

Aug. 25, 1970

I. LARI
DRILL-STEM

3,525,237

Filed June 18, 1968

3 Sheets-Sheet 1

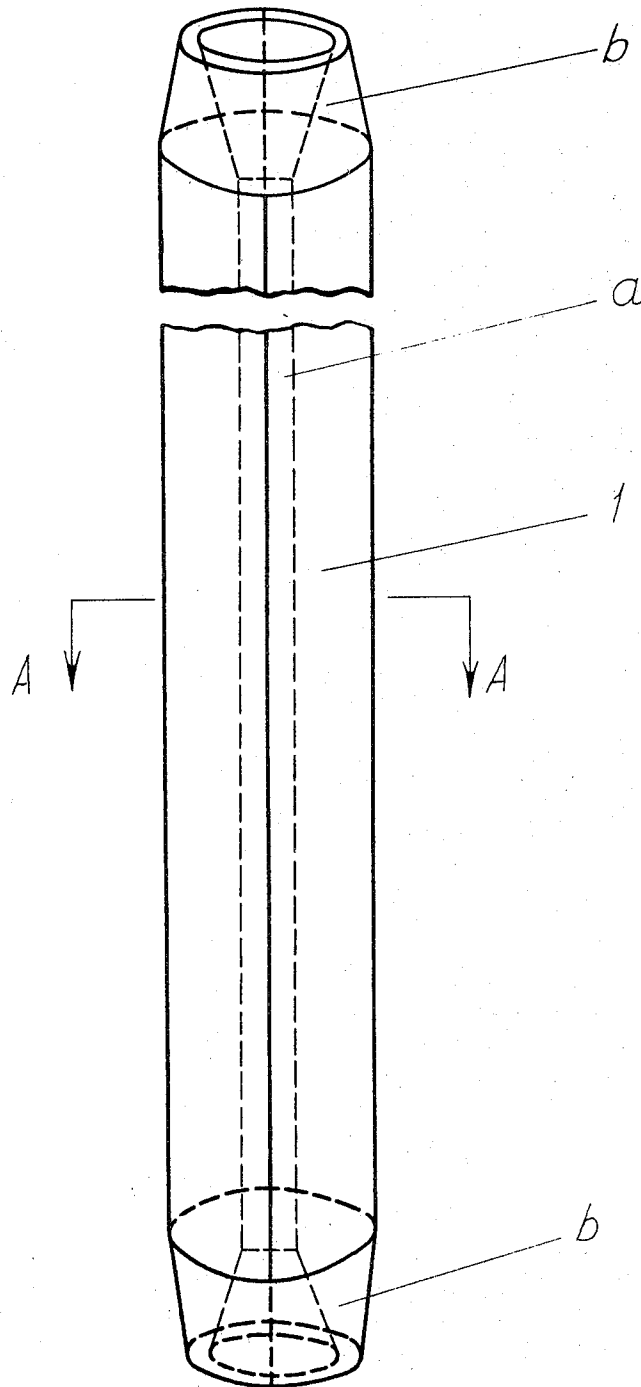


Fig. 1

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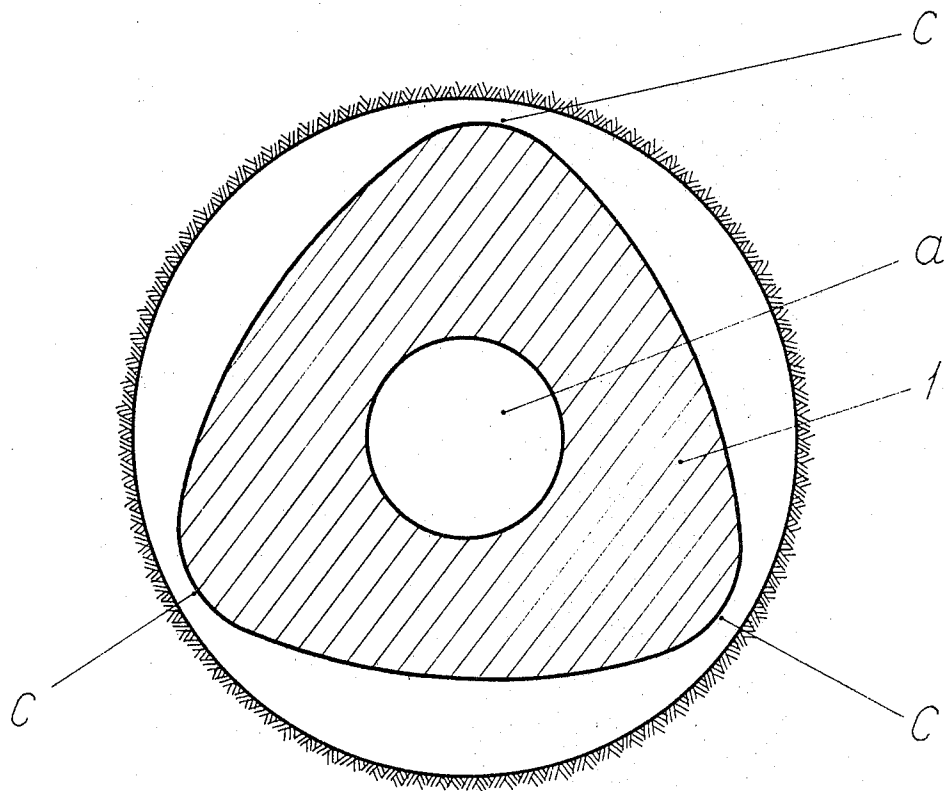


Fig 2

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FIG. 5

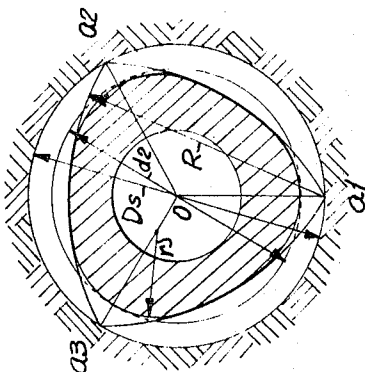


FIG. 4

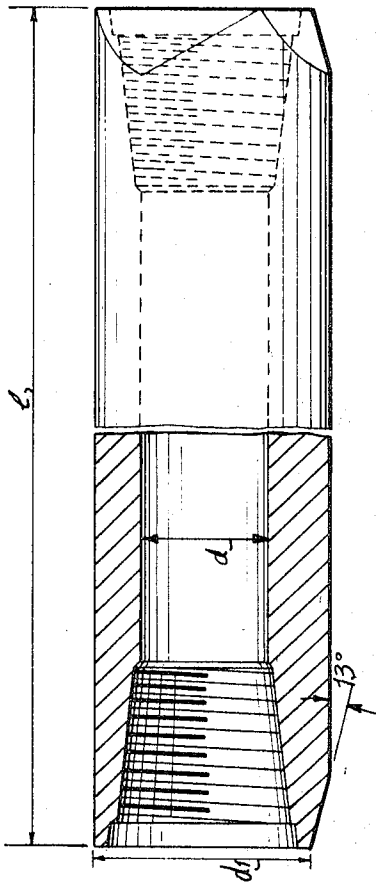
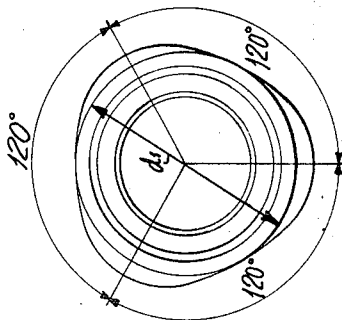


FIG. 3



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3 Claims

ABSTRACT OF THE DISCLOSURE

A drill stem is provided which comprises an elongated body having a cross-section in the shape of a curved equilateral triangle with equal axial moments of inertia as to every axis which passes through the center of the base circle of the cross-section of the triangle.

DRAWINGS

FIG. 1 is a perspective view of a drill stem provided in accordance with one embodiment of the invention; FIG. 2 is a cross-section through line A—A of FIG. 1; FIG. 3 is an end view of the drill stem; FIG. 4 shows a drill collar provided with thread boxes; and

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a flow of drilling fluid in downward direction. At its ends, there are tapered connecting portions *b* provided for assembling the drill stems together with the aid of swage nipples (not shown).

The cross-section of the drill stem, as shown in FIG. 2, has the shape of a symmetrically curved equilateral triangle, the edges *c* of which come in contact with the walls of the bore and are therefore preferably formed with a hard material for eliminating wear during operation in the bore hole. Due to this shape of the drill stem, which can be realized, for example, by rolling, the moments of axial inertia have equal values about all the axes passing through the base center of the cross-section of the curved equilateral triangle. This realizes states of equal strain in every section, the moments of inertia being about 80 to 90% larger than those of cylindrical drill stems.

At the same time, due to this shape, there is obtained, apart from a good stability of the drill stem string, a larger space for the upward circulation of the drilling fluid simultaneously with the realization of a large weight per unit length of drill stem.

The following table indicates in conjunction with FIGS. 3, 4 and 5, various dimensions of operating arrangements:

Nominal size, E.D. in.	Bit size, D.S. mm.	<i>d</i>	<i>d</i> ₁	<i>d</i> ₂	<i>l</i>	<i>R</i>	<i>r</i>	Thread A.P.I.
4 3/8	142	43	103.6	111	8,000	122.8	47.5	2 7/8 Reg.
5 1/8	165	54	120.6	136.5	8,000	142.8	52.0	3 1/2 Reg.
6 1/8	186	66	136.0	155.5	8,000	161.0	54.5	3 3/4 Fst.
7 1/8	213	79	155.4	184.0	8,000	184.4	57.3	4 1/2 Reg.
8 3/8	241	97	176.4	212.5	8,000	208.7	62.0	5 1/2 Reg.
10 3/8	288.5	108	182.6	269.5	8,000	240.5	65.6	6 3/4 Reg.

FIG. 5 corresponds with FIG. 2 but illustrates some dimensions.

DETAILED DESCRIPTION

The invention relates to drill stems which permit a maximum load on the drilling bit and provide an automatic centering of the drill stem string in a bore hole.

Drill stems are known which have a round or square cross-section. The drill stems with a round section have the disadvantage that their weight per unit length is relatively low and centering devices are necessary to maintain the verticality of the bore. Drill stems with a square section have the disadvantage that free space for the upward circulation of drilling mud is too small and the development of technical operating accidents is possible.

A type of drill stem is also known which consists of a central tube having around it three heavy cylindrical blocks which are solidly fixed by plates to the central tube. This type of drill stem has the disadvantage of having a complicated construction and the further disadvantage that, during operation in the bore hole, operating accidents might occur.

The drill stem according to the invention does away with these disadvantages due to the fact that, in order to realize a maximum weight per unit length and an assurance of a sufficient large space for the downward flow of drilling fluid and the stability of the string without the need for centering devices, the drill stem is provided with a cross-section having the shape of a curved equilateral triangle which has equal axial moments of inertia as to any axis passing through the center of the base circle of the cross-section of the curved equilateral triangle. This insures optimum stability of the drill stem string.

With reference to the drawings, the drill stem consists of a body 1 provided with a central channel *a* for passing

FIG. 5 shows radius *R* for determining the sides of the curved equilateral triangle. Points *a*₁, *a*₂ and *a*₃ of the equilateral triangle are the centers for drawing the circular arcs corresponding to the three sides of the curved triangle.

Any axis passing through center *O* (FIG. 5) is an inertia axis for the axial moments of inertia. The table indicates all the design details of several self-stabilizing drill collars.

FIG. 4 shows a drill collar fitted at both ends with coarse thread boxes of the tool-joint type. The drill collars are threadably connected through the medium of cylindrical stubs which are 500–800 mm. in length.

The drill stem's characteristics according to the invention, have the following advantages:

They insure good stability of the drill stem string;

They realize the most weight per unit length, and

They insure a maximum space for upwards circulation of the fluid.

The central channel *a* flares outwardly at its ends.

What is claimed is:

1. A drill stem comprising an elongated body having a cross-section in the shape of a curved equilateral triangle with equal axial moments of inertia as to every axis which passes through the center of the base circle of the cross-section of the curved equilateral triangle, said body being provided with a central channel of circular cross-section for the downward flow of a drilling fluid therethrough, said body including tapered end portions, the channel having flared end portions in said tapered end portions of the body.

2. A drill stem as claimed in claim 1 wherein the body has three outermost portions at the apices of the triangle which are of a relatively hard material.

3. A drill stem as claimed in claim 2 wherein said

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curved triangle has side surfaces which extend along
circular arcs struck from the opposite apex of the triangle.

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