

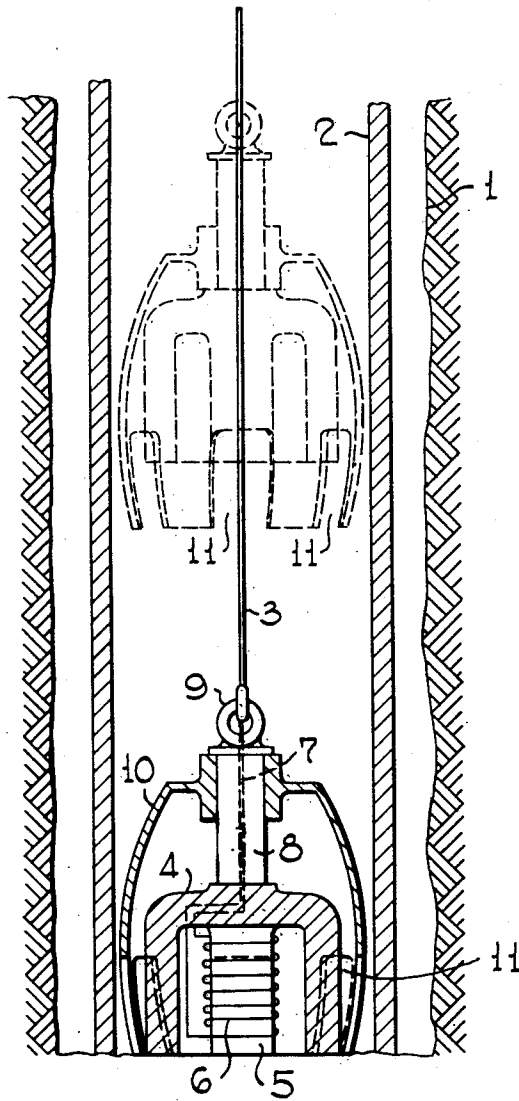
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WELL BORE RETRIEVING TOOL

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WELL BORE RETRIEVING TOOL

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This invention is concerned with the provision of an improved magnetic retrieving tool for recovering metallic objects from wells. The apparatus of this invention is a cable suspended apparatus particularly adapted for use in well bores provided with casings. It is the particular object of this invention to provide a tool of this general character having material advantages over the tools known to the art, as regards simplicity and effectiveness of use.

In the drilling of oil wells it frequently happens that drilling bits employed in the operation will break, leaving fragments of hardened steel at the bottom of the well bore. Similarly, it is possible for tools, or metallic fragments to accidentally drop into the well bore, or to be broken off in the bore. In general it is impossible to continue drilling the well when this occurs until the metallic fragments, or tools are recovered from the well. Heretofore it has been the practice to use rather cumbersome apparatus to remove the metallic impediments, or else to change the direction of the well, or to drill a new bore hole. It may be appreciated then that a simple and effective manner of recovering metallic objects from a well bore is of considerable practical importance.

The apparatus of this invention essentially consists of a cable supported magnetic retrieving tool. It is the particular feature of this apparatus that a non-magnetic housing is placed around the retrieving tool. By this means it is possible to employ the apparatus in a cased borehole as well as in an uncased hole. Similarly, the provision of the nonmagnetic housing together with the feature permitting the housing to drop into a position around and below the magnetic retriever minimizes any possibility of knocking the fragments held by the magnet away from the magnet as it is being pulled to the surface of the earth.

This invention may be understood by reference to the attached drawing in which the retrieving tool is illustrated in two positions; at the bottom of the well, and off the bottom of the well. The drawing particularly illustrates the nature of the nonmagnetic housing, showing this housing in its withdrawn or working position.

Referring to the drawing then, a bore hole is identified by numeral 1. While this bore hole has been shown as being substantially straight and vertical, it must be appreciated that in actual practice the bore hole may be considerably off vertical, and may include bends. Again, it is to be understood that the bore hole may ex-

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tend any distance into the ground, and may in fact be several thousand feet in depth. As illustrated in the drawing, the bore hole may be provided with the conventional type of casing 2. This casing may or may not extend completely to the bottom of the bore hole although the apparatus illustrated will function equally well in either case. Assuming that it is necessary to remove metallic fragments from the bottom of bore hole 1, the magnetic retrieving tool is lowered into the casing 2 by means of cable 3. As will be brought out, the supporting cable 3 may simply be a wire line when the magnet is a permanent magnet, or alternatively the cable 3 may contain conductors to supply electrical energy to an electromagnet which may be used in place of a permanent magnet. Thus, an electromagnet 4 may be employed, and preferably this magnet is of the annular type having a central pole 5 about which is wrapped the magnetizing coil 6 connected to electrical leads 7, extending upwardly into the cable 3. The upper portion of the magnet 4 is fixed to a supporting shaft, or rod 8, supplied with an eye bolt, or equivalent supporting means 9 to which the cable 3 may be attached. The supporting member 8 between the eye bolt 9, and magnet 4 is preferably of about a length equal to that of the magnet 4. This portion of the support 8 thus serves as a shaft, about which a nonmagnetic housing 10 may be maintained in slidable relation. As shown, the nonmagnetic housing is provided with vertically curved sides so that the upper portion of the housing is of materially less cross-sectional horizontal diameter than an intermediate portion of the housing, and so that the lowest portion of the housing is again of smaller diameter than the intermediate portion of the housing. It may be appreciated that this type of construction ensures the convenient movement of the housing and magnet along the well bore, or casing, permitting the tool to slide along, and over irregularities in the bore hole or casing, both when the tool is being pulled upwardly from the well and when it is being dropped into the well. Stops are provided at the upper portion of the support 8 so that the non-magnetic housing in its uppermost position will terminate at the lowest extension of the magnet 4. In its lowermost position, as illustrated by the upper view of the apparatus in the bore hole, the non-magnetic housing will extend some distance below the magnet 4. It is desirable that the lower extremities of the housing 10 be provided with cutaway openings 11 to permit the attraction of metallic frag-

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ments through these openings to the magnet in the event that the fragments are of considerable length or in the event that fragments are located adjacent the wall of the bore hole. It is apparent that any desired non-magnetic material may be used in constructing the non-magnetic housing. For example, the housing may be constructed of brass, fibrous material, plastic material, etc.

It is a matter of choice as to whether the electromagnet illustrated is to be employed, or whether a permanent magnet is used. Thus, permanent magnets consisting of the alloys of aluminum, nickel and cobalt are entirely suitable for use in the apparatus of this invention. Again, the particular configuration of the magnet may be varied although as stated an annular type of magnet is preferred.

In employing the apparatus illustrated, when it becomes necessary to retrieve metallic objects from a well bore, tools are removed from the bore hole and the retrieving tool is lowered into the well on the cable 3. During the lowering operation, the housing 10 will be in its lowermost position shielding the magnet 4 from the walls of the bore hole, or from the casing 2 in the bore hole. The curvature of the housing 10 will permit the tool to readily pass downwardly in the well. When the tool has reached the bottom of the bore hole, as shown by the lowermost view, the housing 10 will be pushed upwardly along the shaft 8 so that the magnet 4 may contact the bottom of the bore. It is thus possible for the magnet to pick up and retain any metallic objects at the bottom. It is preferred, in using the equipment, to raise and lower the apparatus several times to permit rotation of the apparatus to insure passage of metallic fragments through the openings 11 of the housing 10. When this has been done, the entire apparatus, together with the recovered metallic fragments may be pulled to the surface of the earth and normal drilling operations may be continued. It is apparent that when the apparatus is lifted from the bottom of the hole, the non-magnetic housing will again drop around the magnet to shield the magnet and metallic fragments held on the magnet, from contact with the housing, or bore hole. Consequently, any possibility of metallic fragments being knocked

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from the magnet during the retrieving operation is eliminated.

What is claimed is:

1. A magnetic retrieving tool for well bores comprising a supporting means attachable to a suspending cable, a shaft element attached to said supporting means, a magnetic element held by said shaft element, a nonmagnetic housing slidably supported on and guided by said shaft element and extending downwardly about said magnetic element, said housing being provided with cut-away openings in its lower edge whereby direct horizontal access is provided through the housing to the magnetic element, said nonmagnetic housing being slidable on said shaft element to a first position in which the lowermost edge of the housing is adjacent the lowermost edge of the magnet and to a second position in which the lowermost edge of the housing is below the lowermost edge of the magnetic element, said non-magnetic housing normally assuming said second position by force of gravity and sliding to said first position when resting on the bottom of a well bore.

2. Retrieving tool according to claim 1 in which said magnetic element comprises an electromagnet and includes conductors electrically connected to said electromagnet and leading to a supporting cable.

3. Retrieving tool as defined by claim 1 wherein said housing has vertically curved sides, the cross-sectional horizontal diameter in an intermediate portion of the housing being greater than the horizontal diameter of the upper and lower portions.

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