Dec. 22, 1959 C. W. COFFEE 2,918,323

MAGNETIC FISHING TOOL

Filed May 26, 1958

FIG. 1

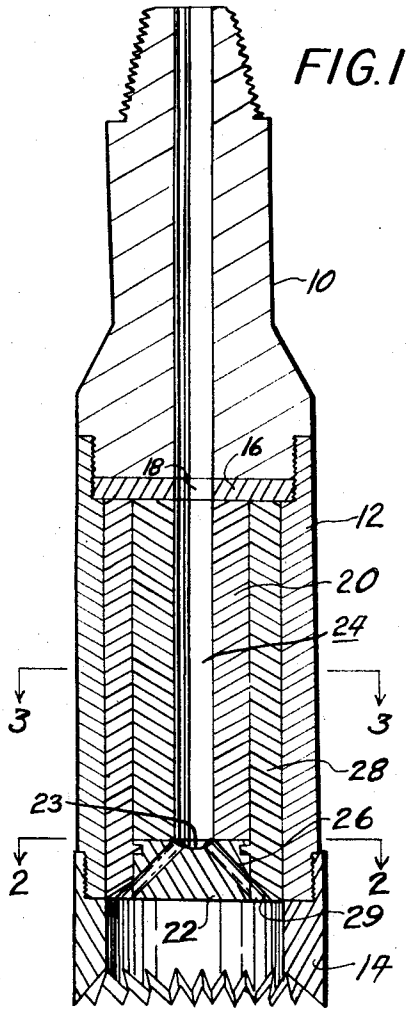



FIG. 2

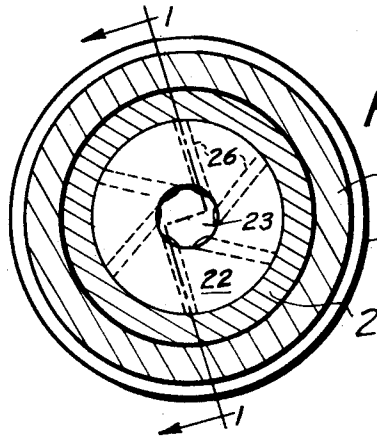



FIG. 3

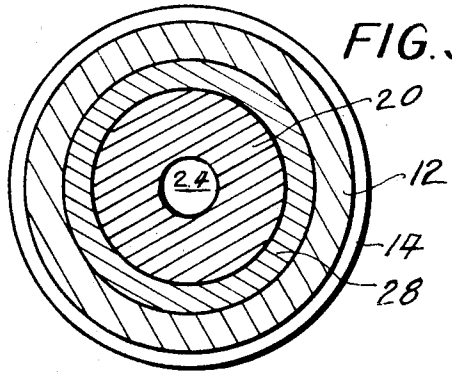
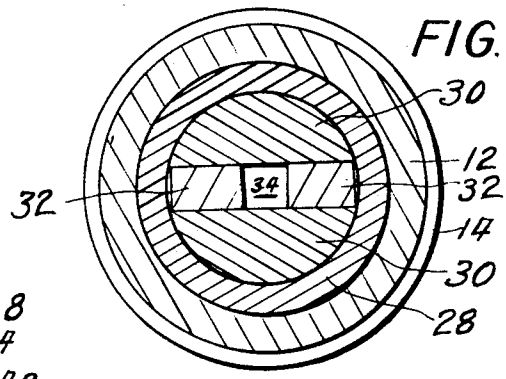



FIG. 4



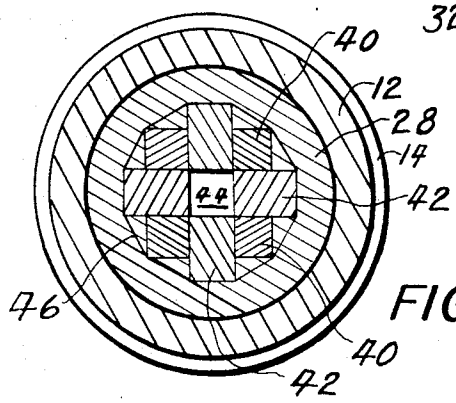




FIG. 5

INVENTOR.

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2,918,323

# MAGNETIC FISHING TOOL

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4 Claims. (Cl. 294—65.5)

This invention pertains to magnetic fishing tools and, more particularly, to those tools designed to be lowered into oil well bores to retrieve small parts of various junk which may be there.

An object of this invention is to provide a magnetic fishing tool which produces considerable turbulence of circulating fluid to agitate the pieces of junk against the magnet.

Further objects are to achieve the above with a device that is sturdy, simple and reliable yet cheap and easy to manufacture.

The specific nature of the invention as well as other objects, uses and advantages thereof will clearly appear from the following description and the accompanying drawings in which:

Fig. 1 is a sectional view of a tool in accordance with this invention, as taken on line 1—1 of Fig. 2.

Fig. 2 is a cross sectional view taken on line 2—2, Fig. 1.

Fig. 3 is a cross sectional view of the tool taken on line 3—3 of Fig. 1.

Fig. 4 is a cross sectional view of a modification taken on a plane similar to the plane of Fig. 3.

Fig. 5 is a cross sectional view of another modification taken on a plane similar to the plane of Fig. 3.

An embodiment of this invention as shown in the accompanying drawings is somewhat similar to the tool as disclosed in the U.S. patents to Kirby #2,668,077 and #2,790,116 and to Trowbridge #2,729,494.

The tool has a cylindrical connector **10**, which is threaded at its upper end to be connected to a string of drill pipe. There is a cylindrical axial bore for the passage of fluid from the drill pipe to the working area. On the lower end are threads for the connection of tubular body **12**. The lower end of the tubular body has external threads for connection of rotary shoe **14**. Tubular body **12** has internal threads on its upper end both for the purpose of connection to connector **10** and for securing upper pole plate **16** which is threaded along its edge to mate with the threads of the tubular body. The upper pole plate **16** is a disc of paramagnetic material. It has aperture **18** through the center for the passage of fluid.

Within tubular body **12** there is an upright elongated mass of magnetic material **20**. The upper end of this mass of magnetic material is a plane surface, in contact with the upper pole plate **16**, and normal to the axis of the tool. The lower end of this elongated mass of magnetic material is also a plane surface which is parallel to the upper surface. Lower pole piece **22** is in contact with the lower end of the magnetic material **20** and approximately the same width. The lower pole piece is likewise comprised of a paramagnetic material. As taught in the Trowbridge patent, it should be of a tough material.

The mass of magnetic material **20** has fluid passage **24** from end to end thereof. This fluid passage is coaxial with the tubular body **12** and therefore registers with the passage through the connector **10** and upper pole plate **16**. Pole piece **22** has a concave depression **23** in its contacting face which registers with the fluid passage **24**. A plurality of fluid passages **26** diverge from this depression. They extend downward and outward to a point on the surface of the lower pole piece which is adjacent to the lower face. Considering the fluid passages **26** as seen in Fig. 2 which is in a plane of the contacting face, it will be noted that they do not extend radially. They extend in an oblique direction from the central area, i.e. semitangential from depression **23**. In this manner the fluid pumped through the fluid passages impinges with a greater degree of turbulence around the teeth of the rotary shoe. This aids in agitating whatever junk may be in the bottom of the well so it is more readily attached to the lower face of the lower pole piece **22**. As seen in the drawings, I prefer to have the diverging fluid passages angle generally in the direction of rotation of the tool as evidenced by the teeth of the rotary shoe **14**.



As may be seen in Fig. 3, a cylindrical permanent magnet may be used with a circular bore therethrough. Since many of the better magnets are presently made from extremely hard and brittle materials, the bore may be formed by the process of sonic vibrations in a slurry of abrasive material sometimes known as the "Cavitron" process.

Because of the difficulty of machining magnetic materials a modification of the mass of magnetic material is shown in Fig. 4. In this modification the magnetic material is made up of two prisms **30** which have a D-shaped end or base. The two D-shaped prisms are separated by two rectangular prisms **32**. The width of these rectangular prisms is less than one-half the cord lengths of the D-shaped ends. This leaves a central aperture **34** for the passage of fluid through the magnetic mass. The rectangular prisms **32** may be of magnetic material themselves. Then the permanent magnet also includes the rectangular prisms **32**. Of course, having four elongated magnets all having their north poles adjacent and south poles adjacent will cause a repelling force between the four magnets. However, this aids in holding the magnetic material in the tubular body **12** as will be explained later. Of course, it is not essential that the prisms **32** be of magnetic material. They can be constructed of non-magnetic material as taught by Trowbridge.

Fig. 5 illustrates a further modification. In this modification, a magnetic mass is made up of eight rectangular prisms. Four of these rectangular prisms **40** are square-based while the other four **42** are not. These particular configurations have been chosen as they most nearly fill the circular space within which it is most convenient to confine the magnetic mass, yet leave room for aperture **44** through the center for the passage of fluids, and also provide for the use of shapes which are easily formed from the magnetic material which will be used.

To assemble the device as shown in Fig. 5, I choose to first arrange the prismatic magnets in the unmagnetized state. A block of wood may be positioned in the aperture **44** to hold them in place temporarily. The magnets are securely strapped by metal bands **46**. Then they are subjected to a high intensity unidirectional magnetic field to magnetize them so that all of their north poles are adjacent. This magnetization will cause each of the magnets to repell the others so that they tend to radiate from the central aperture **44**. This makes it possible to easily remove the wooden block from this aperture. Also, they are held securely in place as they tend to stretch out against the metallic bands **46**. Then, using wooden poles as rails, the magnetized mass may be inserted within the tubular body **12** which already has the upper pole plate **16** in place. It is necessary to use non-magnetic rails around the magnetic mass; otherwise, if the magnetic mass ever touches the tube **12**, it is difficult

to center it again. Also, a wooden guide may be used through the fluid passage in this process. After the magnet has been placed in the tube, the lower pole piece **22** is placed in position. The annular space between the magnet and the body may be filled with Babbitt **28** or any other diamagnetic material that has a low melting point. Also, certain plastics may be used, such as epoxy resins. It is necessary that the temperatures not be extremely elevated in filling this space because of the adverse effect upon the magnet. At the lower end of the assembly the filler material **28** in the annular space between the magnet and the tubular body **12** is removed to a conical form as seen at **29**. This provides the final passage for the fluid which comes through the connector **10**, magnetic mass **20** and on out the pole piece **22**.

Thus it may be seen that in the three embodiments of Figs. 3, 4, and 5, I have provided a tool wherein there is a lower annular magnetic pole around and concentric the magnetic pole in pole piece **22**. The magnetic flux path extends from the pole piece **22** through the magnetized magnetic mass, through the upper pole piece **16**, and through the tubular body **12**. There is no closed magnetic path or short circuit (absent junk) because the pole piece **22** is isolated from the opposite concentric pole by diamagnetic material **28**.

It will be apparent that the embodiments shown are only exemplary and the various modifications can be made in the construction, materials, and arrangement within the scope of the invention as defined in the appended claims.

I claim as my invention:

1. A magnetic fishing tool for operation on a string of drillpipe, comprising: an upright elongated mass of magnetic material having a fluid passage therethrough, said passage extending from end to end, a north pole at one end of the mass and a south pole at the other, a lower pole piece contacting the lower end of said mass, said pole piece having diverging fluid passages extending from an area on the contacting face which mates the fluid passage of the mass, and means for connecting said mass to a drillpipe.

2. The invention as defined in claim 1 wherein the lower pole piece has a plane contacting face and the fluid passages in the lower pole plate extend obliquely from a central area on the contacting face when projected to said plane.

3. The invention as defined in claim 1 wherein the mass of magnetic material includes a plurality of prisms; each of which has an upper base in a common plane and a lower base in a common plane, this being the contacting plane; and each prism being magnetized so that the north poles are adjacent.

4. A magnetic fishing tool comprising: an elongated mass of magnetic material, said mass comprising a plurality of prisms of magnetic material, each prism having an upper end in a common plane and a lower end in a common plane, each prism being magnetized so that the north poles are adjacent, said prisms arranged so that there is a central fluid passage from end to end, and means for binding the prisms together against the natural magnetic repulsion.



No references cited.