March 12, 1935. L. DILLON ET AL 1,993,877

CASING METER

Filed June 10, 1930

Fig. 1.

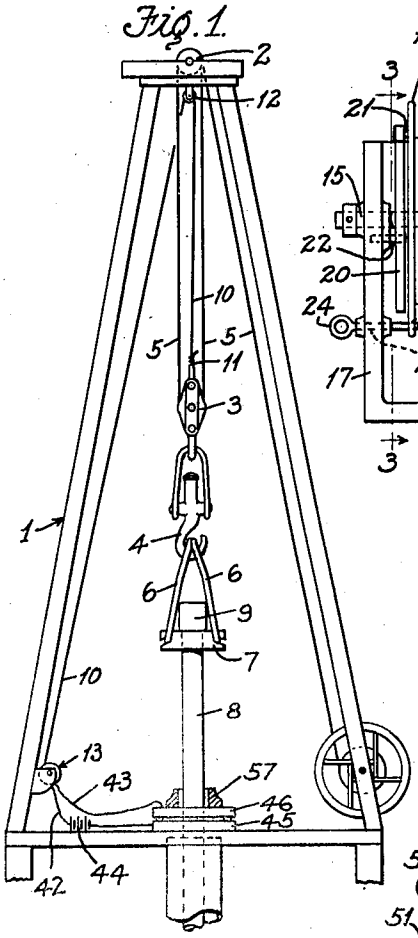



Fig. 2.

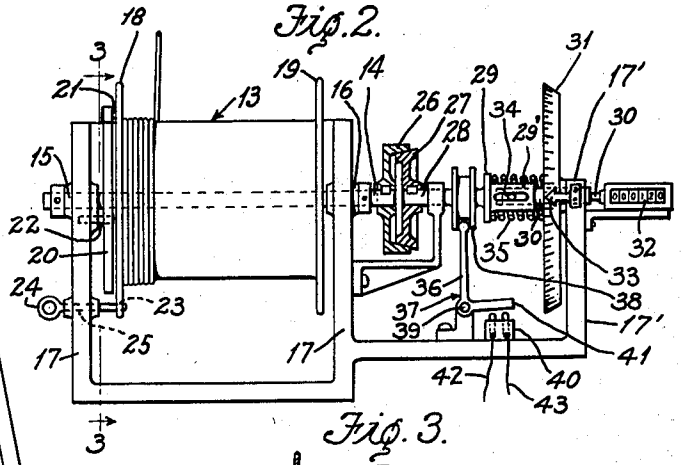



Fig. 3.

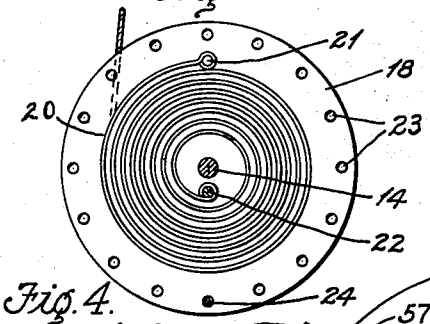



Fig. 4.

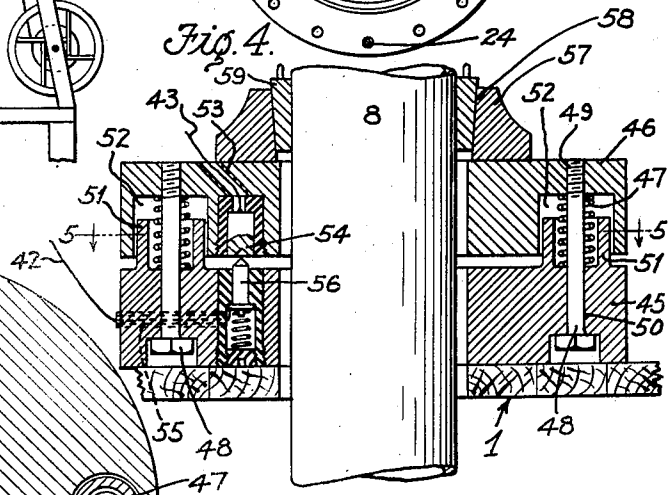
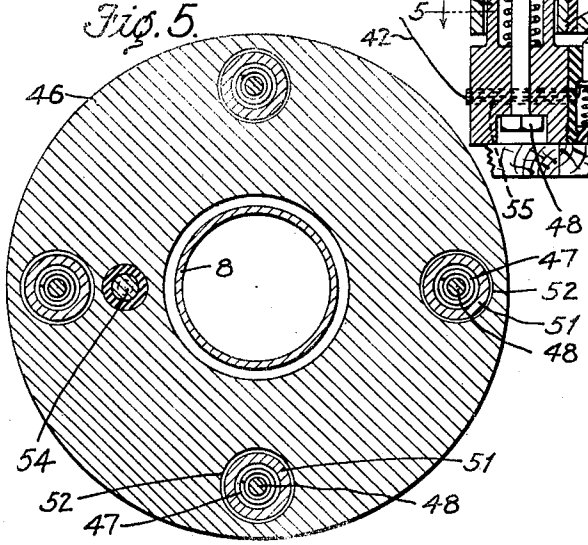



Fig. 5.




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## CASING METER

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Application June 10, 1930, Serial No. 460,234

3 Claims. (Cl. 33—134)

This invention relates to methods and devices which may be employed for the purpose of measuring the length of pipe lowered into or raised from a well-bore.

The primary object of the invention is to provide means of this type which is simple and efficient in operation and which automatically registers at all times the amount or length of pipe which has been lowered into or raised from a well.

In ordinary practice, pipe is moved in and out of a well by means of a hook attached to a travelling block or movable pulley suspended from a crown block or stationary pulley located at the top of a derrick. By means of a pair of links the hook carries an elevator clamped around the pipe just below a coupling screwed onto the upper end of said pipe. When a length of pipe has been lowered into the well, and when it is necessary to attach another joint of pipe, the pipe in the well is caught just above the derrick floor by wedges or slips inserted around said pipe in some appropriate support, such as a spider, placed on the floor and provided for the insertion of said wedges, thus causing said support to carry the weight of pipe suspended in the well. The elevator is then uncoupled from the pipe, raised in the derrick along with the hook, and clamped around the next joint of pipe which stands upright within the derrick. This joint is raised somewhat by lifting the hook and elevator, and is then lowered so as to permit the screwing of the joint into the top coupling of the pipe suspended in the well. The whole string of pipe is then raised slightly to free the wedges or slips, and, after the removal of the latter, the pipe is again lowered into the well by lowering the travelling block carrying the hook. It is thus clear, that only a portion of the vertical movements of the travelling block and hook is used for the actual work of lowering the pipe, the other portion of said movements being used to place the hook and elevator in position to pick up the new joints of pipe and to move said joints into place for connecting them to the pipe already suspended in the well. It is further clear that the same applies when raising pipe out of a well, only a portion of the vertical movements of the travelling block and hook being used for the actual work of raising the pipe, while the other portion is for the purpose of setting the unscrewed pipe aside and coming down to pick up the pipe still in the well.

In view of these conditions, another object of the invention is to provide a method and means for measuring and registering only that portion of the movements of the travelling block and the hook which causes the lowering of the whole string of pipe into a well, or the raising thereof as the case may be, in order to register the actual length or amount of pipe lowered into or raised from a well.

Briefly stated, the invention comprises in combination a string of well tubing, a registering device, means to actuate said device and means associated with the tubing for operating said actuating means. Said means may include a selective control. The invention also comprises means actuated in direct proportion to the movement of a travelling block mounted in a derrick or rig, and means in operative engagement with the first means to register only a predetermined portion of the motion of the first mentioned means, for example, the downward movement only or the upward movement only. The invention further comprises a cable or the like attached to and used in combination with said travelling block, a register and a control connecting said cable and register in such manner as to record only a portion of the movements of the travelling block. More specifically stated, the invention comprises a drum carrying the cable, a magnetic clutch connected with said drum, a register connected with the clutch and electric control means connected with the magnetic clutch to cause the registering of only a desired portion of the movements of the cable as it responds to motions of the travelling block. In a preferred form, the imposition of the weight of the pipe upon the control means and its removal therefrom, is relied upon as the primary actuating agency for said control means.

Referring to the accompanying drawing which discloses certain embodiments of the invention by way of illustration:

Fig. 1 is a vertical elevation showing a derrick having conventional pipe lowering and raising means connected in operative relation with the novel recording or registering means hereof;

Fig. 2 is a detailed side elevation of the registering or recording means;

Fig. 3 is a section along line 3—3 of Fig. 2;

Fig. 4 is a detailed vertical section showing switch means for actuating the electro-magnetic clutch; and

Fig. 5 is a transverse section along line 5—5 of Fig. 4.

Referring more in detail to the drawing and especially in Figs. 1 to 3, at the top of a derrick or rig 1 there is a crown block or pulley 2 from which a travelling block 3 and a hook 4 are sus-

pended on a cable 5. A pair of links 6 suspended from the hook 4 carry an elevator 7, which latter is clamped around the upper end of a pipe 8 just below a coupling 9 threaded onto said pipe 8. One end of a cable 10 is attached at 11 to the travelling block 3, said cable being then passed over a small pulley 12 at the top of the derrick 1 and having its other end wound around a spring-operated drum 13 rotating on a shaft 14 held in bearings 15 and 16 in supports 17. Said drum 13 has two flanges 18 and 19 rigidly fixed on the shaft 14. A spiral spring 20 is attached at one end at 21 to the flange 18 of the drum 13 and at its other end at 22 to one of the supports 17 to maintain a tension in the cable 10 and thus prevent it from sagging and also to rewind the cable under certain conditions which will be described hereinbelow. The flange 18 is also provided with a plurality of holes 23 near its circumference as shown in Fig. 3. A removable key or bolt 24 may be passed through a hole or bore 25 in the support 17 and into one of said holes 23 when it is desired to stop the rotation of the drum 13, as when the cable 10 is to be disengaged from the travelling block. One end of the shaft 14 is provided with a disc 26 of a friction clutch, the other disc 27 of said friction clutch being carried by a short shaft 28. The shaft 28 is provided with a shoulder 29 having a housing 29' which loosely slides over and along a rod 30 rotating in a bearing in the support 17'. Rod 30 carries a graduated disc 31 and a registering device 32. An index or pointer 33 is carried on the support 17' opposite the graduations on disc 31. The shaft 28 and the rod 30 rotate in unison due to a slot-and-key connection 34. A spring 35 placed on shaft 28 abuts against shoulder 29 and the graduated disc 31, thus tending to hold disc 27 of the friction cltuch against the disc 26. Arm 36 of an L-shaped lever 37 has its outer end positioned to actuate the shaft 28 by engagement with a collar 38 thereon, said lever 37 being pivoted at 39 on the support 17'. An electro-magnet 40 is placed on said support 17' just under the other arm 41 of lever 37. Electric conductor wires 42 and 43 lead from the electro-magnet 40 through a battery 44 to a switch 45, 46 to be described hereinbelow.

As shown more specifically in Figs. 4 and 5, the switch is placed on the floor of the rig 1 around the axis of the well-bore into which the pipe 8 is to be lowered. This switch comprises two superimposed plates 45 and 46 normally held away from each other by means of a plurality of springs 47 placed between said plates. Each spring 47 is guided by a bolt 48 threaded at 49 into plate 46 and sliding in a bore 50 provided in the plate 45. The plate 45 is also provided with annular guide collars 51 sliding in bores 52 in the plate 46 and constituting pockets which receive the springs 47. The conductor 43, leading from the electro-magnet shown in Fig. 2, passes through an insulated conduit 53 in plate 46 and terminates in a contact 54 on the lower face of said plate 46, while the conductor 42 passes through an insulated conduit 55 in plate 45 and terminates in a spring contact 56 on the upper face of the plate 45 and opposite the contact 54. These contacts 54 and 56 are embedded in bodies of insulation positioned in the plates 45 and 46 and constituting extensions of the insulating conduits 53 and 55 as shown in Fig. 4. The contacts 54 and 56 serve to close the circuit through the conductors 42 and 43 when the the contacts are brought together by the lowering of the upper plate 46 onto the lower plate 45. A block or spider 57 is placed around the pipe 8 and on the upper plate 46, said block 57 being provided with a bevelled circular hole 58 to receive wedges or slips 59 by means of which the pipe 8 may be held suspended on plate 46 and in the well-bore.

The operation of the measuring apparatus is as follows:

At the start of operations, the upper plate 46 of the switch is held in slightly spaced position above the lower plate 45 by means of the springs 47. Contacts 54 and 56 are therefore open and the de-energized electro-magnet 40 permits the spring 35 to hold the clutch disc 27 against disc 26 and connect the registering means with the drum 13 and cable 10. With the switches 45—46 in this position, the elevator 7 is clamped around the top of the first stand of pipe 8 and this pipe is shifted so that its lower end is substantially at the mouth of the well-bore. The registering device 32 and the graduated disc 31 are read for zero or starting position. The pipe 8 is then lowered into the well-bore by releasing the cable 5 and thus allowing the travelling block 3 and the hook 4 to descend. During the lowering of the pipe, the cable 10 is unwound from its drum 13. The resultant rotation of the drum 13 and its shaft 14, and clutch discs 26, 27, shaft 28 and rod 30, causes a corresponding rotation of the graduated disc 31. Each complete revolution of drum 13 is recorded by the registering device 32, and the pointer 33 indicates fractional revolutions. When the first stand of pipe 8 has been lowered into the well and the coupling 9 is just above block 57, the wedges 59 are slipped into the hole 58 around said pipe 8, thus providing for the suspension of said pipe 8 and permitting the removal of elevator 7. Due to the weight of pipe 8 which is supported by block 57, plate 46 is forced downwardly against the tension of the springs 47 and onto the lower plate 45. This closes the circuit through conductor 43, contacts 54, 56, conductor 42, battery 44 and the electro-magnet 40. This energizes the electro-magnet and draws the arm 41 of the L-shaped lever 37 downwardly thus disengaging the disc 27 of the friction clutch. When the travelling block 3 is raised to pick up the next stand of pipe, tension on cable 10 is relieved, thus allowing the cable to be rewound on the drum 13 by the action of spring 20. But, since the clutch discs 26 and 27 have been disengaged, the rotation of said drum 13 and shaft 14 will not be registered on the registering device 32 or indicated on the graduated disc 31. However when the next stand of pipe 8 picked up by the elevator 7 is screwed into the coupling 9 of the first stand and the whole string of pipe in the well is raised to release the wedges 59, plate 46 is again moved upwardly by the springs 47, thus disengaging contacts 54, 56, breaking the circuit through wires 42 and 43, de-energizing the electro-magnet 40, releasing the L-shaped lever 37 and permitting the spring 35 to force disc 27 of the friction clutch against disc 26 and cause the graduated disc 31 and the registering device 32 to register the rotations of the drum 13. From this it will be clear that only the vertical movement of the spring of pipe being lowered into the well, is registered, since the registering means records only those vertical movements of the travelling block 3 and elevator 7 which occur when the load of the string of pipe in the well is removed from the switch 45, 46 and is transferred to the block 3 and cable 5. When pipe is being raised from the well, the upward motion causes reverse operation of the register 32 to substract the respective amounts from the

reading thereon. As in lowering, the register will be disconnected when the weight of the pipes is transferred to the switch 45, 46, thereby avoiding recording of movements of the travelling block alone.

It is obvious that, knowing the circumference of the drum 13, and the number of complete and fractional revolutions of said drum, it is possible to compute the length of pipe raised from or lowered into the well. It is further obvious that the registering means may be constructed so as to give a direct reading of the length of pipe lowered into or raised from the well. Also, when raising pipe the connection of the register 32 with rod 30 may be reversed, as by connecting the opposite end of the register, so that the upward movements of the pipe will be added to the register reading rather than subtracted as above indicated.

Thus it will be seen that the device automatically registers and indicates at all times the amount or length of pipe in the well.

The above disclosures are to be considered not as limiting but as merely illustrative, and many variations which will be apparent to those skilled in the art may be made within the scope of the following claims. It is to be understood that the term "lowering" when used is to be taken as inclusive of the equivalent operation of raising.

We claim:

1. In combination with an oil well rig, a travelling block, means movably suspending the travelling block in the rig, a cable attached to said travelling block, a drum to which the cable is connected, a shaft for said drum, registering means having a shaft aligned with the drum shaft and a clutch means between said shafts for effecting a direct driving connection therebetween, a relatively stationary support associated with the floor of the rig to suspend pipe stationarily in the well comprising a pair of superimposed plates one movable relatively to the other, one of which is adapted to receive the weight of the suspended pipe suspended in the well, means for normally holding the plates apart, electrical contacts carried by said plates and adapted for electrical engagement when the weight of the pipes is transferred to the one plate, electrical means to actuate the clutch and an electrical connecting circuit between said contacts and the electric clutch actuating means for actuation of the clutch when the suspended pipe weight is transferred from the movably suspending means to the plate.

2. In combination with an oil well rig, a travelling block, means movably suspending the travelling block in the rig to raise and lower pipe, a cable attached to said travelling block, a drum actuated by said cable, a register, a releasable clutch for operatively connecting the drum and register, an electro-magnet to actuate said clutch, relatively stationary means to support pipe suspended in the well, an electric switch associated with said support and actuable by the transfer of the pipe suspension thereto to control the magnet and the clutch for recording on the register only certain desired movements of the travelling block.

3. In a combination according to claim 2 wherein the relatively stationary means to support pipe comprises two superimposed plates, and springs normally holding the plates apart, the upper plate being adapted to receive the weight of suspended pipe whereby the switch is operated.

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