United States Patent [19]

Kempster

[11] **3,831,384**

[45] **Aug. 27, 1974**

[54] **SHUTTERING FOR USE IN A MINE AND METHODS OF USE THEREOF**

[75] Inventor: **Edward Kempster,** Llanelly, Wales

[73] Assignee: **Thyssen (Great Britain) Limited,** Llanelly, Carmarthenshire, Wales

[22] Filed: **Sept. 18, 1972**

[21] Appl. No.: **289,636**

[30] **Foreign Application Priority Data**

Sept. 21, 1971 Great Britain 44028/71

[52] **U.S. Cl.** ..... **61/35,** 61/45 R

[51] **Int. Cl.** **E02d 15/00**

[58] **Field of Search** ..... 61/45 R, 45 D, 41 A, 63, 61/84, 85, 35, 36

[56] **References Cited**

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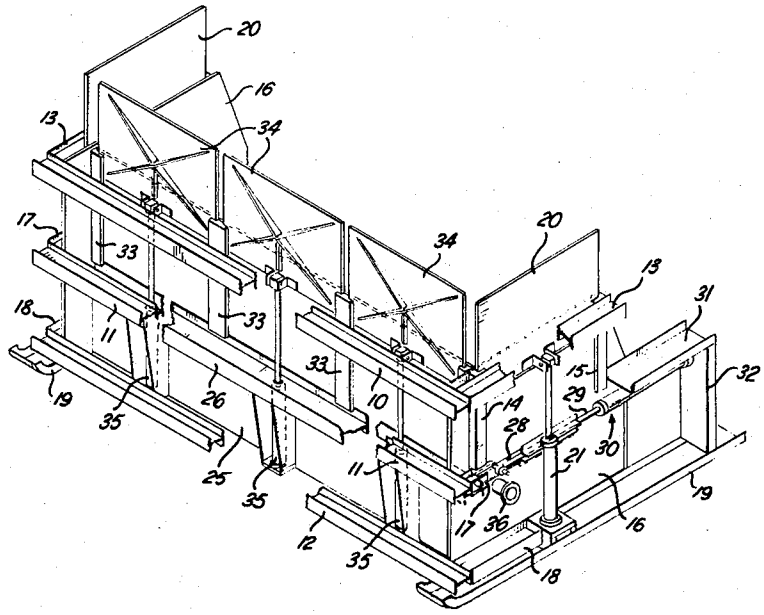
Primary Examiner—Dennis L. Taylor

Attorney, Agent, or Firm—Cushman, Darby & Cushman

[57] **ABSTRACT**

For forming gateside packs, roof supports, stoppings, etc. in a mine from pit dirt with a quick setting cement, shuttering is employed having a main frame with side walls, each side wall having hydraulically operable extension plates to adjust the wall height. The front plate of the shuttering, with its adjustable extension plates, is movable between the side plates in a direction normal to the front plate, hydraulic rams being provided for this purpose. After material has been injected into the shuttering, the side plates are moved forwardly leaving the front plate to support the pack. The front plate can then be moved forward to give a further space for injecting material.

9 Claims, 16 Drawing Figures



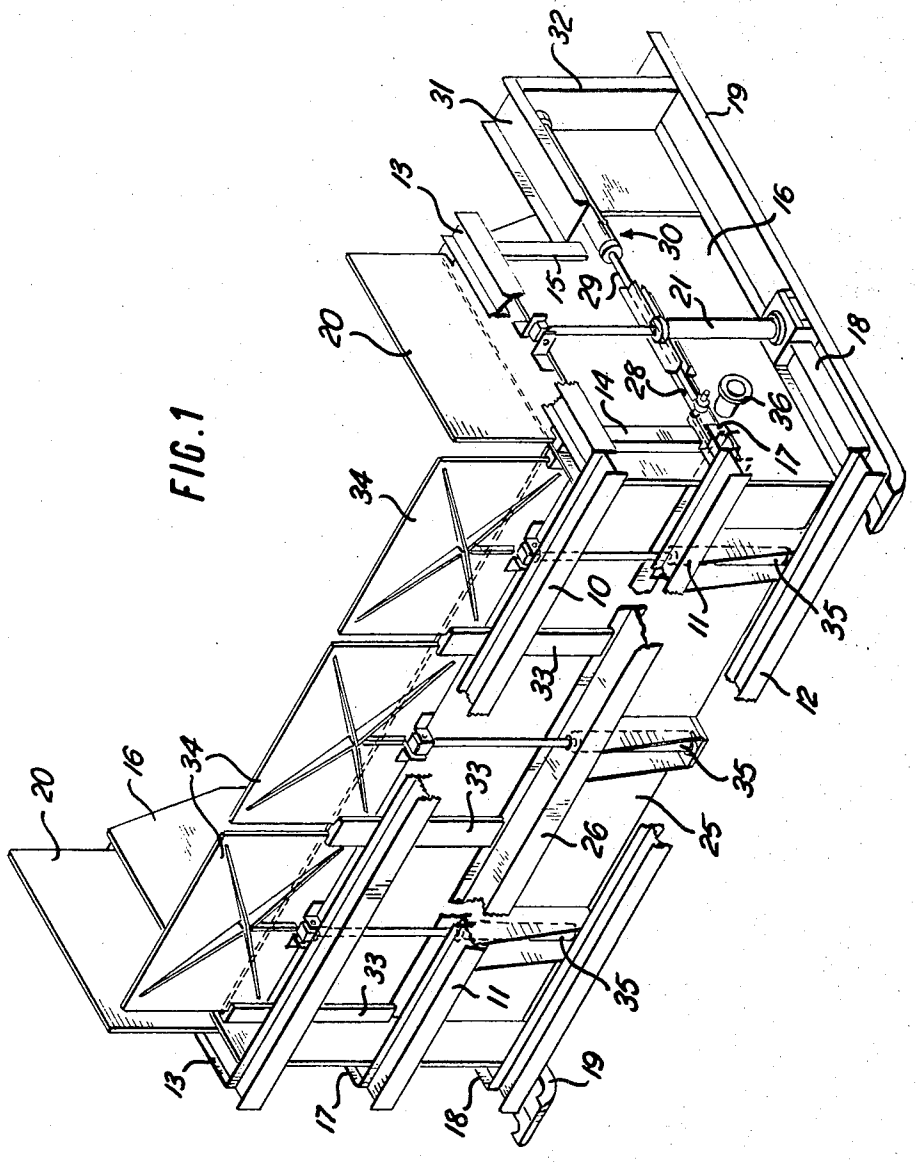


FIG. 1

FIG. 3

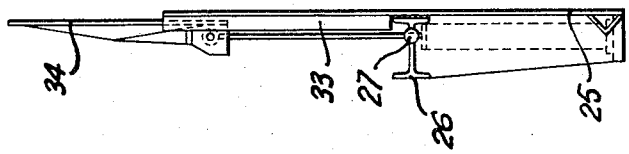
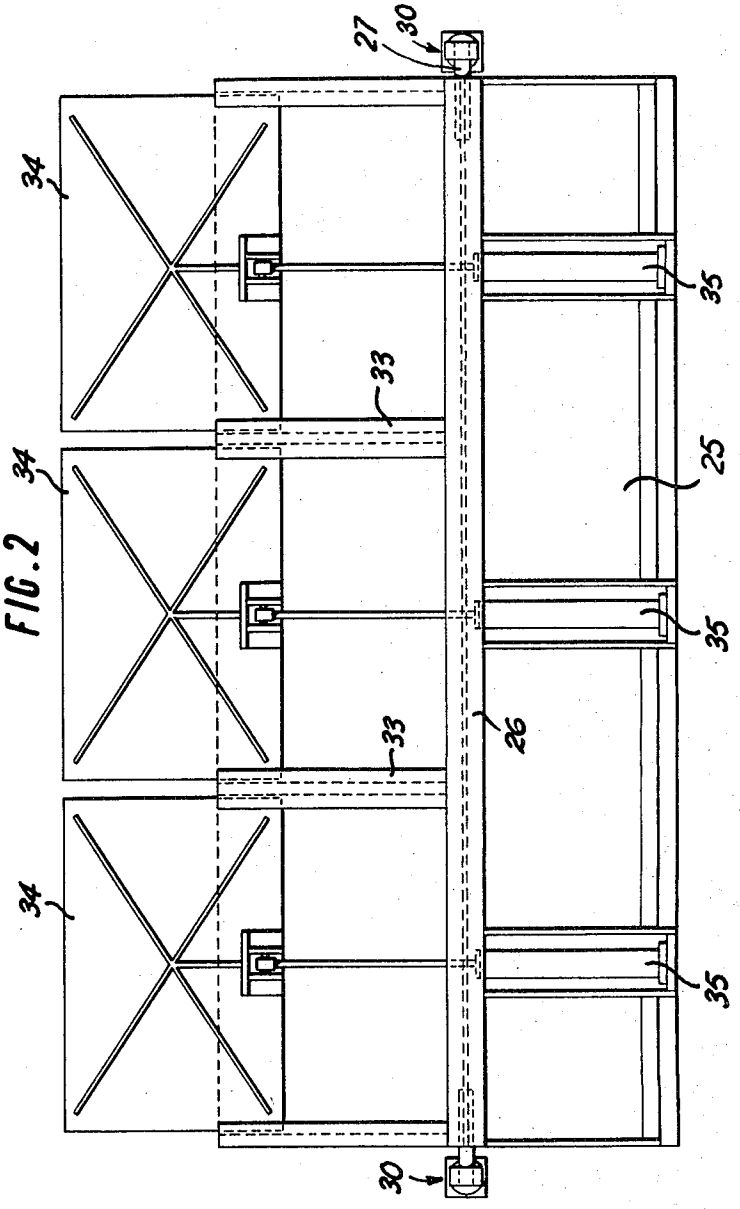


FIG. 2



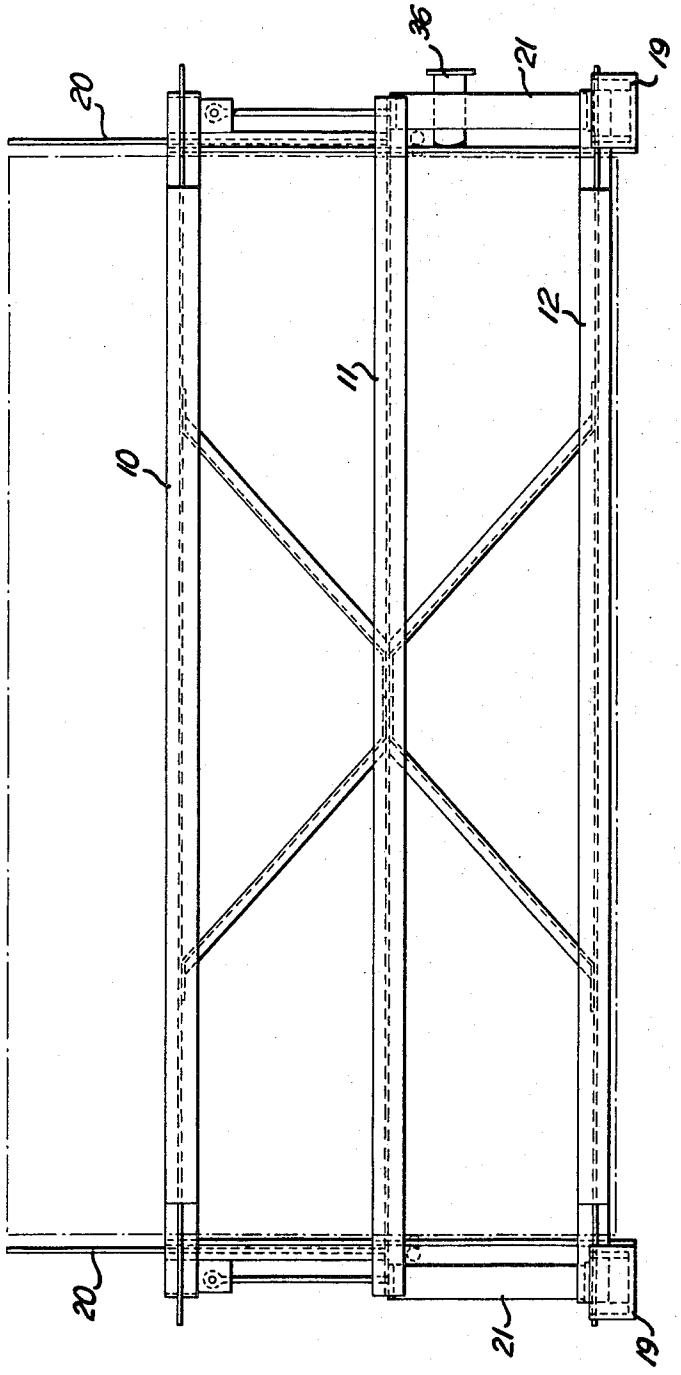


FIG. 4

FIG. 5

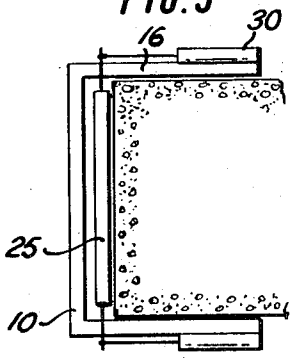


FIG. 6

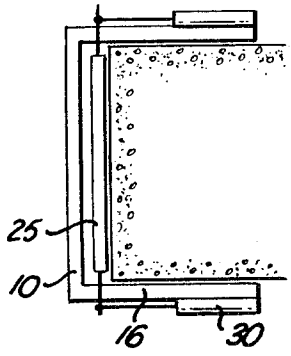


FIG. 7

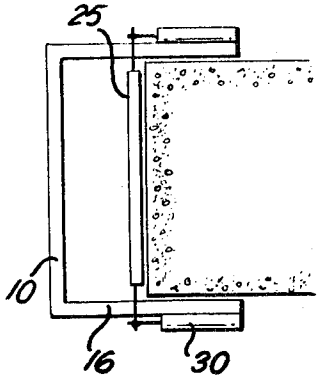


FIG. 11

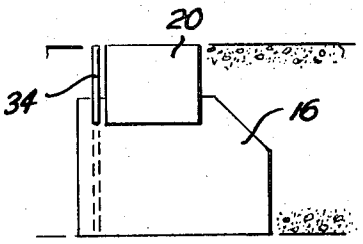


FIG. 12

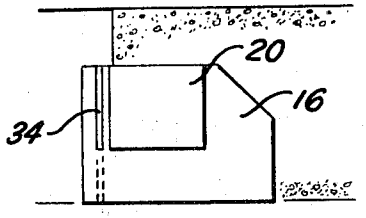


FIG. 13

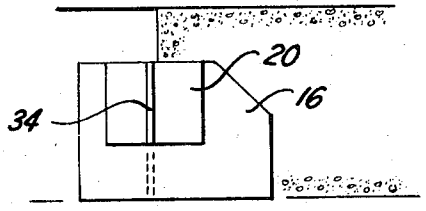


FIG. 8

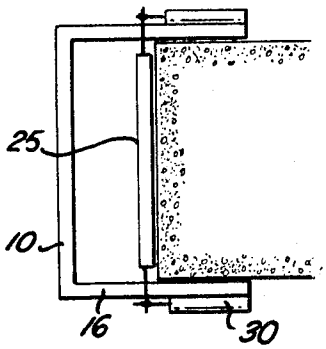


FIG. 9

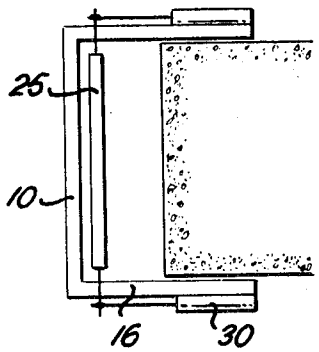


FIG. 10

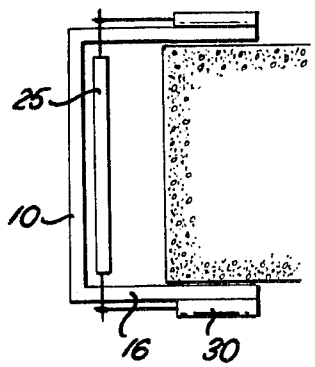


FIG. 14

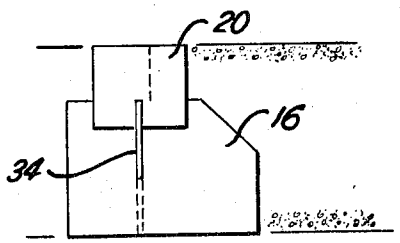


FIG. 15

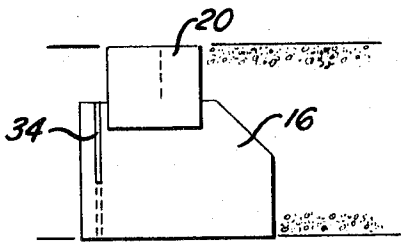
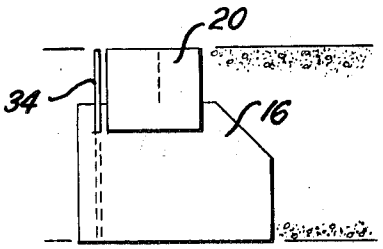


FIG. 16



SHUTTERING FOR USE IN A MINE AND METHODS OF USE THEREOF

BACKGROUND OF THE INVENTION

This invention relates to mining and is concerned more particularly with the construction of roof supports, gateside packs and stoppings in a mine.

In mining operations, particularly coal mining, a lot of waste material is produced underground which is disposed of by putting it in worked-out portions of the mine, for example by packing it alongside the gates or roadways through the worked-out portions or using it for stopping off worked-our portions. The material may be mixed with a setting agent such as cement so that it will set into the form of a low quality concrete. As is described in our co-pending British Patent Application No. 29770/71, the waste material may be mixed with bentonite and water to form a flowable sludge which can be pumped to the point of utilisation before it is mixed with the setting agent. If the waste material is treated in this way, it is necessary to use shuttering to hold the waste material whilst it is setting.

SUMMARY OF THE INVENTION

The present invention is concerned more particularly with a form of shuttering for use in a mine in making roof supports, gateside packs and stoppings using waste material.

According to one aspect of the present invention shuttering for use in packing waste material in a mine comprises a face plate for forming a shutter extending to the height to which the material is to be packed, a support structure in front of the face plate, one or more hydraulic rams operative between the support structure and face plate for effecting relative movement between the face plate and the support structure in a direction normal to the plane of the face plate, and side plates forming shuttering at the sides of the region to be packed, which side plates are carried on said support structure and extend from the support structure past the face plate, lying closely adjacent the sides of the face plate. With this construction of shuttering, the side plates and face plate together form shuttering defining a region open at its rearward end into which pit waste and a setting agent can be injected. When the material is set sufficiently, by operation of the aforementioned hydraulic ram or rams, the support structure can be moved forwardly away from the face plate thereby withdrawing the side plates forwardly along the sides of the packed material. During this operation, the face plate supports the front end of the pack; the side plates may extend rearwardly beyond the region last filled and thus, even when moved forwardly, can still provide support for the sides of the pack. Then, by securing the support in position, operation of the rams can be used to move the face plate forwardly between the side plates so as to form a further region within which waste material with a setting agent may be stowed. With this arrangement, the front end of the pack is supported as the side plates are moved forwardly and likewise the side plates will support the pack as the front plate is moved forwardly. Using a quick setting agent this method permits of the rapid construction of gateside packs and stopping with very little manual labour.

Preferably injection means are provided on one or both of the side plates. When the side plates are moved forwardly, the injections means will be moved forwardly past the face plate thereby enabling access to be obtained to the injection means for cleaning or maintenance when necessary without anyone having to enter the waste area.

Preferably the sides of the shuttering are adjustable in height to accommodate variation in the seam height of the working in which the waste material is to be packed. For this purpose hydraulically liftable extension plates may be mounted on side plates.

As the shuttering is gradually advanced, roof supports may be withdrawn in front of it and settling may occur. For this reason, the side plates are preferably tapered to be of lower height at the end furthest from the face plate to allow the pack to take the roof load while still supported at its sides. The face plate may be made the full height of the seam but, to accommodate variations in roof height, it may be provided with one or more hydraulically liftable extension plates. The side plates may be made in sections for ease of assembly and dismantling and to enable different lengths of side plates to be used. Furthermore, by making the side plates in sections, when the packing of a gateside has been completed with the face plate support frame in or adjacent the gate, the side sections can then be withdrawn and dismantled by jacking the face plate against the end of the pack to bring the sides forwardly, removing the front sections of the sides, retracting the ram or rams to bring the support structure rack, attaching the sides thereto and repeating the operation. There is no necessity for anyone to go into the waste area.

The invention furthermore includes within its scope a method of disposing of pit waste in mining by packing it underground using a setting agent mixed with the pit waste wherein the pit waste and setting agent are injected into a cavity defined by a face plate and side plates, the side plates then being moved forwardly away from the face of the packed material whilst keeping the face plate in position and the face plate subsequently being moved forwardly away from the packed material whilst keeping the side plates in position to form a shuttered area into which material is injected.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is an isometric view of a shuttering assembly forming one embodiment of the invention, the assembly being shown partly cut-away to illustrate certain details;

FIGS. **2** and **3** are respectively a front elevation and side elevation of a face plate employed in the assembly of FIG. **1**;

FIG. **4** is a front elevation of the support structure of the assembly of FIG. **1**;

FIGS. **5** to **10** are diagrammatic plan views illustrating six successive stages in the operation of the shuttering assembly of FIG. **1**; and

FIGS. **11** to **16** are diagrammatic side elevations corresponding respectively to the plan views of FIGS. **5** to **10**.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIGS. **1** to **4** illustrate the construction of a shuttering assembly for use in the formation of packs for disposing of pit waste underground. This particular assembly is used to form packs which extend up to the roof of the seam in the mine, the packs, when set and after the

shuttering assembly is removed, forming a permanent roof support.

The shuttering assembly comprises a support structure having three horizontal beams **10, 11, 12** extending across the front of the assembly one above another. Extending rearwardly from the two ends of the topmost beam **10** are side beams **13,** one at each side of the assembly. Each side beam **13** is secured to two upright guide members **14, 15** attached to a side plate **16.** Also attached to each side plate is a short element **17** secured to an end of the beam **11** and a lower beam **18** secured to the end of beam **12.** These lower beams **18,** one on each side plate, are carried on skid members **19** which rest on the floor of the seam in the mine.

Each side plate **16** comprises a vertical plate extending upwardly from the skid plate **19** and having a vertical height less than the minimum roof height of the region in which the shuttering assembly is to be used. On each side plate **16,** an extension plate **20** is movable vertically in the guides **14, 15** by means of a hydraulic ram **21** acting between the extension plate **20** and the skid member **19,** the ram **21** enabling the plate **20** to be moved up to the roof of the seam so that the plates **16, 20** form a side shutter for the region into which the waste material is to be packed.

The front face of the shuttering is constituted by a vertical front plate **25** having a main horizontal cross beam **26** which is behind and slightly lower than beam **11.** In FIG. **1,** beam **11** is partly cut-away to show the beam **26** which is always behind the beam **11.** The beam **26,** at its two ends, as is most clearly seen in FIGS. **2** and **3,** carries horizontal bars **27** extending through horizontal slots **28** (FIG. **1**) in the side plates **16.** These bars **27** are each attached to the movable element **29** of respective hydraulic rams **30** lying on the outer side of but adjacent to the side walls **16.** On each side wall, the cylinder from ram **30** is carrued on the underside of a channel section element **31** supported on the side wall **16** and by an upright frame member **32** from the skid member **19.**

The front plate **25** has, on its front face, guide members **33** in which are slidable vertical extension plates **34,** each operable by means of a hydraulic ram **35.** The main front plate **25** has a height less than the minimum height in which the shutter assembly is to be operated and the extension plates **34** enable the shuttering to be extended up to the roof of the seam.

It will be seen that the assembly thus far described has a support frame including the front beams **10, 11, 12** and the side plates **16** with their extensions **20** forming one part, Movable therein by means of rams **30** is the front face assembly of FIGS. **2** and **3.**

Injection of material into the region within the shuttering is through an inlet **36** (FIG. **1**).

The operation of this shuttering assembly is as follows:

With the face plate and support frame in the position shown in FIGS. **5** and **11,** pit waste is pumped through the inlet **36** into the region between the previously formed pack and face plate. This pit waste is conveniently crushed or granular material mixed with sodium bentonite and water as is described in the aforementioned British Patent Application No. 29770/71. A setting agent in the form of a cement or other settable material together with water is injected as a grout into the pipe leading to the inlet **36.** In one typical example the setting agent is formed of 30 percent gypsum and 70 percent Portland cement. Preferably a cement with a water polyethylene oxide gel is employed as the setting agent. This forms a low quality cement in the region within the shuttering. When this material has set, or partially set, the front and side extension plates **34** and **20** are lowered by rams **21, 25** as illustrated in FIGS. **6** and **12.** The side rams **30** are then operated to move the support member and side plates **16** forwardly leaving the front plate **25** in position as shown in FIGS. **7** and **13.** During this time, the face plate **25** supports the front end of the pack as the side plates **16** are being moved. It will be noted that the side plates are only moved a short distance forwardly and thus the sides of the pack remain substantially supported by the side plates over the region where material was last injected. This operation can be effected while the material is only partially set. The side extensions **20** are then raised as shown in FIGS. **8** and **14.** As soon as the last injected material has been sufficiently set, the front plate **25** can then be moved forwardly as shown in FIGS. **9** and **15** and the front extension plates **34** raised, as shown in FIGS. **10** and **16** to form a new cavity into which waste material can then be injected.

The method and apparatus described above may be used for disposing of waste material in mining by forming gateside packs, that is to say packing the material into worked out seams along the sides of gates (or roadways). It may also be used in other ways, for example, to form a roof support extending along the length of a wide roadway.

I claim:

1. Shuttering for use in packing waste material in a mine comprising a face plate, a support structure including a front portion extending across the front of the face plate and side portions extending at right angles to the front portion, the face plate being arranged to be moveable with respect to the support structure in a direction normal to the plane of the face plate, at least one hydraulic ram operatively connected between the support structure and face plate and arranged to effect relative movement between the face plate and the support structure in the direction normal to the plane of the face plate, and said plates carried on said side portions of said support structure and lying in parallel planes spaced apart a distance slightly greater than the width of the face plate, the face plate being located between the side plates.

2. Shuttering as claimed in claim **1** wherein injection means are provided on at least one of the side plates.

3. Shuttering as claimed in claim **1** wherein said side plates are adjustable in height to accommodate variation in the seam height of the working in which the waste material is to be packed.

4. Shuttering as claimed in claim **1** wherein the side plates are tapered so as to be of lower height at the ends furthest from the face plate.

5. Shuttering as claimed in claim **1** wherein hydraulically liftable extension plates are mounted on the side plates to enable the height of the sides of the shuttering to be adjusted.

6. Shuttering as claimed in claim **1** wherein one or more hydraulically liftable extension plates are mounted on the face plate to enable the height of the front face of the shuttering to be adjusted.

7. Shuttering as claimed in claim 1 wherein said side plates are made in sections to enable different lengths of side plates to be used.

8. Shuttering for use in packing waste material in a mine comprising a support structure, side plates carried on said support structure at the two sides thereof and extending rearwardly from said support structure, a face plate behind said support structure extending between the two side plates and slidably mounted thereon, hydraulic ram means operatively arranged between the support structure and face plate to effect relative movement therebetween in a direction normal to the plane of the face plate and hydraulically operable extension plates on said sise plates and face plates for adjusting the height of the shuttering.

9. A method of disposing of pit waste in mining by packing it underground using a setting agent mixed with the pit waste comprising the steps of injecting the pit waste and setting agent into a cavity defined by a face plate and side plates at right angles to the face plate and hydraulically moving the side plates forwardly away from the face of the packed material while keeping the face plate in position and subsequently hydraulically moving the face plate forwardly away from the packed material while keeping the side plates in position to form a further shuttered area into which material is injected.

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