Rock bolts, which are inserted into the rock walls of mines for various utilitarian purposes, frequently break off inside the hole. Heretofore it has been difficult, if not impossible, to remove the broken bolts, thus necessitating the drilling of a new hole and the insertion of a new rock bolt with consequential delay and expense. The invention disclosed is a tool for removing such broken rock bolts which comprises a length of pipe having an internal diameter slightly larger than the diameter of a rock bolt shaft. A hollow cylindrical insert of hard material extends from the mouth of the pipe at least part way along the length of the pipe and has an internal diameter such that it may be force-fitted over a rock bolt shaft, as by hammering the end of the pipe. Also, at least one inwardly directed tooth of hard material is provided back from the mouth and extending slightly into the interior of the cylindrical insert, which tooth digs into the rock bolt shaft to assist the tool in unscrewing the broken rock bolt shaft, e.g., by means of a handle passed through diametrically opposed holes in the pipe adjacent to its other end.
This invention relates to a tool used for extracting broken rock bolts from the rock walls of mines. Rock bolts inserted into holes drilled in the rock walls of mines for various purposes frequently break off at or below the surface of the rock. Up to the present time, no device is known which can be used to remove rock bolts broken off close to or beneath the surface of the rock. When this happens the usual practice has been to drill a new hole and insert a new rock bolt, a procedure which is both time consuming and expensive.

The present invention permits the broken bolt to be withdrawn from the hole, thereby permitting a new bolt to be inserted without the necessity of drilling a new hole. The invention comprises a hollow cylindrical tool, having an inwardly directed gripping surface, e.g. a tooth of hard material located a short distance back from the mouth of the tool, which is driven over the broken bolt so as to engage the bolt's shaft. The broken bolt may then be unscrewed from its sleeve and removed. A new bolt may then be inserted into the same hole at a considerable saving of time and expense.

Features of the invention in a preferred embodiment and its method of application are illustrated in the accompanying drawings, wherein:

FIG. 1 is an elevation view in section of the tool,
FIG. 2 is an end view of the tool, and
FIG. 3 is a fragmentary sectional view showing the mouth of the tool in an intermediate stage of being driven over a rock bolt shaft.

The rock bolt remover in accordance with the invention is illustrated in FIGS. 1 and 2 and comprises a cylindrical sleeve insert of hard, tough steel tapered at one end and secured, as by welding, into a hollow shaft or pipe (which may be low grade steel) so that the sleeve's tapered end forms an annular edge 3 with a corresponding taper 4 on the pipe. A tooth portion 5 of hard material, e.g. tungsten carbide, is located back a short distance from the mouth 6 of the tool and protrudes slightly from the inner surface of the sleeve into the interior region thereof. Adjacent to the other end of the tool are located two diametrically opposed holes 7.

The method of application of tool is illustrated in FIG. 1, wherein a fragmentary view of a rock bolt inserted into a rock wall 8 shows the broken rock bolt shaft 9 which has been threadedly inserted into its sleeve 11 with the space between the shaft and sleeve filled with grout 12. The sleeve is fixed in the hole by a wedge arrangement at its inner end (not shown). The mouth 6 of the tool 10 is seen partially driven over the broken rock bolt shaft 9.

In operation the tool is driven, for example with a hammer, between the rock bolt's outer sleeve 11 and its shaft 9 over the shaft until it firmly grips the latter. The end 6 of the tool is tapered to facilitate sliding it over the broken end 13 of the bolt. In addition, the inside diameter of the cylindrical sleeve insert 1 is larger than the outside diameter of the rock bolt shaft 9 so as to accommodate bolts which become bent whenever they break. Moreover the sleeve insert 1 is made of hard material to withstand the frictional contact it has with the rock bolt shaft. Normally the tool is driven so that the tooth 5 digs into the broken shaft. A rod or bar (not shown) is then inserted through holes 7 and used as a handle to turn the tool and unscrew the rock bolt. Occasionally the broken bolt is sufficiently bent so that the wedge fit of the shaft within the tool is enough to enable the bolt to be unscrewed even if the tooth 5 has not dug into the shaft.

It is possible to fabricate the tool from a single hollow shaft without the need of a cylindrical sleeve insert; however, an expensive, high quality material for the shaft would be required in order to do this. Other possible embodiments may feature a gripping surface with more than one tooth or even a number of small teeth randomly spaced throughout or a number of grooves running the length of the cylindrical sleeve insert having a sawtooth appearance when viewed at the mouth end on.

For standard 5/8 inch rock bolts the pipe 7 may be 12 inches long with a 13/16 inch inside diameter and 33/32 inch outside diameter. The inside diameter of the insert 6 may be 19/32 inch and the tooth 8 may extend 3/32 inch in from the inside of the pipe and be 3/16 inch long. However, these dimensions are illustrative and may be varied without departing from the invention.

The invention claimed is as follows:

1. A tool for removing broken rock bolts comprising: a hollow cylindrical pipe having a tapered wall at one end extending from its inside surface at that end, a short distance along the length, to the outside surface and having, adjacent to the other end, two diametrically opposed holes; a hollow cylindrical sleeve insert of hard material extending part way along the length of the tool from its mouth end and secured thereto, said insert having an inside diameter slightly larger than the diameter of a rock bolt shaft and tapered back from the mouth of the tool a short distance with said taper meeting the taper of the pipe in an annular edge; a gripping surface directed inward from the inside surface of the cylindrical insert extending partially into the interior thereof.

2. A tool as claimed in claim 1, wherein the gripping surface is comprised of an inwardly directed tooth of hard material located part way along the length of the tool from its mouth and projecting through the inside surface of the cylindrical sleeve insert to the interior thereof.

3. A tool as claimed in claim 2 wherein said hard material is a high quality steel.

4. A tool as claimed in claim 3 wherein said insert is secured to said hollow cylindrical body by welding.

5. A tool as claimed in claim 2 wherein said tooth is formed of tungsten carbide.