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CASING ROLLER

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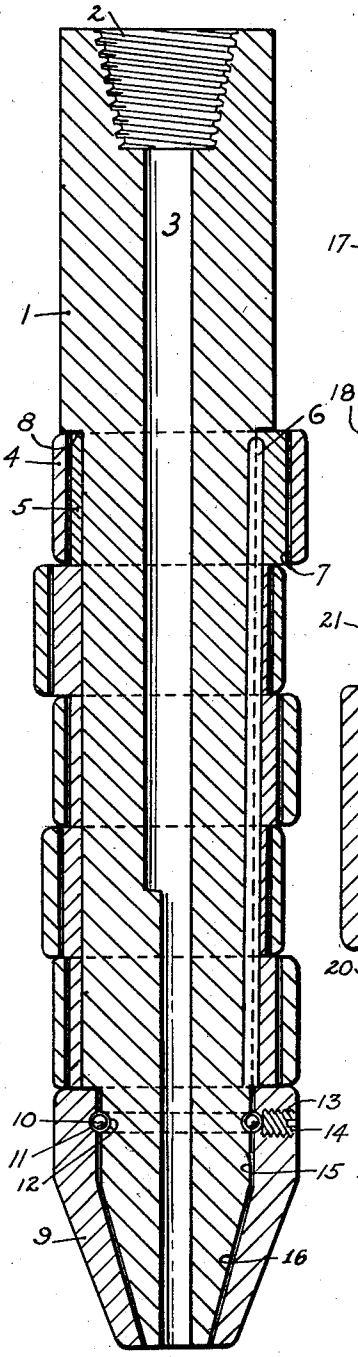


Fig. 1

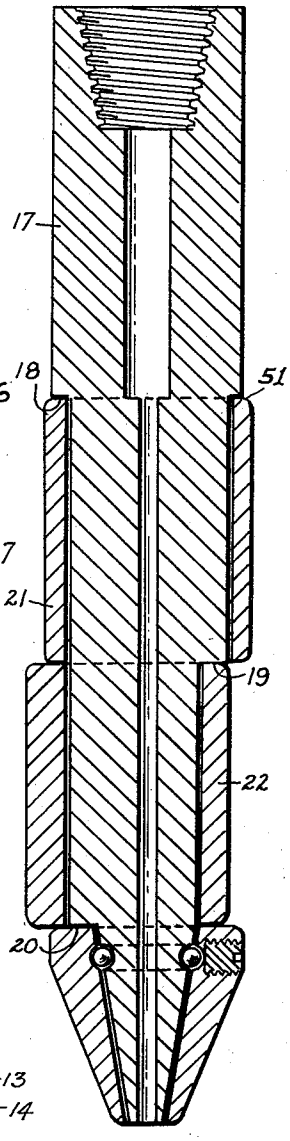


Fig. 2

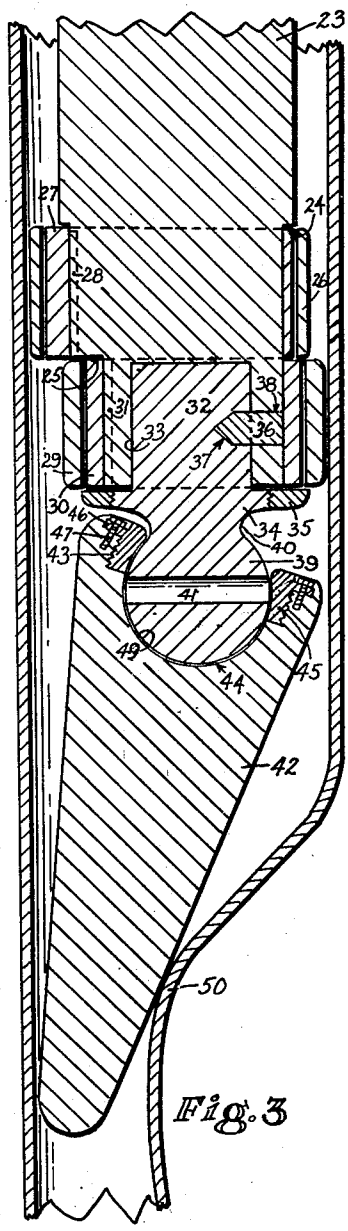


Fig. 3

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## CASING ROLLER

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5 Claims. (Cl. 153—81)

My invention relates to casing rollers such as are used for swedging out pipe or casing when it has collapsed.

In oil well operations it is common practice in many fields to line the well with tubular casing. This casing is usually cemented in place and can not be removed from the well without damaging it beyond repair. It is not uncommon for well casing to collapse in one or more places due to various reasons such as rock pressure, shifting formations, crooked wells, earthquakes, or the placing of too much weight on the casing while cementing it in place. When casing has collapsed for any reason it is common practice to attempt to bring it back to its normal tubular shape. The swedges commonly used for this purpose are called "casing rollers" and usually consist of a cylindrical, wedge shaped body adapted to be screwed on the lower end of a string of drill pipe and provided with series of small rollers mounted on pins secured in recesses in the body. The swedge is rotated and pushed downwardly by the drill pipe until it has forced its way thru the collapsed portion of the casing.

The trouble with the usual casing rollers is that the bearing pressure on the small roller pins is so great that the rollers, pins and bearings wear excessively rapidly and in many instances the rollers and pins are unable to withstand the pressure necessary to swedge out the casing.

It is an object of the present invention to provide a casing roller in which the bearing pressures are greatly reduced.

Another object is to provide a casing roller having a much greater bearing area than is possible with rollers of the usual design.

Another object is to provide a casing roller having an eccentric swedging action which exerts great lateral pressure against the casing.

Other objects and advantages will be apparent from a study of the following specifications and the accompanying drawing wherein

Figure 1 is a sectional elevation of one form of my invention in which the rollers and body are cylindrical and the rollers are mounted on eccentric sleeves.

Figure 2 is a sectional elevation of another form of my invention in which the rollers are cylindrical, the body is eccentric, and there are no sleeves.

Figure 3 is a sectional elevation of still another form of my invention in which the rollers are cylindrical, and the body and sleeves are eccentric.

Referring to the drawing, I have illustrated the preferred embodiment in Fig. 1 wherein is shown a cylindrical body 1 provided at its upper end with a threaded portion 2 adapted to be connected to a string of rotary drill pipe (not shown). The body may be provided with central axial fluid passage 3 altho this is not essential. A series of cylindrical rollers 4 are mounted on the body with their axes parallel to the vertical axis of the body. Interposed between each roller and the body is an eccentric bushing or sleeve 5 which is non-rotatably secured to the body by any suitable means such as the key 6. The rollers 4 are freely rotatable on the sleeves 5 but are held from longitudinal movement by any suitable means. In the present instance the body diameter is reduced as shown at 7 forming a shoulder 8 which prevents upward movement of the rollers and sleeves on the body. The lower end of the body is provided with a nose in the form of a wedge shaped cone 9 rotatably secured to the body by any suitable means, for example, a ring of balls 10 fitting in complementary grooves 11 and 12 in the cone and body respectively. The balls are inserted thru an opening 13 in the cone and are held in place by a screw plug 14. I prefer that the body 1 be reduced in diameter at the lower end as shown at 15 where the cone 9 is attached, and I also prefer that the reduced portion 15 be eccentric to the body, as shown. The lower extremity of the body 1 is reduced to a still smaller diameter and is preferably tapered as shown at 16 to receive a corresponding taper in the cone 9. The cone 9 retains the rollers from moving downwardly on the body. Any number of rollers 4 may be provided, as desired. The sleeves 5 are keyed in position so that the eccentric portions are oppositely disposed around the periphery of the body. Obviously the body 1 could be provided with eccentric bearing surfaces integral with the body (as shown in Fig. 2) so that the sleeves 5 might be cylindrical instead of eccentric. By successively reducing the diameter of the body any desired number of rollers can be used.

The rollers may all be of the same diameter or they may be of different diameters with the larger rollers at the top of the tool and the smaller rollers at the lower end. In Fig. 1 I have shown the three lower rollers as being of equal diameters and smaller than the two upper rollers which are of equal but larger diameters, I have found this tapered construction to be particularly useful in rolling casing which is most difficult to expand with a series of straight rollers.

In operation, the body 1 is attached to the lower end of a string of rotary drill pipe and lowered into the well casing until the sleeve 5

rests upon the collapsed portion of the casing. The drill pipe and body are then rotated and gradually lowered thru the casing. The reduced portion of the cone 9 readily enters between the collapsed walls of the casing and as the body is rotated the eccentrics force the rollers 4 and cone 9 outwardly against the casing walls with great lateral pressure. The rollers 4 do not rotate on the casing wall and therefore do not wear out the casing, which is an important factor. The large bearing area between the eccentric sleeves 5 and the rollers 4 results in greatly reduced bearing pressures and consequently lengthens the life of the tool considerably and makes it possible to apply greater pressures than can be successfully applied to casing rollers of the usual type. The cone 9 and the adjacent body at 15 and 16 receive the greatest wear and may be hardened in any suitable manner as by carburizing, nitriding or hard facing. The rollers, sleeves and body may also be hardened if desired.

Figure 2 shows a somewhat simpler arrangement than that shown in Fig. 1. The body 17 is successively reduced in diameter as shown at 18, 19, and 20, each reduction being arranged so that one side is flush with the outside diameter of the body portion next above it (with the exception of the first stage of reduction which forms a retaining shoulder 18 on the body) the reduced portions of the body at 18 and 20 being cylindrical and concentric with the axis of the body and the reduced portion 19 being cylindrical and eccentric to the axis of the body. No bushings or sleeves are shown in Fig. 2 which simplifies the construction but increases the maintenance cost since the body must be replaced or built up frequently. The rollers 21 and 22 are cylinders.

Fig. 3 shows still another form of my invention in which the body 23 is provided with a concentric portion 24 and an eccentric portion 25. The upper roller 26 on the concentric portion of the body 24 is mounted on an eccentric sleeve 27 keyed to the body as shown at 28. The lower roller 29 is likewise cylindrical and is mounted on a concentric sleeve 30 keyed to the body at 31. In order to hold the lower roller 29 in place I may use the construction shown in Figs. 1 and 2 or I may provide a pin 32 adapted to fit in a recess 33 in the lower end of the body 23. The pin 32 is provided with an enlarged flange 34 adapted to abut against the lower end of the body. The flange 34 is threaded to receive a threaded ring 35 which serves to retain the rollers and sleeves in place. The pin 32 may be secured in the recess 33 by means of threads or by means of a pin 36 which fits in a hole 37—38 in the body and pin 32. The sleeve 30 retains the pin 38 in place. The lower end of pin 32 is provided with a spherical head or ball 39 with a reduced neck portion 40. The head 39 is provided with a transverse opening 41 to receive a bar for assisting in inserting and removing the pin 32 from the body 23. A long, pointed conical nose 42 is mounted on the spherical head 39 with a universal joint action. The upper end of the nose 42 is provided with a circular opening having threaded walls 43 and terminating in a hemispherical indentation 44 adapted to snugly receive the spherical head 39. A threaded gland 45 is screwed into the threaded opening 43. The gland 45 is provided with a spherical inner face 49 of smaller cross section than the head 39 whereby the nose 42 is held in place on the head. Suitable means may be provided for locking the gland 45 in place, such as the laterally extending flange 46 provided with holes for receiving bolts 47 which are screwed into threaded openings in the cone 42.

The casing roller of Fig. 3 is shown in place in a section of collapsed well casing 50 with the sharp point of the nose 42 entering the collapsed portion with a powerful wedging action.

While I have illustrated and described three specific embodiments of my invention, I do not desire to be limited to any of the details shown or described herein, except as defined in the appended claims.

I claim:

1. A casing roller comprising a body adapted to be attached to a string of pipe, a plurality of cylindrical, axially spaced bearing surfaces on the body, cylindrical rollers mounted thereon and enclosing the body, said rollers having smooth inner and outer surfaces, at least one of the rollers being mounted eccentrically to the axis of the pipe, the maximum diameter of the tool being substantially the same as the inside diameter of the casing to be rolled, and a downwardly tapered nose rotatably mounted on the lower end of the body.

2. A casing roller comprising a body adapted to be attached to a string of pipe, a plurality of axially spaced cylindrical bearing surfaces on the body, cylindrical rollers having smooth inner and outer surfaces mounted thereon, and enclosing the body, said roller comprising an upper roller mounted concentrically to the axis of the pipe and being of slightly less diameter than the inside diameter of the casing to be rolled, a lower roller mounted eccentrically to the axis of the pipe and being of substantially the same diameter as the inside diameter of the casing to be rolled, and a downwardly tapered nose rotatably mounted on the lowermost end of the body.

3. A casing roller comprising a body portion adapted to be attached to a string of pipe and provided with a series of axially spaced non-rotatable bearing surfaces, cylindrical rollers having smooth inner and outer surfaces mounted on said bearing surfaces, at least one of said rollers being mounted for rotation eccentric to the axis of the pipe, and a downwardly tapered nose rotatably mounted on the lower end of said body in eccentric relation to the axis of the body.

4. A casing roller comprising a body portion adapted to be attached to a string of pipe and provided with a plurality of axially spaced, non-rotatable, cylindrical, bearing surfaces, cylindrical rollers having smooth inner and outer surfaces mounted on said bearing surfaces and enclosing said body, at least one of said rollers being offset eccentrically to the axis of the pipe, a spherical extension on the lower end of the body and offset eccentrically from the axis of the pipe, and a cone-shaped nose rotatably secured to said spherical extension whereby said nose has a universal joint motion.

5. In a casing roller comprising a body portion adapted to be attached to a string of pipe and provided with a plurality of axially spaced cylindrical bearing surfaces, cylindrical rollers having smooth inner and outer surfaces mounted on said bearing spaces, at least one of said rollers being mounted for rotation eccentric to the axis of the pipe, a downwardly tapered cylindrical extension on the lower end of said body having its axis parallel to the axis of the body, and a downwardly tapered conical nose rotatably mounted on said tapered extension.

ANDREW J. COLMERAUER.