PLUGGING UNDERGROUND CAVITIES
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ABSTRACT OF THE DISCLOSURE
A method of plugging an underground cavity with a plug that can support a filling consists in drilling a series of holes from surface to intersect the cavity at a predetermined level and to penetrate into the opposite wall of the cavity, passing a series of porcupines through the drill holes to span the cavity, and dropping concrete containing a fibrous aggregate such as plumber's yarn on to the porcupines, the set concrete re-införmed by the porcupines forming the plug and each porcupine consisting in a rigid spine and a series of springy quills radiating from the spine all inclined in a direction which allows them to be deformed into a bundle which can pass down a drill hole.

This invention relates to the plugging of underground cavities.

Sometimes it is necessary to erect buildings or other works in areas where underground cavities occur. These works cannot be erected until the cavities have been filled with a satisfactory material. The cavities themselves may be due to mining activities or they may occur naturally.

Often it is impossible or economically prohibitive to enter the cavities to erect a barrier which can serve for supporting a filling such as a plug of injectable material or grout.

An object of the invention is to provide a barrier which can be erected without entering the cavity.

In a method according to the invention a series of holes is drilled from predetermined points to intersect the cavity in a desired pattern at the level where a barrier is to be erected, each hole is continued across the cavity for a short distance, a porcupine is passed down each hole to span the cavity and a settable moulding composition containing a fibrous aggregate is dropped on to the porcupines either through the mouth of the cavity or suitable drill holes.

A porcupine in the context of the present invention is a new device provided by the present invention and consists in a rigid spine and a series of springy quills radiating from the spine and all inclined in a direction which allows them to be deformed into a bundle which can pass down a drill hole.

When the moulding composition has set, the cavity above the barrier can be grouted up or otherwise filled up.

Note that the spines serve as re-införments for the barrier. If desired, further re-införments may be dropped down through suitable drill holes.

It has been found that a composition, e.g. ordinary concrete, which does not contain a fibrous aggregate is not suitable for forming the barrier. It is essential that the composition contain a suitable fibrous component which can entangle with the quills and serve to form a mat with the quills. In use plumbers' yarn cut into short lengths and mixed with concrete has produced a very satisfactory composition.

The invention is further discussed with reference to the accompanying drawings in which:

FIGURE 1 is a side view of a porcupine,
FIGURE 2 is a sectional view showing a porcupine placed across an underground cavity,
FIGURE 3 is a plan view in the direction of 3—3 in FIGURE 2, illustrating the entanglement of quills formed by a series of porcupines spanning a cavity, and
FIGURES 4 to 6 illustrate in section various stages in the plugging of a steeply inclined stoppe cavity.

FIGURE 1 illustrates one of the basic features of the invention which is the porcupine. It consists of a tubular spine 7 to the outside of which have been welded steel spring quills 8 radiating from the spine 7 and all inclined in the same direction towards the end 9 of the spine 7. If the end 9 is inserted into a hole, the quills 8 will be folded into a bundle alongside the spine 7 and as they emerge from the hole with the end 9 leading the quills 8 will flare out.

This is illustrated in FIGURE 2 where a porcupine is shown in position across an underground cavity. Those quills 8 which are still in a drill hole 10 remain folded while the others have expanded into the cavity. A series of porcupines spanning a cavity side by side would have the appearance illustrated in FIGURE 3.

Referring to FIGURES 4 to 6 if a stope cavity 11 has to be plugged from a level 12 upwards, the first step is to drill two rows of holes 10 side by side in the same row and staggered between rows from a suitable position on the surface. The holes 10 are large enough for the porcupines to be passed down them. Each hole 10 is continued across the cavity 11 to provide a socket on the opposite face of the cavity for the end 9 of a porcupine.

Next a porcupine is passed down each hole 10 and pushed home to the position shown in FIGURE 2. The series of porcupines will then look something like FIGURE 3 if viewed from above in the stope cavity. The porcupines in the lower row are shown dotted in FIGURE 3.

When the porcupines are in position, a series of holes 13 (FIGURE 5) is drilled to intersect the cavity 11 above the level 12. A concrete mixture is then poured down the holes 13 to drop on to the entanglement formed by the porcupines.

A suitable mix contains by weight one part of cement, three parts of sand, five parts of crushed stone and part of plumber's yarn.

The plumber's yarn in the concrete causes the concrete to become entangled with the quills 8. After the concrete has set, a solid barrier reinforced by the spines and quills will have been formed. After the barrier is formed it is advisable to fill up the cavity still further with a good concrete mix to a level of, say, about 4 feet above the barrier.

The cavity 11 is now plugged and may now be grouted up by using further holes 14 drilled to intersect the cavity 11 as shown in FIGURE 6.

I claim:
1. A method of plugging an underground cavity at a predetermined level which consists in drilling a series of holes from predetermined points to intersect the cavity in a desired pattern at the predetermined level, continuing each hole across the cavity for a short distance, passing a retaining means comprising a rigid spine and a series of springy quills radiating therefrom down each hole to span the cavity, and dropping a settable moulding composition containing a fibrous aggregate on to the retaining means.
2. The method claimed in claim 1 in which the moulding composition is dropped through the mouth of the cavity.
3. The method claimed in claim 1 including the steps of drilling a second series of holes to intersect the cavity above the predetermined level and dropping the moulding composition through the second series of drill holes.

4. The method claimed in claim 1 followed by the step of filling the cavity above the barrier.

5. The method claimed in claim 4 in which the cavity is filled by grouting.

6. The method claimed in claim 1 in which the settable moulding composition is concrete.

7. The method claimed in claim 6 in which the fibrous aggregate consists in short lengths of plumber's yarn.

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