

June 21, 1932.

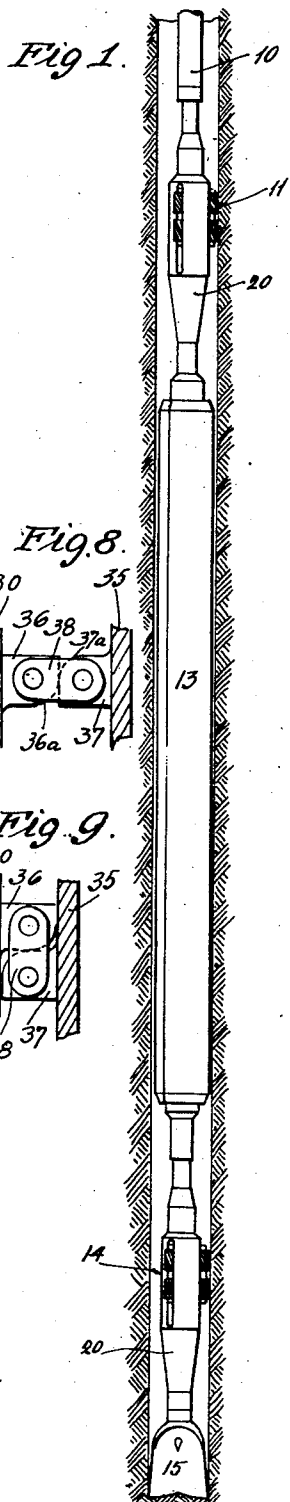
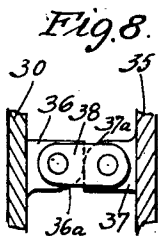
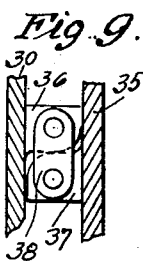
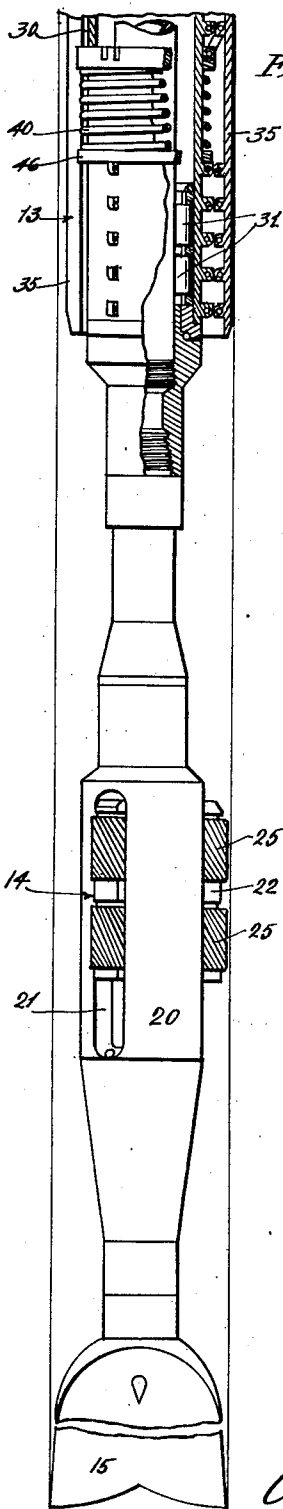
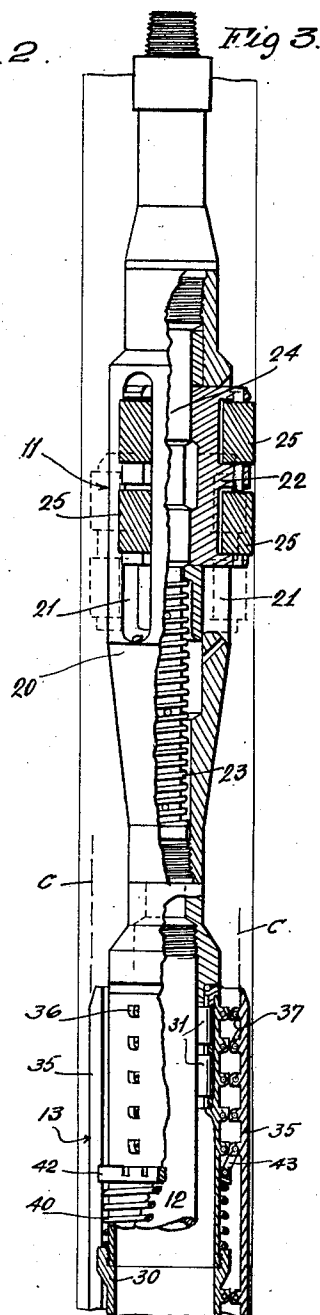
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1,864,274

COLLAPSIBLE HOLE STRAIGHTENER

Filed Jan. 22, 1930

2 Sheets-Sheet 1



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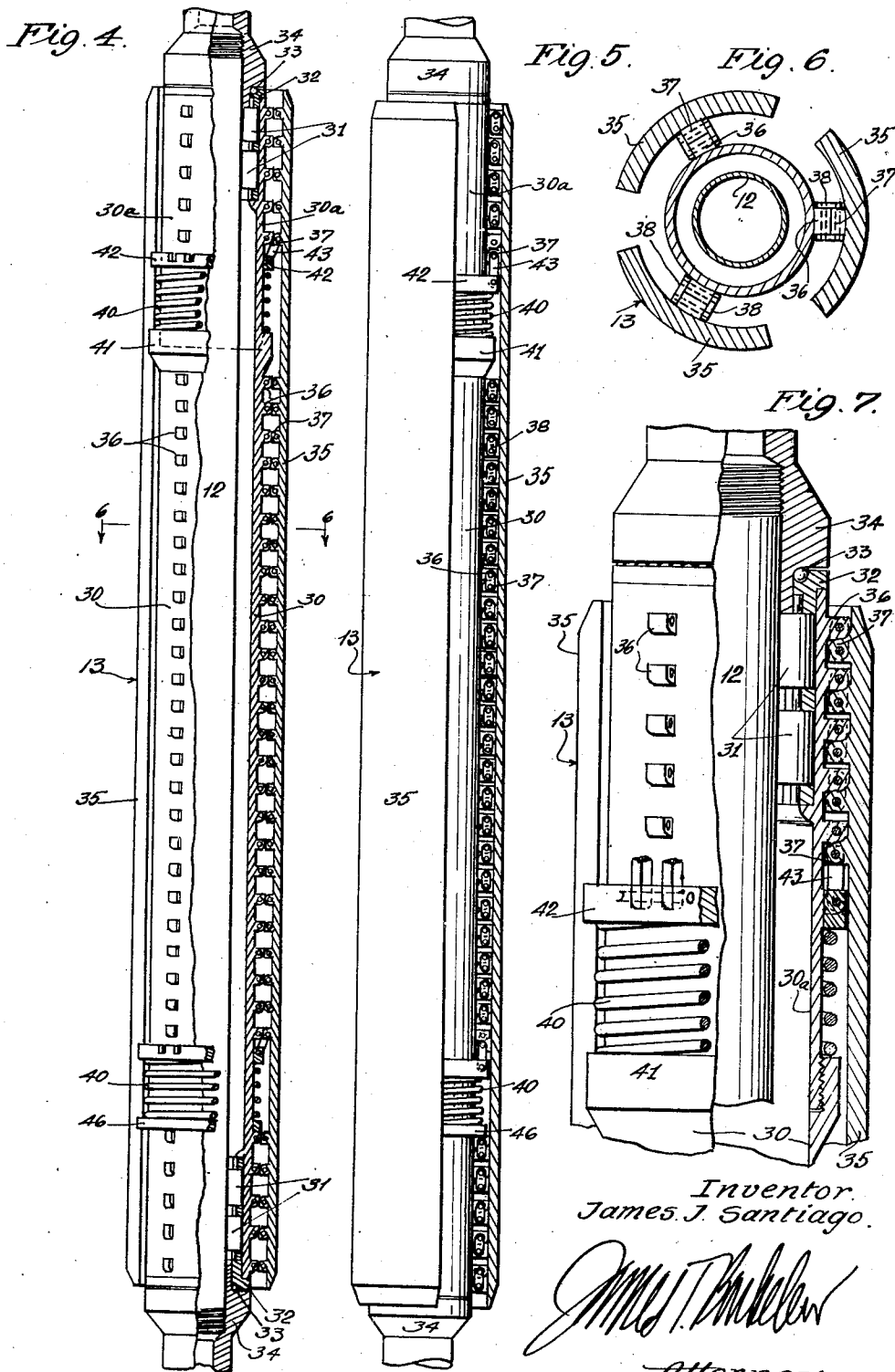
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UNITED STATES PATENT OFFICE

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COLLAPSIBLE HOLE STRAIGHTENER

Application filed January 22, 1930. Serial No. 422,578.

This invention relates to devices for straightening or for drilling a straight well bore; relating generally to that type of devices set out in my prior application entitled "Hole straightener", filed December 14, 1929, Serial No. 414,072 and in prior application which I have filed jointly with John Grant, entitled "Hole Straightener", filed January 6, 1930, Serial No. 418,870; and the present invention, although not in all its aspects limited to be improvements upon or within the inventions set forth in said prior applications, is in some aspects concerned with improvements upon said prior devices.

It is a general and characteristic object of the present invention to provide a device of the character set forth and which is constructed to be easily withdrawn from the drill hole, without any danger of becoming jammed or stuck in the hole. For this purpose I provide a guide member or element, generally tubular in formation, which is collapsible upon upward movement so as to contact to a diameter smaller than its operating diameter to be readily withdrawn. At the same time I associate this collapsible guide element preferably with expansive and contractive reamers; so that all the elements of the whole device are contractive for removal from the hole.

In said prior applications the straight hole devices there explained comprise characteristically a comparatively long and relatively stiff guide tube surrounding the drill pipe and within which the drill pipe is preferably rotatable. The guide tube is long enough, and relatively stiff, and engages the hole below with sufficient snugness, to guide the drill pipe and the adjacent drilling and reaming elements along a comparatively straight course. The reaming element or elements associated with the guide tube are of such size as to ream the hole out substantially to full diameter and perfect circular form; and the guide tube fits the hole which is thus reamed out.

In the present invention I provide a guide element which is expansive and contractive, primarily for surety of withdrawal from the hole. But that characteristic of ex-

pansion and contraction, particularly when expansive and contractive reamers are used in association with the guide element, may make the device capable of use not only for forming a straight hole but also for enlarging the hole under a well pipe—that is, for under-reaming. That last mentioned use of the device, however, need not be particularly dwelt upon herein, because it follows from the expansive and contractive nature of the devices to be explained.

I have shown typical and preferred details in the accompanying drawings, in which

Figure 1 is an elevation indicating the operation of the complete device in a hole.

Fig. 2 is an enlarged elevation and partial section of the lower parts of Figure 1;

Fig. 3 is a similar enlargement of the upper parts of Figure 1;

Fig. 4 is a part elevation and part section of the guide element showing the expanded position;

Fig. 5 is a similar view showing the contracted position;

Fig. 6 is a further enlarged cross section on line 6—6 of Figure 4;

Fig. 7 is a further enlargement, of the parts shown in the upper portion of Figure 4;

Fig. 8 is an enlarged fragmentary diagrammatic view showing a detail of the guide element in expanded position and

Fig. 9 is a similar view showing the same in contracted position.

In the drawings the main portion of the drill pipe is shown at 10. The upper reamer 11 is coupled at the lower end of that main portion of the drill pipe, and to the lower end of reamer 11 is coupled the section 12 of drill pipe which extends through the guide element 13. The section 12 may be one or more standard lengths of pipe. Then to the lower end of this drill pipe section 12 the lower reamer 14 is coupled, and the usual drill bit 15 is connected to the lower end of the lower reamer 14. The proportionate length of guide element 13, and of the drill pipe section 12 surrounded by it, may be somewhat longer than is proportionately illustrated in the drawings; it being desired that the guide element fit the hole through-

out a sufficient length to make sure that the guide element is always aligned accurately along the axis of the hole.

Two expansive and contractive reamers 11 and 14 are shown herein as reamers of the Phipps type (Phipps Patent 1,678,073, dated July 24, 1928). In this form, these reamers each comprise a body 20 having cutter holding slots 21 in which cutters or cutter bars 22 move vertically, being moved upwardly by the action of a spring 23. Within the body there is an internal cutter expanding mandrel 24, which, when the cutters move upwardly, cause the cutters to expand outwardly to the expanded position such as shown in Figure 3, and allow the cutters to contract inwardly when they are moved down by contact with the casing shoe or any other obstruction. The dotted lines in Figure 3 indicate the contracted position of a cutter. For the purposes concerned in the present invention the ultimate cutting elements of these reamers are preferably roller cutters 25.

It is not necessary to explain these reamers further in detail. From what has been described it will be understood that the reamers, when in operation, are normally expanded to the expanded cutting positions illustrated, to ream out the hole to the full expanded reamer diameter. And it will also be understood that when the devices are withdrawn from the hole, and if for any reason the hole at any point has filled in or become contracted, the reamers will be capable of reaming at least to their contracted diameter. If in withdrawing the reamers from the hole any obstruction is met by the cutters, they move downwardly and inwardly, so that withdrawal from the hole is thus facilitated; and if the obstruction is such as to oppose passage of the contracted reamers, they may be operated, by rotation, to ream upwardly and to ream out the hole to a size equal at least to their contracted diameter; and in so doing, as is hereinafter pointed out, they will ream out the hole to a diameter at least large enough to pass the contracted guide element.

The guide element, as particularly shown herein, is made up of an inner tubular member 30 which, for convenience of manufacture and assembly, may have an end extension 30a screw-threadedly joined to the central portion 30. Considering this inner tubular member as one piece, it is to be noted that it is preferably mounted upon the drill stem section 12 in such manner that the drill stem may rotate within the tubular member, and is also preferably mounted so as to have bearing upon the drill stem section at its ends only. Thus, at the ends of the tubular member, roller bearings 31 are provided within the tubular member and surrounding the drill stem section 12; and the ends of the tubular member are provided with end-thrust bearing

rings 32 which form one element of the end thrust ball bearings which include the balls 33 and end thrust races formed in the coupling members 34 which are screwed onto the end of drill stem section 12. The tube 30 so mounted upon the drill stem section does not necessarily revolve with the drill stem—it may stand rotatively stationary within the well while the drill stem revolves within it.

The tube 30 does not, however, contact directly with the hole wall; but carries the contact shoes 35. These contact shoes 35 are in the nature of long cylindric segments whose curvature is preferably on a diameter equal to the expanded diameter of the shoes. The shoes are mounted on tube 30 and its extension 30a by means of the toggle mountings shown in the drawings. For instance, the tube 30 and its extension 30a are provided with a series of pivot lugs 36, and the inner faces of the shoes are likewise provided with similar pivot lugs 37; and short pivoted links 38 interconnect these lugs and swing between the relative expanded positions shown in Figure 4 and the relative contracted position shown in Figures 5 and 7. The lower corner of each lug 36 is rounded off as indicated at 36a (see particularly Figures 8 and 9) while the upper corner of each lug 37 is similarly rounded off at 37a. This allows the lugs to swing between the relative positions shown in Figures 8 and 9; but, with the links 38 of the relative lengths illustrated, causes the lugs to come into stop contact with each other as is clearly shown in Figure 8 in the expanded position. Thus when the contact shoes 35 move upwardly to their expanded positions they are stopped in that position; and from that expanded position they can only move back down and inwardly to their contracted positions.

To provide means for urging the contact shoes to their expanded positions I use a pair of springs 40 which surround the tube 30 or its extension. The upper one of these springs 40 rests upon a shoulder 41 which is formed at the screw-threaded connection of the tube 30 and its extension 30a. Upon the upper end of this compression spring 40 a ring 42 rests and this ring is connected by links 43 with lugs 37 of the contact shoes 35. The lower spring 40 is similarly connected to the contact shoes; this lower spring 40 rests upon a ring 46 which in turn rests upon lugs 36 of the tube 30. Springs 40 exert sufficient upward force to move the shoes upwardly and outwardly to their expanded positions and normally to hold them in those positions. But the springs do not exert so much force but that the shoes may be forced downwardly and inwardly when the device is withdrawn from the hole and in case the device should meet any obstruction or contraction of the hole.

The expanded diameter of contact shoes 35 is preferably just slightly less than the hole diameter which is supposed to be drilled by bit 15, or the diameter to which the expanded lower reamer 14 reams out the hole. In a typical use of these devices drilling and reaming and straightening may be carried on simultaneously, although the devices may also be used for reaming and straightening a hole which has previously been drilled. And in a typical use, the expanded reaming diameter of the lower reamer 14, or of both reamers, may be equal to the drilling diameter of bit 15—that is, equal to the diameter of the hole which bit 15 is supposed to drill. There is, however, no inherent reason why either or both of the reamers should not be of expanded reaming diameter larger than the drilling diameter of bit 15; and also it is not necessary that the reaming diameters of the two reamers be equal. That of the upper reamer may be larger than that of the lower reamer so that the hole may be further enlarged and reamed out above the guiding element; and the lower reamer may likewise be larger than the bit. But, as a typical instance, and in order to explain the present invention in a simple form and use, it will be assumed that the expanded reaming diameters of both reamers are equal to the supposed drilling diameter of bit 15; so that the action of these reamers is merely to ream out the hole to a true circle of full size.

The expanded diameter of the guide element is in all cases just slightly less than the expanded reaming diameter of the lower reamer 14; so that the guide element following down behind reamer 14 will fit the reamed hole as snugly as may be practicable and will thus form an accurate guide for the whole tool. See Fig. 2. The upper reamer 11 may then, following the guide element, act merely as a clean-up reamer, or it may act, in its expanded condition to ream the hole out still larger.

But, whatever the expanded reaming diameter of the upper reamer 11 may be, its contracted diameter is preferably somewhat larger than the contracted diameter of the contact shoes 35. The contracted position of the upper reamer cutters is indicated in dotted lines in Figure 3; and the diameter of that contracted position is shown to be somewhat greater than the contracted diameter of the contact shoes, as shown in Figures 3 and 4. Consequently, in case any obstruction, contractive swelling, or cave-in occurs above the tool, the contracted upper reamer 11 will be capable of reaming the way out for the contracted guide element.

I claim:

A collapsible tool guide comprising, in combination with a drill stem section, an elongate tubular member surrounding said section and having bearings thereon allow-

ing relative rotation between the section and the tubular member, pivot lugs on the tubular member, a plurality of elongate contact shoes of cylindric segmental form and having pivot lugs on their inner faces, swinging links interconnected between the pivot lugs of the tubular member and of the contact shoes, and a spring mounted upon the tubular member and acting upon the contact shoes to move them upwardly and outwardly.

In witness that I claim the foregoing I have hereunto subscribed my name this 14 day of January, 1930.

JAMES J. SANTIAGO.