Feb. 23, 1943. G. McCRAY 2,311,768

CASING CENTERING DEVICE

Filed Nov. 12, 1940 3 Sheets-Sheet 1

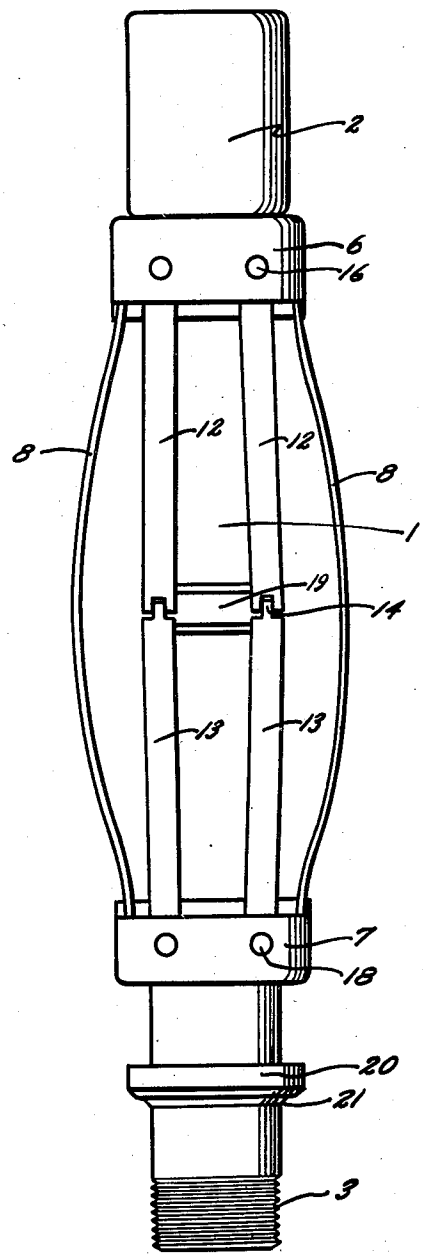


Fig. 1

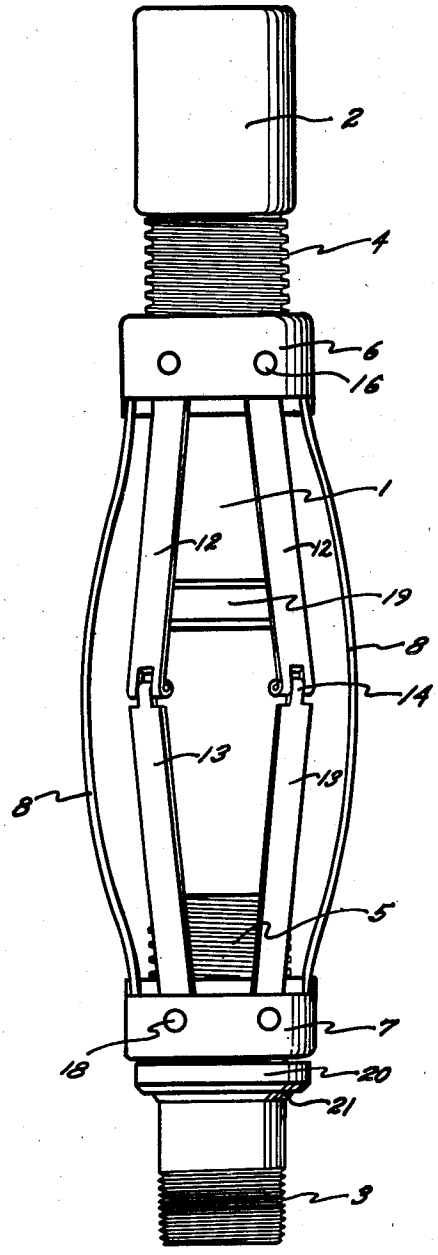


Fig. 2

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Filed Nov. 12, 1940 3 Sheets-Sheet 2

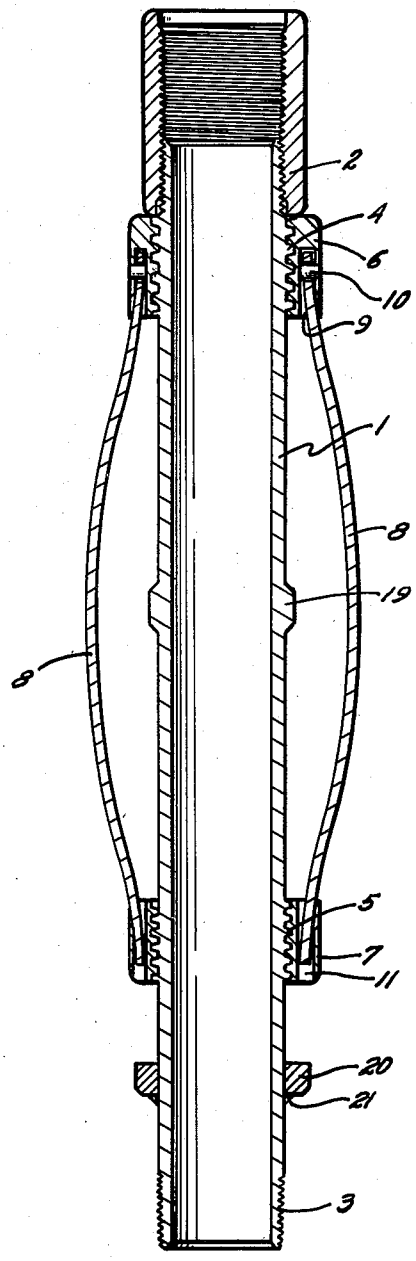


Fig. 3

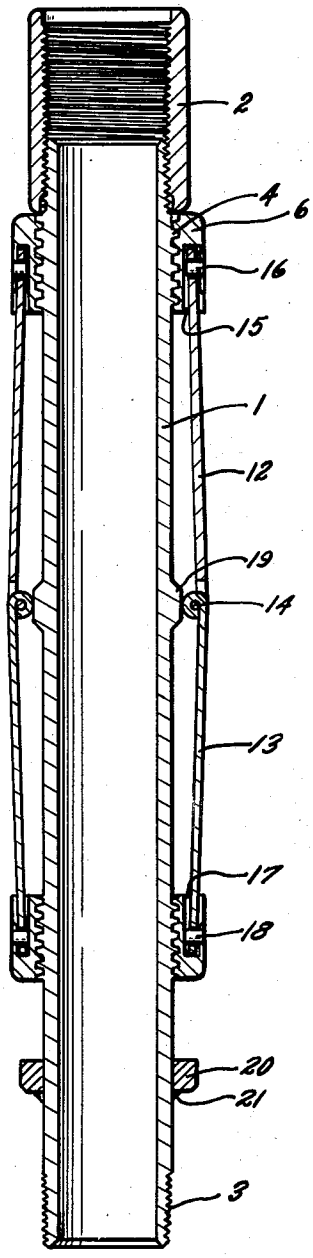


Fig. 4

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Filed Nov. 12, 1940 3 Sheets-Sheet 3

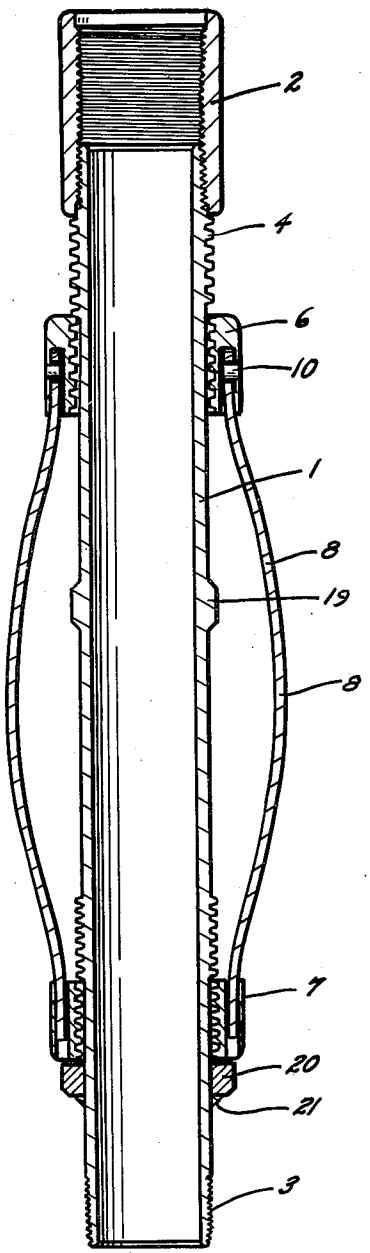


Fig. 5

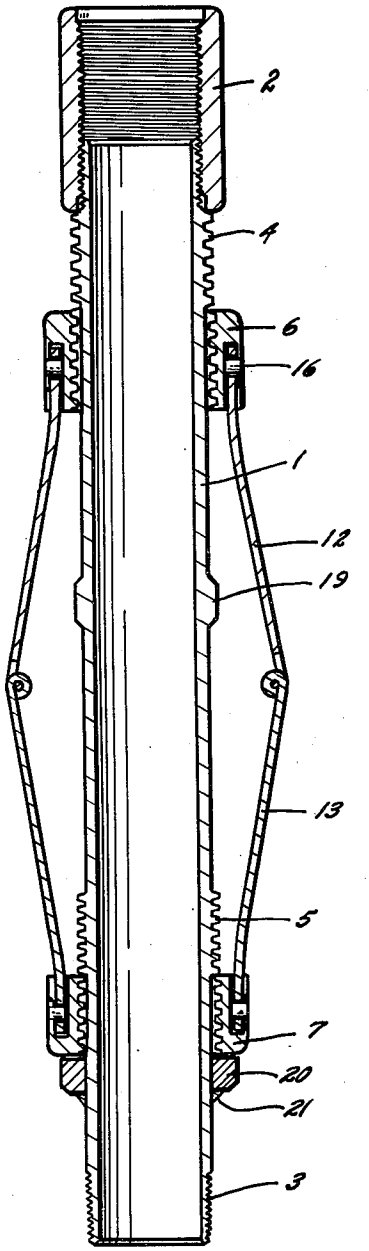


Fig. 6

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2,311,768

CASING CENTERING DEVICE

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9 Claims. (Cl. 166—4)

This invention relates generally to casing centering devices and specifically to devices for centering pipes or the like in wells.

It has for its general object the provision of a new and improved device including pipe centering means which are normally retracted so as not to interfere with the lowering of the pipe into the hole, said means being expansible into engagement with the wall of the hole after the pipe has reached a desired depth, to effect the centering of the pipe.

The invention will be further particularly useful in the cementing of oil wells in that it will provide a substantially uniform space between the pipe and the wall of the well surrounding the pipe. It is customary to lower a casing into a well after the same has been drilled to a predetermined depth and then to pump down through the casing a quantity of cement. This cement passing out through the lower end of the casing is intended to fill the hole surrounding the lower end of the casing and for some distance above the lower end and is for the purpose of sealing off any liquids or gases which may be produced from formations above the lower end of the casing.

However, it has been a not infrequent occurrence that a casing upon being lowered into a well will come to rest with its lower end either against or close to one side of the hole and in many such cases when the cement is poured down into the well it will form a solid body on one side of the casing but will leave the other side of the casing in contact with the formation so that a proper seal will not be obtained.

It is an object of this invention to provide a means whereby that portion of the casing which is to be cemented in place may be previously centered in the hole so that the casing will be substantially equal distance from the side of the hole on all sides of the casing and will be held in such position during the time the cement is being put in place. The cement will thus form a substantially uniform solid seal around the lower end of the casing and will not leave a channel through which fluids or gases might flow and get into the casing.

A more specific object of this invention is to provide such a device which may be positively expanded by mechanical means after the casing has been lowered to the desired position within a well but which prior to its expansion will be in contracted form and will in no wise interfere with the lowering of the casing into the well.

Another object of this invention is to provide a device of the character referred to in which the expansion will be produced by positive acting mechanical means but in which the full expansion will be accomplished only after several complete rotations of the casing.

A further object is to provide such a device which will not be inadvertently retracted once it has been expanded.

Another object of this invention is to provide such a device which will be expanded by rotation of the casing, but which will not prevent continued rotation of the casing once it is fully expanded.

Other objects and advantages of this invention will become apparent from the following description taken in connection with the accompanying drawings in which one embodiment is set forth by way of example.

In the drawings:

Fig. 1 is a side elevation of a casing centering device constructed in accordance with this invention, the same being shown in its original or inactive contracted position;

Fig. 2 is a view similar to Fig. 1 showing the same device after it has been expanded;

Fig. 3 is a longitudinal cross section through the structure illustrated in Fig. 1 showing in cross section springs which contact the walls of the hole to assist in the operation of the device, the springs being here shown in their unexpanded position;

Fig. 4 is a view similar to Fig. 3 but taken through the expanding fingers which are adapted to contact the walls of the hole in centering the pipe;

Fig. 5 is a view similar to Fig. 3 but showing the parts in their expanded position;

Fig. 6 is a view similar to Fig. 4 showing the parts in their expanded position.

The device illustrated in the drawings is built on a body 1 which is similar to a short section of pipe and has threads 2 and 3 on its opposite ends adapted to receive pipe collars. This body is intended to be inserted in and form a part of the well casing.

Adjacent its upper end the body 1 is formed with a plurality of external coarse threads 4 just below the pipe threads 2 referred to above. A second set of external coarse threads 5 are formed on the body 1 a short distance above the lower end thereof. Both of the threads 4 and 5 are left hand threads when the tool is intended for use on a casing made up of pipe which has right hand threads. The upper threads 4, however, are made with a somewhat longer pitch

than the lower threads for a purpose which will presently appear.

Threadedly engaging the threads 4 is a nut 6, and a similar nut 7 engages the threads 5. Extending between the nuts 6 and 7 is a pair of springs 8 which are inserted at their upper ends into slots 9 extending upwardly from the lower end of the nut 6. The upper ends of these springs are secured in the said slots by means of pins 10. At their lower ends, the springs 8 extend into similar slots 11 in the nut 7, but the lower ends of these springs are not secured within the nut 7 as they are in the nut 6. The springs 8 are so shaped that their natural tendency is to bow outwardly and bear against and wipe the walls of a hole. Since they are not secured to the nut 7, a longitudinal movement of the nut 7 with respect to the nut 6 will not affect substantially the amount these springs will bow outwardly. The springs are preferably spaced from each other substantially 180 degrees so that they will press against opposite sides of the hole and not interfere with the centering of the body 1 in the hole.

Spaced between the springs 8 about the body 1 are a plurality of pairs of centering fingers 12 and 13, the fingers of each pair being pivoted to each other at their adjacent ends 14. At their upper ends the fingers 12 are secured within slots 15 in the nut 6 by means of pins 16 in substantally the same manner that the upper ends of the springs 8 are secured within the slots 9. Likewise, the lower ends of the fingers 13 are secured within slots 17 by means of pins 18. This manner of securing the ends of the fingers 12 and 13 within the nuts 6 and 7 permits a swinging movement of the hinged ends of these fingers with respect to the nuts 6 and 7 without bending the fingers themselves. The fingers are held out of direct alignment with each other by means of an enlargement 19 on the body 1 opposite the point where the hinges between these fingers will lie when the fingers are in contracted position.

Below the threads 5 a distance substantially equal to the length of the nut 7 is an abutment providing an upwardly facing shoulder which is adapted to prevent downward movement of the nut 7 after it has been screwed off of its thread 5. In this instance this abutment is provided by means of a ring 20 which is welded or otherwise secured at 21 to the body 1.

In operation, the device will be lowered into the well forming an integral part of the casing with the various parts in the position shown in Figs. 1, 3, and 4. Under most circumstances it will probably be found adequate to provide one device of the type described but it is within the concept of this invention to provide two or any greater number of such devices at spaced points along the casing.

After the casing has reached the point where it is to be set, it will be rotated to the right. Inasmuch as the springs 8 will be in contact with the side walls of the hole, the tendency will be for these springs to remain stationary during the right hand rotation of the casing and for them by virtue of their engagement with the nuts 6 and 7 to hold these nuts likewise against rotation. It will be readily seen that rotation of the casing and of the body 1 which forms a part of the casing will under such circumstances cause both nuts 6 and 7 to move downwardly. However, inasmuch as the pitch of the threads 4 is greater than the pitch of the threads 5 the nut 6 will move downwardly faster than the nut 7 and the distance between these nuts will decrease due to this differential movement. It follows that when the distance between the nuts decreases the fingers 12 and 13 will of necessity pivot with respect to each other at the pivotal connection 14 and will bulge outwardly at this point until they come into contact with the walls of the hole. The parts are so proportioned that at the time these fingers come into tight contact with the walls of the hole the nuts 6 and 7 will pass below the lower ends of their respective threads 4 and 5 so that there will be no further expansion of the fingers 12 and 13 Thereafter, the casing may be rotated as much as may be desired during the cementing of the hole or for any other purpose and such rotation will not affect the position of the fingers 12 and 13. Neither will it be possible to cause the nuts 6 and 7 to move back to their original position so as to retract the fingers 12 and 13 because both of these nuts will have been screwed off their respective threads and a left hand rotation of the casing would furthermore be apt to disengage the sections of the casing from each other rather than rotate the body 1 to the left.

It will be readily observed that in the device illustrated and described there is no obstruction to passage of fluid or other material through the casing and the casing is continuous with no openings laterally therefrom above the lower end of the casing.

The arrangement is such that the casing will be positively centered by mechanical action and this mechanical action will require several turns of the casing by virtue of the differential action between the threads 4 and 5. The expansion will thus be relatively slow and will give the casing time to center itself before the fingers expand without damaging the fingers.

With the device described in use a casing may be substantially centered within a well so that when the cement is pumped in it will rise about the casing substantially uniformly and will form a good seal all around the casing and will not leave any portion unsealed.

It will be understood that while this specification refers to centering the pipe, it is not necessary that the pipe be truly centered, but only that it be substantially centered. In other words, the purpose of the invention is to provide a substantial space between the pipe and the wall of the hole at all points on the circumference of the pipe.

Having described my invention, I claim:

1. A device for centering a pipe within a well hole including centering means normally retracted to permit movement of the pipe into the hole, and actuating means to move said centering means into engagement with the wall of the hole to cause said centering means to move the pipe toward the center of the hole, said actuating means being rotatable with respect to said pipe and comprising a pair of members threadedly mounted on the pipe and spaced apart axially of the pipe, the threads mounting one member on the pipe being of the same hand but of different pitch from that of the threads of the other member whereby upon rotation of the pipe relative to the members, the latter will effect an axial displacement relative to each other.

2. A device for centering pipe within a hole including centering means normally retracted to permit movement of the pipe into the hole, actu-

ating means to move said centering means into engagement with the wall of the hole to cause said centering means to move the pipe toward the center of the hole, and normally extended yieldable means to hold said actuating means against rotation in said hole, said actuating means being rotatable with respect to said pipe and a rotary driving connection between said actuating means and said pipe whereby said expanding means may be operated by rotation of said pipe in said hole.

3. In a device for centering a pipe within a hole, a plurality of pairs of expansible fingers mounted on the exterior of said pipe, the fingers of the respective pairs being secured to each other at their adjacent ends and extending longitudinally of the pipe, means for securing the remote ends of said fingers to said pipe, and means actuated by rotation of said pipe for moving the remote ends of the fingers of the respective pairs toward each other to cause the adjacent ends of the fingers of said pairs to bulge outwardly simultaneously and contact the walls of the hole to center the pipe.

4. A device for centering a pipe within a hole comprising a body forming a part of said pipe and having spaced externally threaded zones, the threads of said zones being of different pitch, a nut engaging each of said threaded zones, a plurality of pairs of expansible fingers, the fingers of each pair being pivotally joined together at their adjacent ends and secured to said nuts respectively at their remote ends, and said pairs being spaced at intervals about said pipe, and means adapted to frictionally engage the walls of the hole to retard rotation of said nuts, whereby rotation of said pipe will cause said nuts to move longitudinally with respect to said pipe both in the same direction but at different rates, whereby upon rotation of said pipe in one direction said nuts will be moved closer to each other to cause a bulging of said fingers at the points of their pivotal connections to each other.

5. A device for centering a pipe in a hole including pipe centering means, actuating means therefor, and a rotary driving connection between said actuating means and said pipe whereby said actuating means is operable by rotation of said pipe to expand said centering means, said driving connection being of such extent that it will become disengaged when said actuating means has moved to fully expand said centering means so that said pipe will be free to rotate after said centering means has been actuated by said actuating means.

6. A device for centering a pipe within a well hole including centering means normally retracted to permit movement of the pipe into the hole, and actuating means to move said centering means into engagement with the wall of the hole to cause said centering means to move the pipe toward the center of the hole, said pipe and actuating means being relatively rotatable, means resisting rotation of the actuating means in the well hole, and cooperating means on the pipe and actuating means for transmitting relative rotation between the pipe and actuating means into relative axial displacement between the pipe and said actuating means for shifting the latter to effect movement of the centering means into operative position upon rotation of the pipe within said well hole.

7. A device for centering a pipe in a well hole comprising a plurality of expansible parts mounted on the exterior of said pipe, expander means for said parts, said pipe and expander means being relatively rotatable, means resisting rotation of the expander means to effect a relative rotation between the pipe and the expander means upon rotation of the pipe within said well hole, and cooperating means on the pipe and expander means for transmuting relative rotation between the pipe and expander means into relative axial displacement between the same for actuating the expander means to effect expansion of the expansible parts and center the pipe in the well hole.

8. A device for centering pipe in a well hole comprising expansible centering means carried by the pipe, differential screw means associated with said centering means and said pipe and operable upon rotation of the pipe relative to said centering means for actuating said expansible centering means to effect expansion thereof and centering of the pipe in the well hole, and means for retarding rotation of said centering means.

9. A device for centering pipe in a well hole comprising expansible centering means carried by the pipe, a pair of members mounted on the pipe and longitudinally movable with respect to each other and the pipe, means connecting said members to the expansible centering means for effecting expanding the latter upon movement of the members with respect to each other, and means for moving said members in the same longitudinal direction at different speeds to effect a resultant longitudinal movement of said members with respect to each other and a consequent expansion of said centering means to center said pipe in the well hole.

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