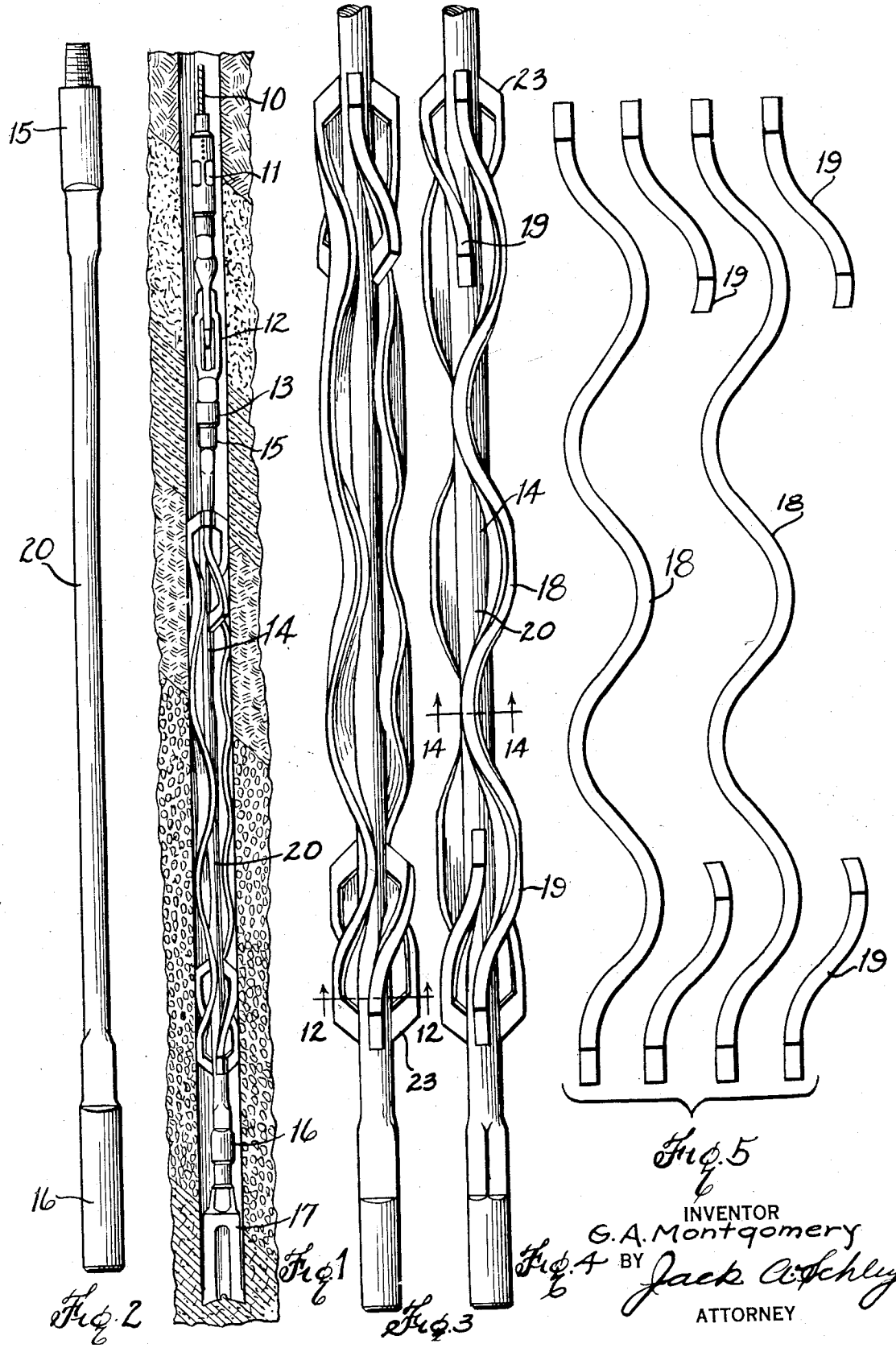
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DRILL STEM GUIDE

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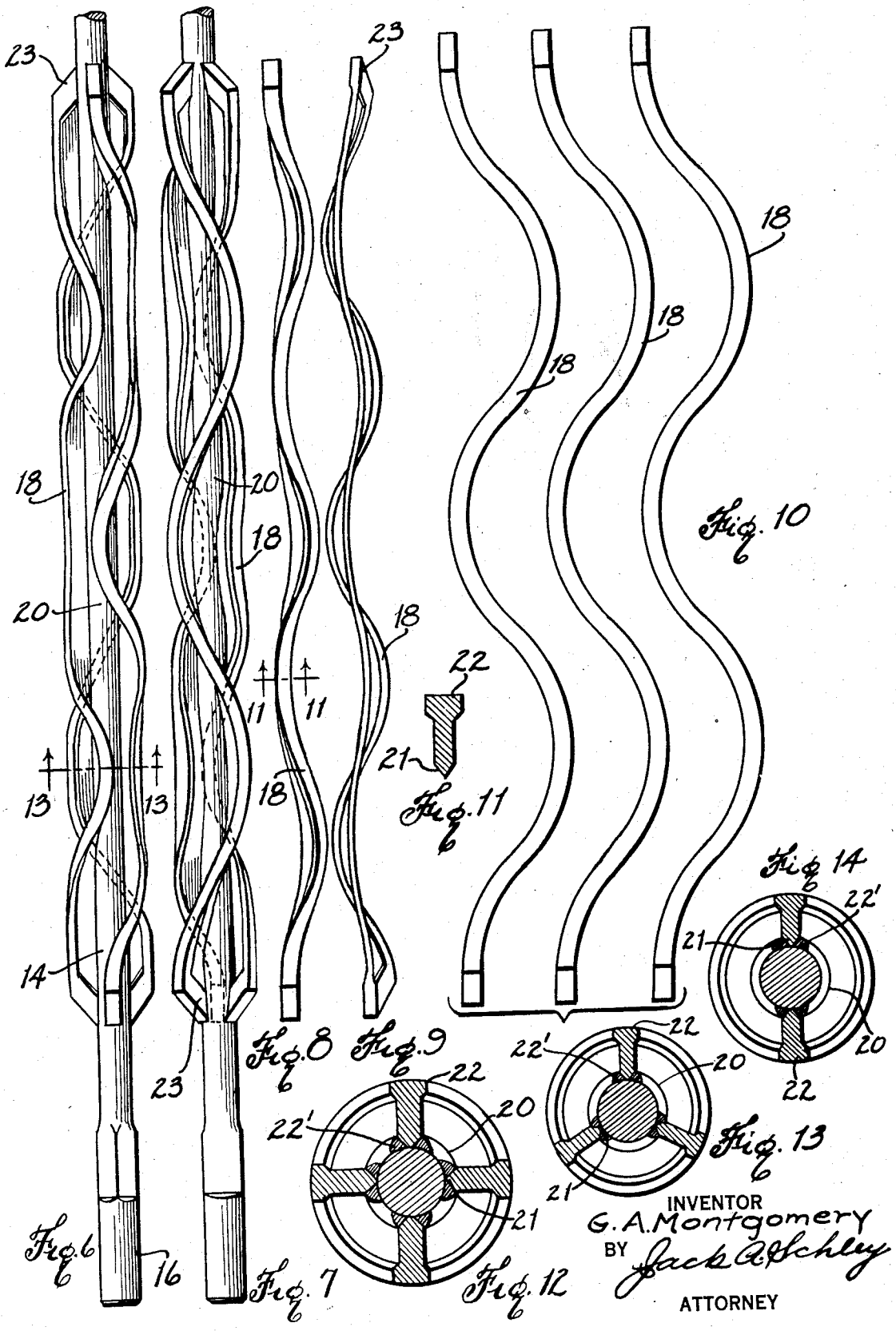


Fig. 6 Fig. 7 Fig. 8 Fig. 9 Fig. 10 Fig. 11 Fig. 12 Fig. 13 Fig. 14

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UNITED STATES PATENT OFFICE

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DRILL-STEM GUIDE

Application filed July 23, 1928. Serial No. 294,671.

This invention relates to new and useful improvements in drill stem guides.

One object of the invention is to provide a drill stem guide in which the individual wings or vanes do not completely encircle the mandrel, thus providing more direct and less obstructed vertical channels for the upward passage of fluids, mud and drillings.

An important object is to provide a drill stem, which, while forming a guide and giving an equalized bearing circumferentially of the hole, will not spiral or tend to rotate when reciprocated, thus avoiding a pumping action. Advantages of such a structure are that the walls of the hole are not cut or grooved and the fluids and drilled detritus are constantly kept in motion and induced to flow.

Another object of the invention is to provide a drill stem with a plurality of sinuous wings or vanes constructed with broad bearing faces, but otherwise reduced so as to eliminate surplus material and weight, thus making for lightness and more ready handling.

A still further object of the invention is to form the wings or vanes in sinuous lengths less than a helix and to make them separately and then secure them on the mandrel. The advantages of such a structure are that the vanes are more easily cast or formed separately than if made integral with the mandrel; also the use of high-powered expensive presses is avoided, and worn-out vanes may be cut off and replaced.

Another object of the invention is to provide a drill stem formed of a mandrel and individual sinuous wings or vanes separately secured thereto, whereby vanes of different lengths and various circumferential spacings may be used.

A construction designed to carry out the invention will be hereinafter described, together with other features of the invention.

The invention will be more readily understood from a reading of the following specification and by reference to the accompanying drawings, in which an example of the invention is shown, and wherein:

Fig. 1 is a vertical sectional view of a well showing in use a typical string of tools including a drill stem constructed in accordance with my invention,

Fig. 2 is an elevation of a plain drill stem or mandrel to which vanes are applied in accordance with my invention,

Fig. 3 is an elevation of a portion of such a drill stem,

Fig. 4 is a view at right-angles to Fig. 3,

Fig. 5 is a diagrammatical view showing the vanes in their relative positions and spread into a horizontal plane,

Figs. 6 and 7 are views similar to Figs. 3 and 4 and showing other forms of the invention,

Figs. 8 and 9 are obverse and reverse elevations, respectively, of one of the individual vanes,

Fig. 10 is a view similar to Fig. 5 but showing the ribs of Figs. 6 and 7,

Fig. 11 is an enlarged cross-section on the line 11—11 of Fig. 8,

Fig. 12 is an enlarged horizontal cross-sectional view taken on the line 12—12 of Fig. 3,

Fig. 13 is an enlarged horizontal cross-sectional view taken on the line 13—13 of Fig. 6, and

Fig. 14 is a horizontal cross-sectional view taken on the line 14—14 of Fig. 4.

In the drawings the numeral 10 designates a cable or suitable suspending element, to the lower end of which a rope socket 11 is attached. A set of jars 12 are connected to the lower end of the rope socket and a box 13 is carried on the lower end of the jars. A drill stem 14 constructed in accordance with the invention has a pin 15 at its upper end screwed into the box 13 and a box 16 at its lower end receiving a bit 17. This illustration is typical and, of course, permits of considerable variation. Under some conditions the jars may be eliminated or they may be connected between the drill stem and the bit. Also more than one drill stem may be used in a string.

The invention resides, of course, in the structure of the drill stem and consists primarily in a plurality of non-helical sinuous vanes 18 extending longitudinally of a mandrel 20, but terminating short of the ends

thereof, and auxiliary vanes 19 mounted between the vanes 18 at the ends thereof in some instances. While a vane may lie around the mandrel one-half of the circumference of said mandrel, and will under no conditions completely surround the mandrel and it does not, therefore, become helical.

In Figs. 1 to 5 inclusive, and Figs. 12 and 14 I have shown a form of stem comprising two diametrically opposite sinuous vanes 18 and relatively short auxiliary vanes 19 between the ends thereof. In forming the stem I employ a smooth mandrel 20, as is shown in Fig. 2, and provide the pin 15 on one end and the box 16 on the other end.

The box and pin may be upset from the body of the mandrel or they may be separately made and welded on the mandrel. It is obvious that it would be less expensive to form the box and pin separately and secure them to the mandrel than to upset or cast them separately from the mandrel. The particular structure and arrangement of the pin and box is not a part of the invention.

As is shown in Figs. 8 and 9, the vanes 18 are formed separately. They may be cast of steel or rolled or otherwise formed. Each vane is given a sinuous shape, as is best illustrated in the diagrammatical showing of Fig. 5. It is preferable to form the vane with its convolutions equally spaced on opposite sides of its longitudinal axis. As shown in Fig. 11, each vane has its inner edge formed on a double bevel 21, which is curved to fit the cylindrical surface of the mandrel.

In assembling the stem the vanes are held in position on the mandrel 20 and welding material 22′ is applied along each side of the bevel 21, whereby the vane is rigidly and substantially attached to the mandrel. I have shown each vane provided with an outlying head or rib 22 which provides an amplified bearing surface and whereby the vane exhibits a T-shape in cross-section, but it is obvious that the vanes may be given other cross-sectional shapes.

The form which has been illustrated shows two diametrically opposite sinuous vanes 18 and it is obvious that these vanes will provide there-between sinuous channels extending longitudinally of the stem. The vanes being non-helical, the channels will consequently be non-helical and, therefore, the liquids and drilled detritus in passing longitudinally of the stem will not be compelled to travel around the mandrel but will take an undulating or sinuous path. The advantage of this is that the liquids and detritus will be kept constantly in motion and any tendency thereby to rotate the stem will be prevented.

Under some drilling conditions the short vanes 19 between the ends of the vanes 18 are very desirable in order to provide a cruciform bearing structure, but if more elongated blades 18 were used the short blades 19 would not be necessary.

A rather important feature is the forming of shoulders 23 at the ends of the vanes, either by upsetting or otherwise, and these shoulders not only strengthen the vanes but sustain the shocks due to the end thrusts of the stem, as for instance where the vanes would strike the lower edge of the casing. It is, of course, obvious that the auxiliary blades 19 may be located at any desirable points.

In applying the vanes it is desirable to locate them on the core by jigs and to spot-weld them in place. The welding is preferably started from the middle or diametrically opposite guides and an individual welder handling each guide. The welders should work toward the same end and remain as close in longitudinal parallel relation with each other as possible, for the purpose of equalizing the contraction and expansion stresses. The weld is completed on one of the bevelled sides and then the weld on the opposite bevelled side is produced. Of course, any approved or satisfactory method may be employed.

In Figs. 6, 7, 10 and 13 I have shown another form in which three continuous vanes 18 are employed instead of two. This structure eliminates the necessity of the short vanes 19, as the vanes give a sufficient bearing surface around the mandrel without being helical.

There are many advantages resulting from a stem constructed in accordance with this invention. The sinuous and non-helical vanes agitate the detritus in the most efficient manner and they offer a greater guide surface with less weight than those guides now in common use. It has been found that the sinuous guides not encircling the mandrel produce a stronger and stiffer guide stem than guides using an equal number of helical vanes. The sinuous vanes are also more readily molded or rolled than helical vanes and the entire structure can be produced much cheaper. The provision whereby a vane may be removed from the mandrel and a new vane substituted is very important.

Various changes in the size and shape of the different parts, as well as modifications and alterations, may be made within the scope of the appended claims.

What I claim, is:

1. In a drill stem, a mandrel, and vertically disposed sinuous vanes extending radially and longitudinally of said mandrel, said vanes being continuous and of relatively great pitch and great length.

2. In a drill stem, a mandrel, and vertically disposed sinuous vanes extending radially and longitudinally of said mandrel, said vanes forming continuous sinuous channels therebetween extending substantially axially of the mandrel for conducting the fluids

and drilling detritus without rotating said stem.

3. A drill stem having continuous sinuous vertically disposed vanes extending longitudinally thereof and providing continuous sinuous channels therebeteween.

4. A drill stem having vertically disposed sinuous vanes extending longitudinally thereof, each vane being T-shaped in cross-section and having an amplified outer beating surface.

5. A drill stem having continuous sinuous vertically disposed vanes extending longitudinally thereof and providing continuous sinuous channels therebetween, and relatively short sinuous vanes disposed in said channels.

6. In a drill stem, a mandrel, elongated sinuous vanes extending radially and longitudinally on the mandrel and spaced from each other, and relatively short sinuous vanes extending radially and longitudinally on the mandrel between the elongated vanes at each end thereof.

7. In a drill stem, a central mandrel, and individual vertically extending sinuous vanes separately fastened on the mandrel, each vane having its convolutions projecting equal distances on opposite sides of a vertical plane extending through the ends of the vane.

8. As a sub-combination in a drill stem, a vertically extending sinuous elongated vane having a plurality of convolutions on each side of a longitudinal plane extending through the ends of the vane.

9. As a sub-combination in a drill stem, a vertically extending sinuous elongated vane exhibiting a T-shape in cross-section throughout its length and also inclined longitudinally at its ends.

10. As a sub-combination in a drill stem, a vertically extending sinuous elongated vane having an amplified outer bearing surface and inclined shoulders at each end.

11. In a drill stem, an axial mandrel, and continuous vanes on the mandrel spaced apart and each composed of regular curved portions in reverse order forming continuous passages axially of the mandrel.

12. A drill stem as set forth in claim 11 in which the curved portions of each vane are struck on the same radius.

13. A drill stem as set forth in claim 11 in which the reverse curves are equal.

In testimony whereof I affix my signature.

GUSTAVUS A. MONTGOMERY.