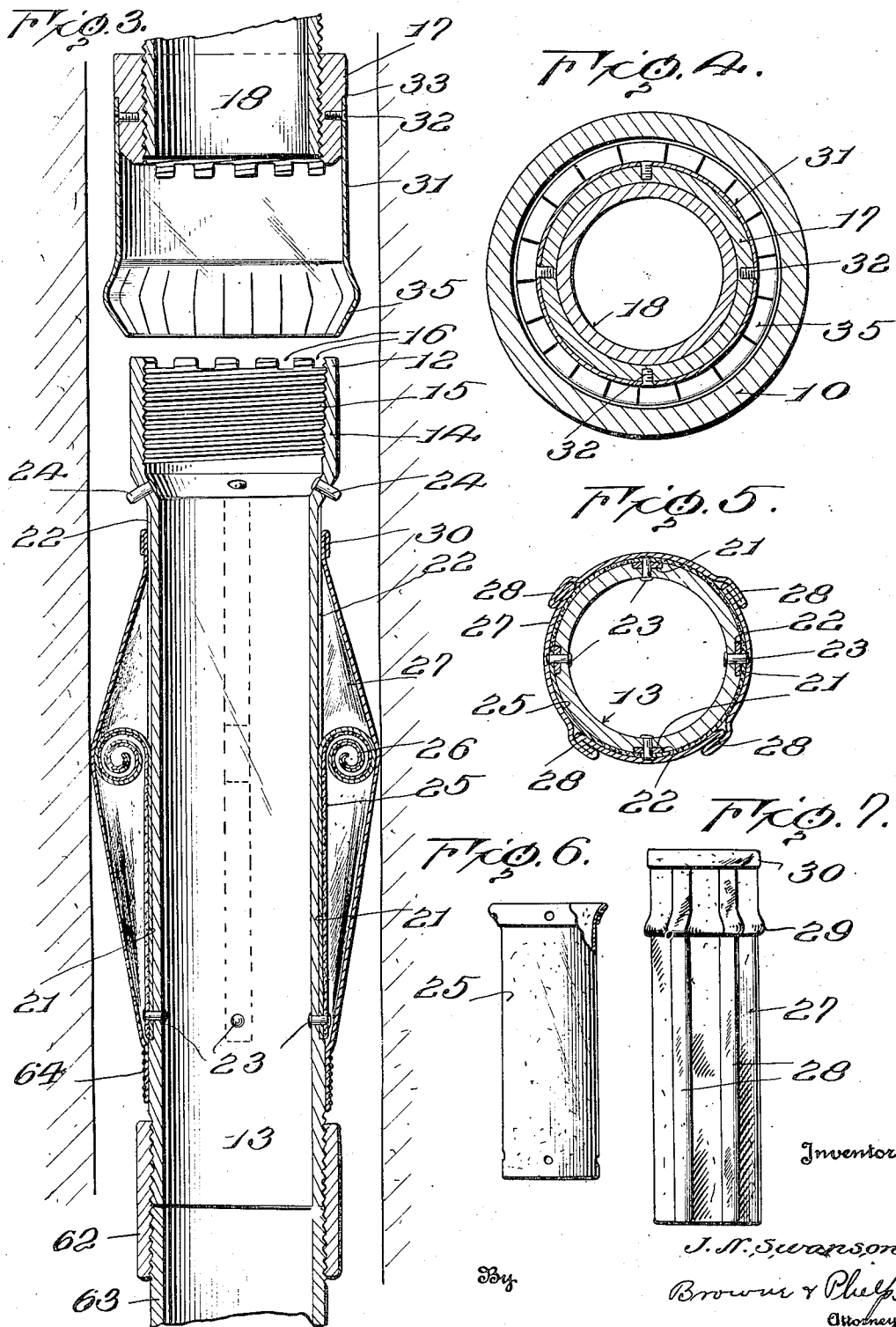
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Fig. 8.

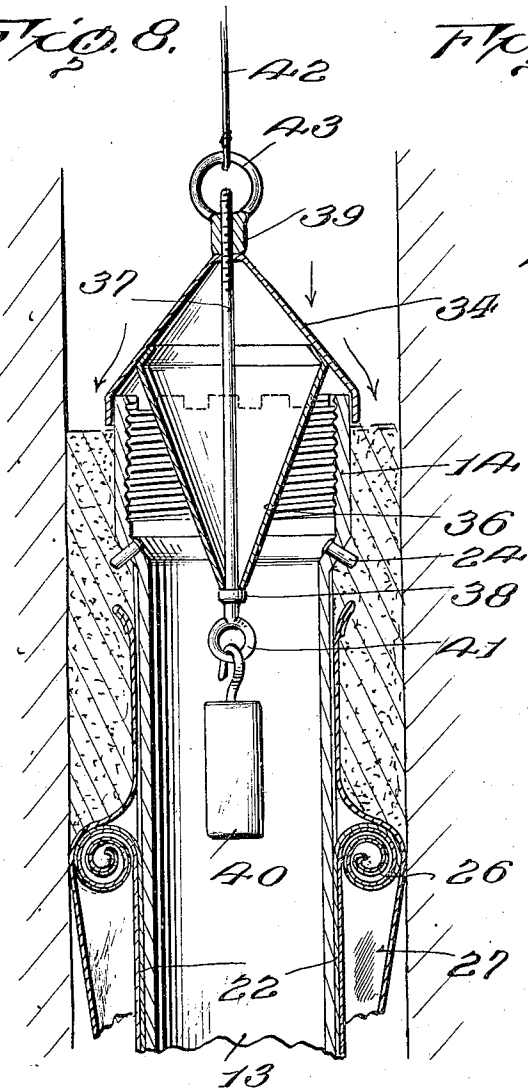
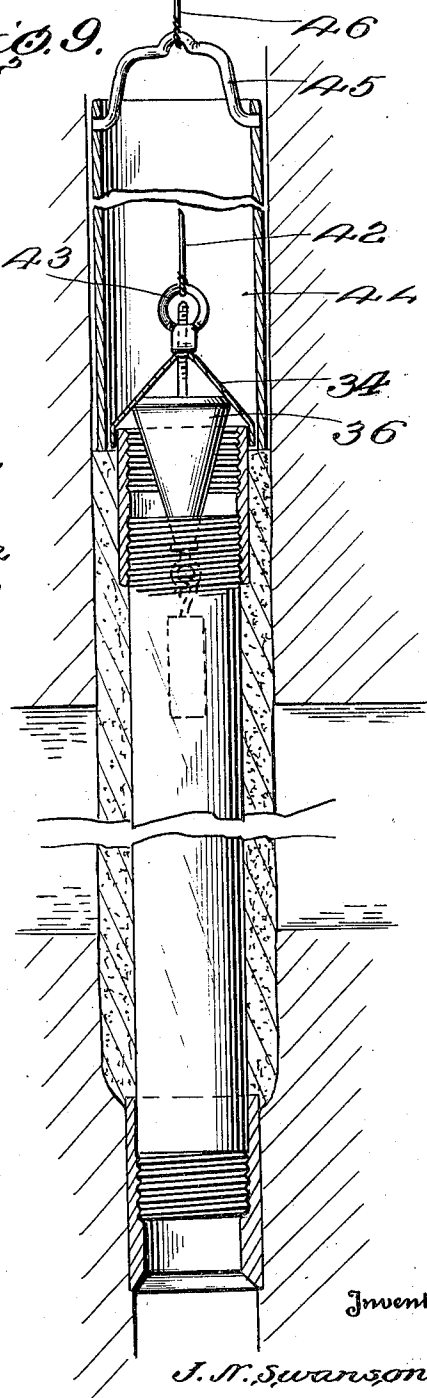


Fig. 9.



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Fig. 10.

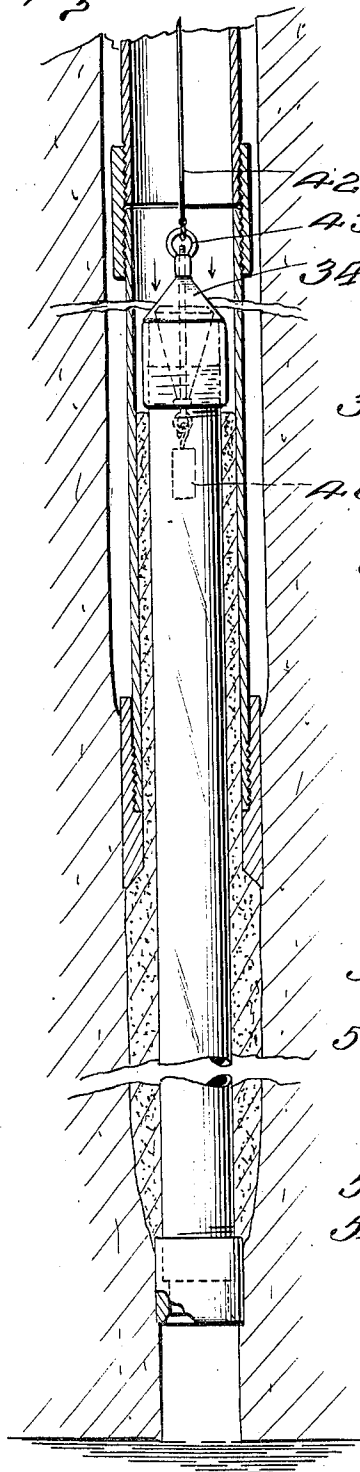


Fig. 11.

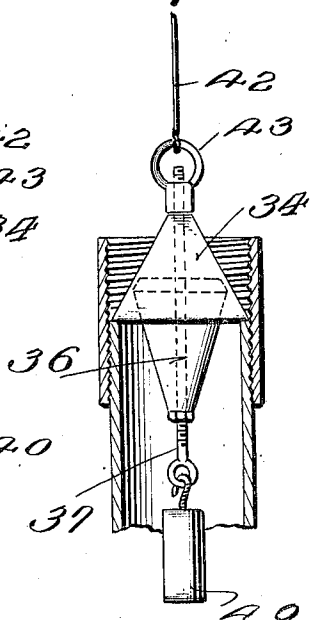


Fig. 12.

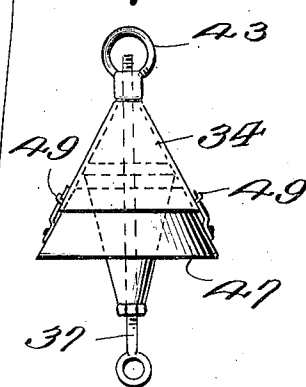


Fig. 13.

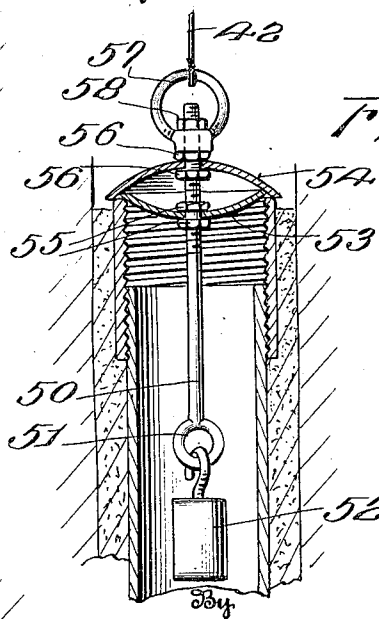


Fig. 14.

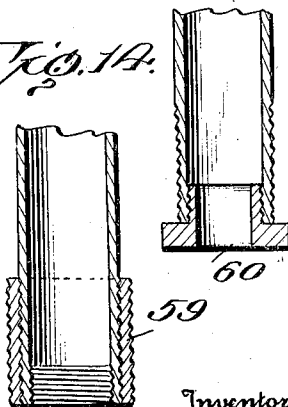
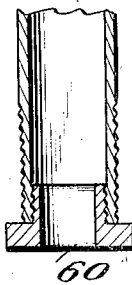


Fig. 15.



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UNITED STATES PATENT OFFICE.

JOHN N. SWANSON, OF IOWA PARK, TEXAS.

WELL.

Application filed July 3, 1922. Serial No. 572,663.

To all whom it may concern:

Be it known that I, JOHN N. SWANSON, a citizen of the United States, residing at Iowa Park, in the county of Wichita and State of Texas, have invented certain new and useful Improvements in Wells, of which the following is a specification.

My invention relates to well packing apparatus and has as an object the provision of apparatus to pack a well and to remove the casing above the packing so as to salvage as large a portion of the casing pipe as possible.

A further object of the invention is the provision of means to place cement about a liner placed in a well or around the casing left in a well after being disconnected as hereinafter fully explained, either to serve as a packing by itself or in addition to other packing means.

An illustrative embodiment of the invention is shown in the accompanying drawing, forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the figures, and in which—

Figure 1 is a vertical section through a well partly broken away to shorten the same.

Figure 2 is a detail vertical section through a portion of the well shown in Figure 1 drawn to an enlarged scale and showing a different position of parts.

Figure 3 is a detail vertical section through a portion of the well showing the packing device released.

Figures 4 and 5 are horizontal sections on lines 4—4 and 5—5 respectively of Fig. 2.

Figure 6 is a side elevation of one of the packing elements.

Figure 7 is a side elevation of a canvas cover for the device of Figure 6.

Figure 8 is a detail vertical section showing action of cement shield.

Figure 9 is a detail vertical section showing the action of the tamping device.

Figure 10 is a detail vertical section showing the application of cement to a well having placed therein a liner seated just above the oil-bearing sand and without the use of the packing device provided by the invention.

Figures 11, 12 and 13 show modified forms of concrete shields.

Figures 14 and 15 are detail vertical sections of modified forms of tamping devices.

The invention is intended to provide means for shutting off water from oil wells or vice versa. In the drilling of an oil well it is customary to place a string of casing in a well after having entered or passed through a water bearing stratum, the bottom end of the casing carrying a driving shoe with a cutting edge of the kind indicated at 10 which cutting edge is passed through the water bearing stratum and driven down into contact with the water tight formation usually found just below the water stratum. It is usually possible to imbed the cutting edge 10 into such intimate contact with the harder formation that water will not find its way past it. The drill with which the well is opened will make a hole of larger diameter in the softer strata than it will in the harder or rock formations. Therefore the casing will have a space such as shown at 11 about it in the softer strata, while the opening in the harder formations will be small enough to make the contact above mentioned with the cutting edge 10.

The first pipe placed in the well as a casing is of large diameter in order to allow the drill to work through it to continue the hole downward after the need of shutting off water, sand, quick sand or cavey formation, has necessitated the placing of a string of casing. When the well is completed or abandoned it is desirable to salvage as much of the casing as possible since it is not needed in the well for other reasons than cutting off of the water from the oil bearing sands. When pulling a string of casing it is customary, using various means known to the art, to apply exceptional pulling power to the upper end of the casing and exert sufficient pull thereon to either cause the whole string of casing to come out intact or to separate at some point. If the string separates it will of course separate at the weakest point, and only a few lengths of casing may be salvaged.

After the pulling of the casing from the hole, water or oil, if under pressure, may rise about the casing and flow over the top of the casing remaining in the well, thus gaining access to some oil or water bearing sand to its rapid deterioration throughout a wide area about the well. It is here understood that in many developed oil fields there are to be found several oil bearing

sands which may themselves be interlaid with water bearing sands at various depths, but the lower oil sands usually prove the better producers; and it has been found inadvisable to try to extract the oil from two or more sands penetrated by the same well; therefore it is desirable and necessary to protect one sand from the other by means of mudding off, packing or by leaving a string of casing for that special purpose.

To enable the operator at will to cause the casing to separate at any desired point the invention provides a separable joint 12 which is supplied upon a specially formed section 13 of casing which section is provided with the usual right hand thread 61 at its lower end for connection with the usual form of coupling 62 to be thereby joined to a length of casing 63. Where the operation is conducted in an old oil field and the formation is well known it is possible to place the cutting edge 10 upon the lower end of a length of pipe and the special fitting 13 at the upper end of the same length of casing, or spaced above the cutting edge two or more lengths if so desired, sufficient casing being placed between the cutting edge and the special fitting to span the water bearing stratum which will be encountered at the lower end of the casing in question. By this practice the greatest possible amount of the casing will be salvaged when the same is pulled.

To provide a separable joint at the upper end of the section 13 a bell 14 is formed upon the section provided with an interior left hand thread at 15. The upper end of the bell is castellated as at 16 and is adapted to join with a complementary castellated end upon a ring 17 provided with a continuation of the left hand thread 15. A short length of pipe or nipple 18 with an exterior left hand thread of considerable length is screwed into the ring 17 and bell 14 while they are joined together as clearly indicated in Fig. 2. The upper end of the nipple 18 is provided with a right hand thread at 19 to connect with an ordinary collar or coupling 20 and to be thereby joined to the regular casing extending to the surface or mouth of the well.

When it is desired to separate the special joint provided by the invention the casing at the mouth of the well is revolved in a clockwise direction which operation will unscrew the left hand threaded nipple 18 from the left hand threads in bell 14. The castellated 16 will prevent revolution of the ring 17 relative to the bell 14. When the casing has been turned the known number of revolutions which are necessary to withdraw the nipple 18 from the bell 14 to a position within the ring 17 the casing may be pulled and all of the casing above and including the nipple 18 and the ring 17 will be retrieved.

To pack the well adjacent the top of the casing left in place the fitting 13 is provided with the automatic packing arrangement which, as shown, comprises a plurality of spring members 21, four being shown, which are placed in grooves 22 formed in the surface of the fitting 13 and which are secured at their bottom ends as by means of rivets 23.

The springs 21 are formed so as to have the quality of curling when released like the main spring of a watch or clock. The springs 21 are prevented from curling until the action is desired by means to be described and to prevent the center of the springs from bulging outwardly by being so prevented from curling their ends are perforated, which perforations are placed over pins 24 projecting from the annular portion of the bell 14. The relation of the springs to the pins 24 is such that they are perfectly free to leave the pins in the direction of the length of the pin but not transverse thereto as would be required by an attempt of the springs to bulge outwardly at their center. To close the space between the fitting 13 and the wall of the hole formed by the drill a sleeve 25, preferably formed of rubber, is slipped over the fitting 13 and over the springs 21, while the latter lie in the grooves 22, and is secured to the fitting 13 by the rivets 23 which hold the lower ends of the springs in place. The upper end of the sleeve 25 is fastened to the springs 21 by means of hollow rivets and which hollow rivets in turn slip over pins 24. When the springs and the sleeve 25 are released the tendency of the springs to curl will cause the sleeve 25 to curl with them into the position shown in Figure 3 at 26 which figure shows the sleeve 25 forming an annular spiral about the fitting 13 and in contact with the wall of the hole. If desired the sleeve 25 may also be manufactured to curl by its own law of internal stresses.

To protect the sleeve 25 while the casing is being placed and also to further assist same and springs 21 in their process of curling, protecting them from interference by possible cavey substances falling down about the casing, a second sleeve or shield 27 preferably formed of canvas and preferably watertight may be placed about the fitting 13 and over the sleeve 25 and secured to the fitting as by means of the wrapping 64 of twine or wire. To provide a fullness of material in the sleeve 27 to allow of the curling action of the sleeve 25 and the springs 21, the material of the sleeve 27 may be laid in plaits or folds, as shown at 28, extending vertically of the sleeve. The sleeve and plaits may also have a horizontal fold, as 29, to provide for the excess material in the vertical direction. If desired the upper edge of the sleeve 27 may be provided with a metal trimming as at 30. To hold the

upper ends of the sleeves 27 and 25 and to prevent the springs 21 from leaving the pins 24, a light metal sleeve 31 may be secured to the ring 17 by screws 32, a shoulder 33 preferably being formed on the ring to bring the ring flush with the exterior of the sleeve 31. The lower end of the sleeve 31 may be slitted to provide tongues 35 which tongues are bulged outwardly and the ends thereof are turned inwardly to grasp the sleeves as shown in Figure 2. When the joint 14, 17 is separated at castellations 16 in the manner already described the tongues 35 will yield so as to pull away from the sleeves 27, 25, upon which the action of the springs 21 will cause the sleeve 25 to assume the position shown in Figures 1, 3 and 8.

The action of the packing sleeve 25 may be sufficient to stop the flow of water where the head is not too great, but if not it will be necessary to place concrete on top of the packing formed thereby. In order to place this concrete after the casing has been removed it is necessary to prevent the concrete gaining access to the inside of the casing. To perform this function the device shown in various forms in Figures 8 to 13 inclusive may be utilized.

As shown in Figure 8 the device comprises a conical shield 34 of a size adapted to fit over the casing to be protected, in this instance over the bell 14. To guide the shield 34 an inverted conical member 36 is shown secured thereto by means of a rod 37 provided with the shoulder 38 at its lower extremity and with the ring nut 39 at its top. A weight 40 may be hung from a ring 41 at the lower end of the rod 37 and a cable 42 may be connected to the ring 43 to lower the device in place and to remove it after the operation is completed. With the shield 34 in place concrete may be freely dropped into the annular space around the fitting 13 or the casing about which the concrete is to be placed.

To tamp the concrete about the casing a tamper such as shown in Figure 9, comprising a section of pipe 44, of any desired length, provided with a bail 45, may be lowered by means of a cable 46 and may be lifted and dropped upon the concrete in an obvious manner. The tamper 44 need not be removed from the well in intervals of the placing of concrete since the concrete will fall to position freely through the same. The illustration of Figure 9 shows the placing of concrete about a well casing of ordinary form not equipped with the special packer provided by the present invention. To avoid the necessity of having a complete separate shield for each size of casing to be treated the modifications of Figures 10, 11 and 12 may be adopted. In these figures a

size of shield is shown in Figure 10 which will sit upon the upper edge of the coupling of a certain size pipe. When used with the next larger size pipe the shield 34 will fit inside the coupling and rest upon the upper edge of the casing as shown in Figure 11. When it is desired to use the size of shield in question with a casing larger than that shown in Figure 10 a supplemental shield 47 may be secured to the shield 34, as by means of hooks 48, taking over studs 49 provided upon the exterior of the shield 34. The supplemental shield 47 is of a size to nest inside the lower end of the shield. A variety of sizes of rings 47 may be provided whereby to pack every size of casing used in the single well.

A still further modified form of shield is shown in Figure 13 in which a rod 50 is provided with a ring 51 at its lower end for attachment of a weight 52 and is provided with an extended length of thread at its upper end. A pair of concavo-convex discs 53, 54 are shown as clamped upon the rod 50 by means of pairs of nuts 55, 56 and a ring nut 57 may be secured to the upper end of the rod and fastened thereon by means of the clamping nut 58 for attachment of the cable 42. The different sizes of casing of a well may be accommodated by the device in Figure 13 by the provision of an assortment of discs 54 each used with the same disk 53 which latter disc will be substantially equal in diameter to the smallest coupling used.

Modified forms of tampers are illustrated in Figures 14 and 15 at 59 and 60.

By the use of the apparatus provided by the present invention each water or oil bearing stratum encountered in the well may be sealed off and only sufficient casing may be left in the well, when the formation is previously known, to span the strata which it is desirable to seal and to accommodate the shields. The retrieving of the casing rendered possible by the invention will result in great economy in the drilling of the well and the sealing off of the strata will result in a conservation of the oil field.

Minor changes may be made in the physical embodiment of the invention without departing from its spirit.

I claim:

1. A well packer comprising in combination, a section of casing, a joint in said casing adapted when in a well to be disconnected by means acting at the mouth of the well and means released by such disconnection to obstruct the space around the casing.

2. A well packer comprising in combination, a section of casing having a right hand thread at its lower end and a left hand thread at its upper end and means operable

upon removal of the casing above said section to obstruct the space about said section.

3. A well packer comprising in combination, a section of casing, a plurality of springs secured at one end to said casing, said springs adapted to automatically assume a spiral form when free, a sleeve about said casing and movable with said springs, means to normally hold said springs and sleeve extended and means to at will release said springs and sleeve whereby said sleeve will assume an annular spiral position to close a space about said casing.

4. A well packer comprising in combination, a section of casing having an external right hand thread at its lower end and an internal left hand thread at its upper end, a section of casing having an external left hand thread at its lower end adapted to unite with said first named left hand thread, a plurality of normally helical springs secured to said first named section at their lower ends and held against curling at their upper ends.

5. A well packer comprising in combination, a section of casing having a right hand thread at its lower end, an internal left hand thread at its upper portion and recesses in the upper end thereof, a ring having an internal left hand thread and projections adapted to seat in said recesses, a section of pipe having an external left hand thread adapted to enter said ring and section whereby the casing above said section may be rotated in a clockwise direction to remove said second named section from engagement with the first named section whereupon the casing may be withdrawn from the well and packing means carried by said first named section.

6. A well packer comprising in combination, a section of casing having an external right hand thread at its lower end and an internal left hand thread at its upper end and recesses in the edge of its upper end, a ring having projections adapted to enter said recesses and a left hand thread to form a continuation of the first named left hand

thread, a section of casing having a left hand thread at its lower end adapted to enter the ring and said first named section and a right hand thread at its upper end, a plurality of springs normally curled secured at their lower ends to said first named casing, and releasably held in an extended position in contact with said section, a sleeve about said section and springs, a metallic sleeve carried by said ring enclosing the end of said first named sleeve and springs, to hold the same in the extended position whereby when the casing is revolved in a clockwise direction the internal left hand thread will be withdrawn from said first named section without revolution of said ring, and said casing, ring and second named sleeve may be withdrawn to release said first named sleeve and springs whereby to pack the space about the first named section.

7. A well packer comprising in combination, a section of casing, a plurality of normally curled springs secured at their lower ends to said casing, means to releasably hold said springs extended, a sleeve enclosing said springs and casing and secured thereto at its lower end, means to at will release the upper end of said springs and sleeve to permit the same to assume a helical position whereby to close the space about said casing in a well.

8. A well packer comprising in combination, a section of casing having longitudinal grooves in its outer surface, a normally curled spring secured at its lower end in each of said grooves, means to hold said springs extended within said grooves, a rubber sleeve enclosing said casing and springs and secured thereto at its lower end, a second sleeve enclosing said first named sleeve and having folds in its material to provide a fullness when released, means to hold said springs and sleeves in their extended position, said means being releasable at will whereby to allow said springs and first named sleeve to assume a helical form to close a space about said casing in a well.

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