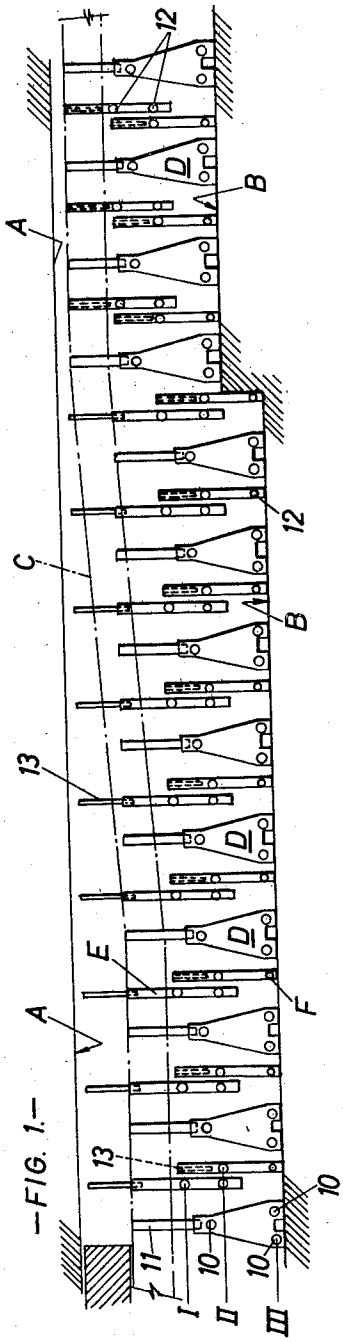
July 16, 1963 J. W. SEDDON 3,097,829

ROOF SUPPORT IN MINES

Filed Jan. 12, 1960 6 Sheets-Sheet 1



—FIG. 1.—

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ROOF SUPPORT IN MINES

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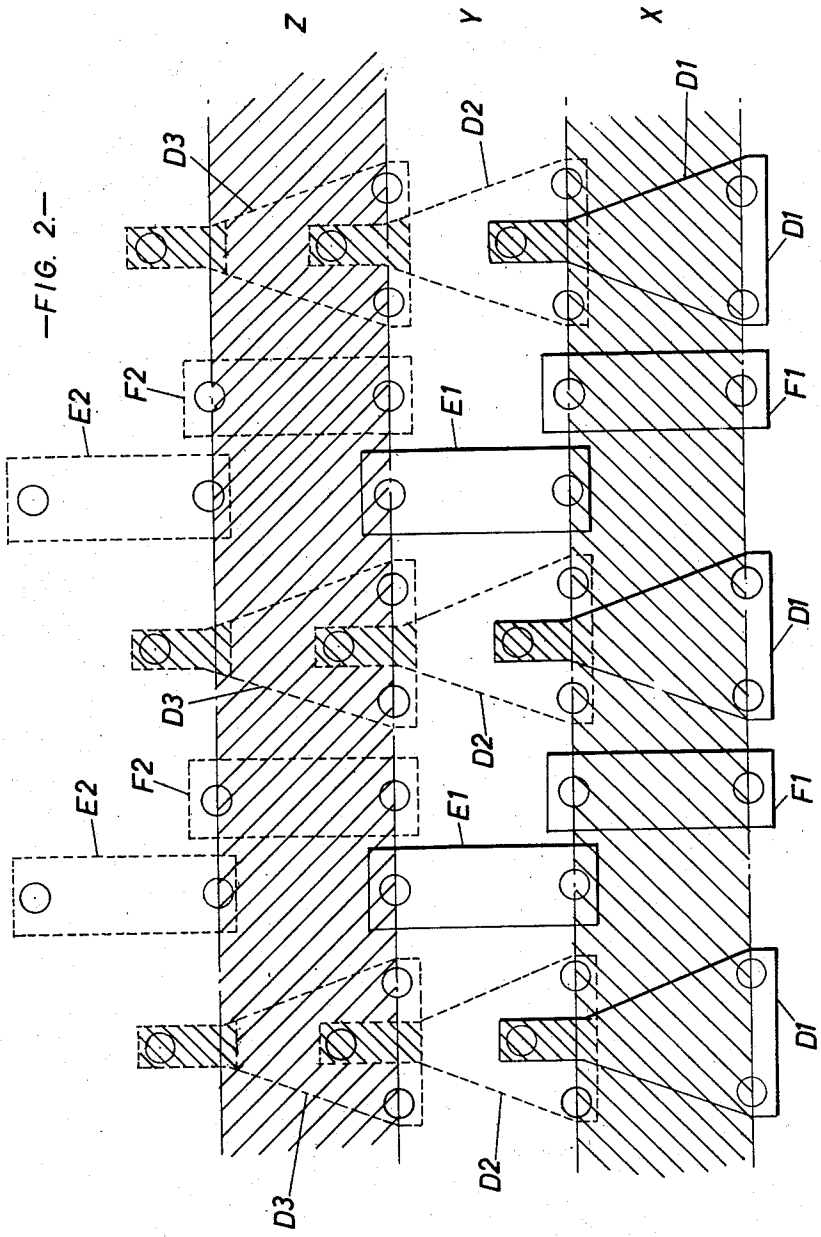
—FIG. 2.—



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ROOF SUPPORT IN MINES

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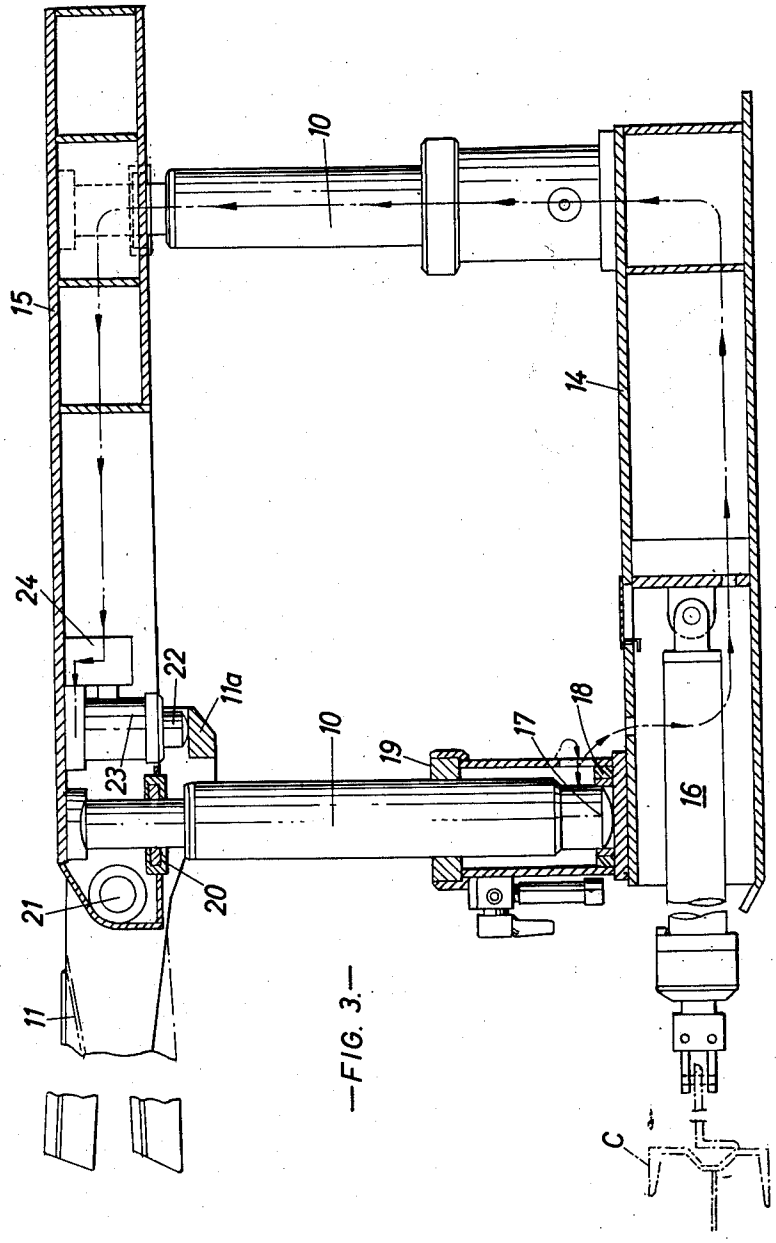

—FIG. 3.—

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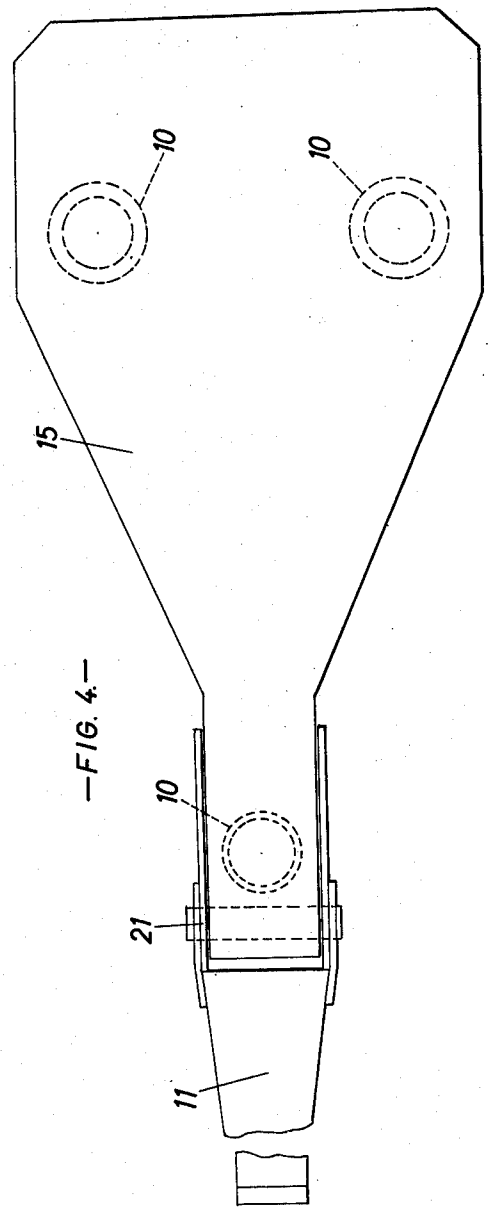
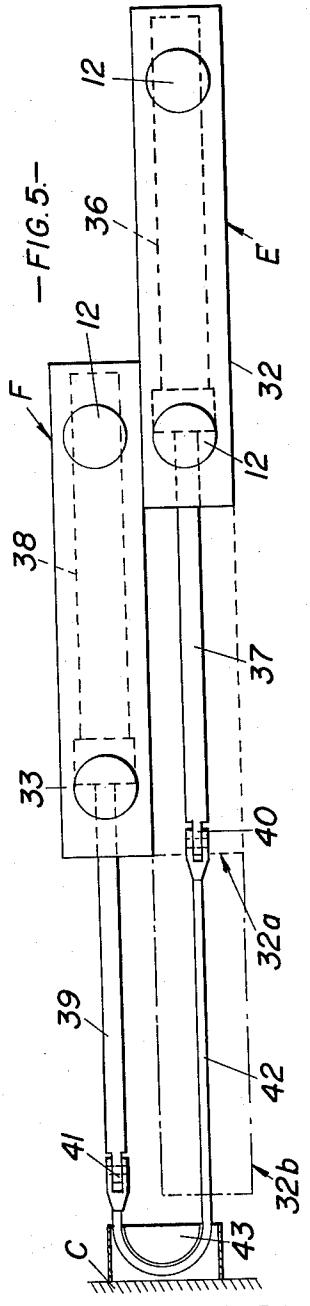


—FIG. 4.—



—FIG. 5.—

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ROOF SUPPORT IN MINES

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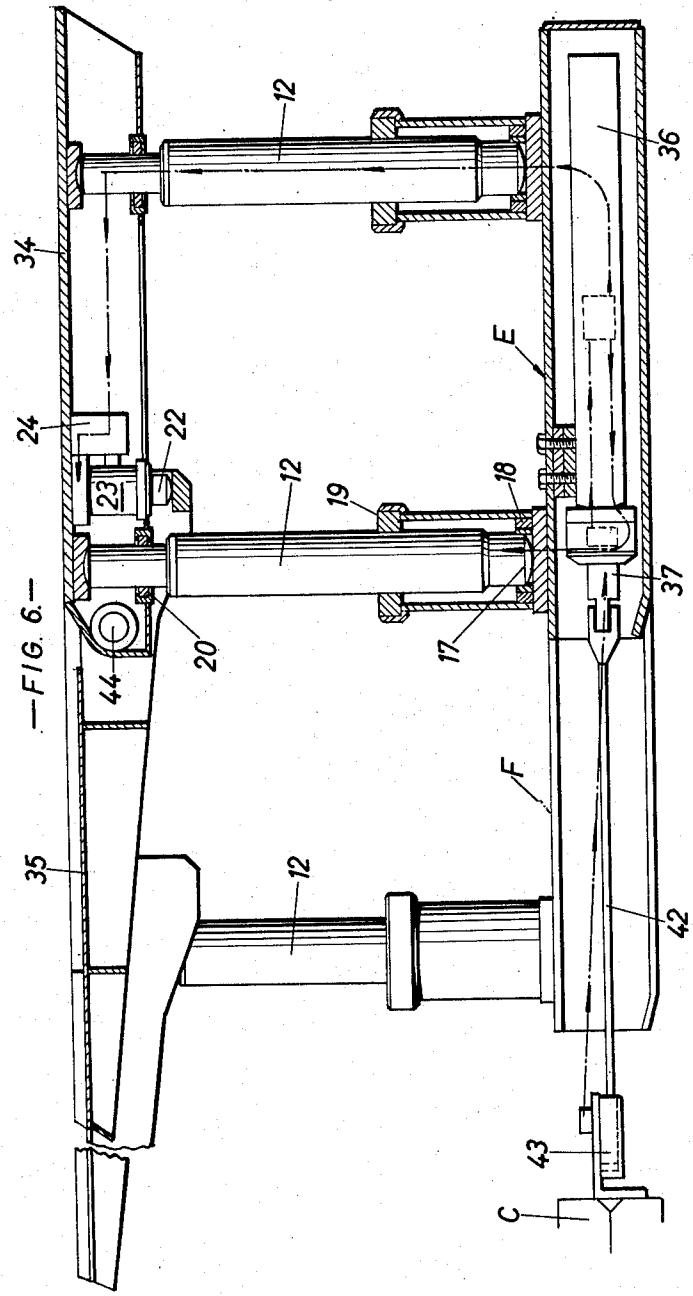

—FIG. 6.—

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ROOF SUPPORT IN MINES

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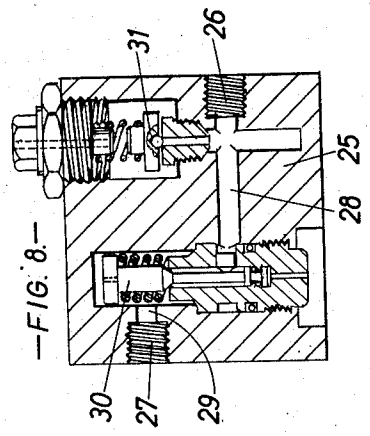
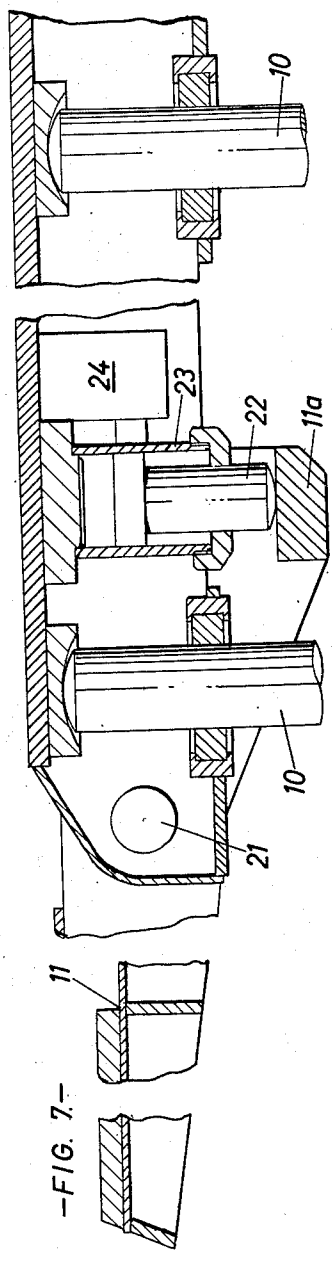


—FIG. 8.—



—FIG. 7.—

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3,097,829

ROOF SUPPORT IN MINES

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Claims priority, application Great Britain Jan. 16, 1959
7 Claims. (Cl. 262—1)

This invention is for improvements in or relating to roof support in mines.

One object of the present invention is to provide a new and improved system or pattern of roof support or "timbering" in mines which, in a self-advancing or "walking" support system, combines the advantages of chocks and in-line suports whilst avoiding the known disadvantages of the latter and in particular ensures that the roof suffers a minimum number of stress reversals.

The self-advancing or "walking" roof support is one which incorporates means (e.g. hydraulic ram devices) which enables it to move itself forwardly as stripping or cutting of the coal face proceeds. Generally some at least of such supports are also adapted to push over the coal conveyor to the newly exposed coal face.

According to the present invention there is provided a method or system of operating and setting self-advancing mine roof supports, comprising main supports (e.g. chocks) and at least two rows of intermediate supports, one row in advance of the other, there being a pair of such intermediate supports, one from each row, between each pair of main supports, wherein following each strip or cut the row of intermediate supports which is then rearmost is advanced and the row of intermediate supports which has become the rearmost row remains in this position until after the next strip or cut, the main supports being advanced following each strip or cut.

The expression "main support" and "intermediate support" where used in this specification and in the claims is intended to mean two different forms of support, each main support being relatively massive as compared with the intermediate supports and the latter being used in pairs so that the novel and advantageous procedure of operation just set forth can be adopted. One of these advantages is that the support pattern combines the advantages of chocks and in-line supports without the disadvantage of having to withdraw and re-set the in-line supports for each cut. Furthermore, the system or pattern provides three lines of supports with a particularly high concentration of support in the region of the waste edge. The system or pattern is also such as to resist damage or clogging from flushing, i.e. the movement of debris into the chocks or other supports or into the spaces between them, the pattern adopted being such that there is a maximum of freedom of movement afforded around and through the supports.

In certain roof conditions the intermediate supports could have retractable extension bars and after a strip or cut has been made the extension bars of the foremost row are extended so as to provide immediate cover under the newly exposed roof.

The invention will be further described, by way of example, with reference to the accompanying drawing wherein:

FIGURE 1 is a diagrammatic plan view of a portion of a mine working,

FIGURE 2 is a diagram illustrating how, with the method or system according to the present invention, the roof suffers a minimum number of stress reversals,

FIGURE 3 is a sectional elevation of one form of main suport or chock provided for the system according to the invention,

FIGURE 4 is a plan view of FIGURE 3,

FIGURE 5 is a semi-diagrammatic plan view of an intermediate support for use in the system illustrated in FIGURE 1,

FIGURE 6 is a sectional elevation showing in greater detail the construction of the intermediate support shown in FIGURE 5,

FIGURE 7 is a fragmentary detail sectional view of an articulated roof bar incorporated in the supports shown in FIGURES 3 and 5, and

FIGURE 8 is a detail sectional view of a relief and loading valve associated with the roof bar shown in FIGURE 7.

Referring first to FIGURE 1, A indicates the coal face, B the waste edge and C the conveyor by which the coal as it is cut is conveyed away. It will be appreciated that following a cut the conveyor has to be advanced towards the coal face. This is effected as hereinafter described.

The roof supporting system shown on the drawing comprises main supports or chocks D and two rows of intermediate supports E and F respectively.

The chocks D comprise a base frame, a canopy or head-piece adapted to bear against the roof and three hydraulic props or legs **10**. Articulated to the forward portion of each canopy or head-piece is an articulated roof bar or extension **11**.

The intermediate supports E and F comprise a base member or foot on which are mounted two hydraulic props or legs **12** which support a roofing bar adapted to be held against the roof. The roofing bar may embody a retractable extension bar **13** but this extension bar may in some cases be omitted.

Incorporated in the chocks D and the intermediate supports E and F are hydraulic ram devices. These ram devices serve to push the conveyor over to the coal face and to advance the chocks and intermediate supports up to the conveyor, as hereinafter described, as cutting of the coal proceeds.

One mode of operating the system or support pattern above described is as follows:

Immediately following the making of a cut all the supports are in the position shown on the left-hand side of FIGURE 1, the extension bars **13**, of the supports E, if provided, being temporarily extended so as to afford protection under the newly exposed roof.

Firstly the hydraulic rams in the chocks D are operated to push the conveyor C over to the coal face and then the supports F (at the time the rearmost row of supports) are advanced into the position shown on the right-hand side of FIGURE 1. The main chocks D are then drawn forward, by their hydraulic rams, to the position shown on the right-hand side of FIGURE 1. This procedure is continued along the whole line of supports until they are all in the position shown on the right-hand side of FIGURE 1.

A further cut is then made following which the above procedure is repeated except that instead of the supports F being moved forward it is the supports E (now the rearmost row) which are moved forward. This procedure of advancing the supports is repeated following each cut, the supports E being advanced following one cut and the supports F following the next cut and so on, the chocks D being advanced at each cut.

It will be appreciated from the above description that the support pattern combines the advantages of chocks and in-line supports without the disadvantage of having to withdraw and re-set the in-line supports for each cut.

FIGURE 2 illustrates clearly how the system ensures that the roof suffers a minimum number of stress reversals. In FIGURE 1 three areas X, Y and Z are shown. On initial setting all the supports D_1 and F_1 are under roof X and all the supports E_1 are under roof Y. When the system is advanced supports F_1 move to the position F_2 under roof area Z and supports D_1 are moved to position D_2 under roof area Y, supports E_1 remaining fixed during this advance.

Furthermore, the system or pattern according to the invention provides three lines of supports with a particularly high concentration of support in the region of the waste edge.

The system or pattern above described is also designed to resist damage or clogging from flushing, i.e. the movement of debris into the chocks or other supports or into the spaces between them, the pattern adopted being such that there is a maximum of freedom of movement afforded around and through the supports.

Referring now to FIGURES 3 and 4, the chock illustrated comprises a base **14** and a canopy **15** supported from the base by the three hydraulic props or legs **10** which, when extended serve to secure the chock firmly between floor and roof. The base **14** houses a hydraulic ram **16** for advancing the chock and which may also be used for pushing over the conveyor C.

It is desirable that the chock should have a strength-flexibility characteristic strong enough to keep the props normal to the roof under uneven floor conditions but with some flexibility to safeguard the chock frame and to return the legs to normal. For this purpose the props are mounted as indicated at **17** so as to provide for limited pivoting on the base **14** and flexible bushes (e.g. of rubber) are provided in the structure as indicated at **18**, **19** and **20**.

The roof bars or canopies should be strong enough to cause a prop to bleed before assuming a permanent set. The cantilever bars **11** should also be capable of supporting a concentrated load of say one half ton at the end of the bar but they should be able to "give" to a limited extent as the roof tends to settle down or otherwise accommodate themselves to the nature of the roof and the load to be supported without becoming distorted. For this purpose the cantilever bar **11** is hinged or articulated to the canopy **15** as indicated at **21** and has an extension or tail-piece **11***a* which bears against a piston **22** adapted to work in a hydraulic cylinder **23** carried by the canopy **15**.

Also mounted on the canopy **15** is a relief and loading valve **24** which is shown in detail in FIGURE 8 and comprises a block **25** having a port **26** adapted for connection to the hydraulic system of the props and a port **27** adapted for connection to the cylinder **23**. Communication between the ports **26** and **27** via passages **28** and **29** is controlled by a loading valve **30**. Communicating with the passage **28** is a spring-loaded relief or bleed valve **31**.

When setting the roof support the pressure fluid flows through the loading valve **30** to the piston and cylinder device **22**, **23** which acts on the articulated roof bar **11** to force it against the roof. When the required and predetermined loading has been achieved the loading valve **30** closes. If subsequently the roofing bar or any of the props should require to "give" or otherwise accommodate themselves to some change in the roof then they can do so because any increase in the load will cause a small amount of hydraulic fluid to be discharged via the bleed valve **31**.

It will be appreciated that whilst the chocks have been described as having three legs or props they may have more or less than this number and similarly the intermediate supports may have more or less than two props or legs.

The intermediate supports E and F shown in FIGURES 5 and 6 serve as double extension hydraulic roof supports and comprise two base members or feet **32** and **33** respectively, which are slidably connected or associated together in side-by-side relationship. Each base member or foot carries the two hydraulic props or legs **12** which are adapted to support a roofing bar **34**, **35** at their upper ends.

The foot **32** incorporates a hydraulic ram comprising a cylinder **36** and ram proper **37**. Similarly, the foot or base member **33** incorporates a hydraulic ram comprising a cylinder **38** and ram proper **39**.

The rams **37** and **39** are linked together as indicated at **40** and **41** by a flexible member (e.g. a wire rope, cord, chain or belt) **42** which runs over an anchorage in the form of a shoe **43** attached, in this particular case, to the coal conveyor C. If the flexible member is in the form of a chain the shoe **43** may be replaced by a chain wheel.

In the position shown in FIGURE 5 it may be assumed that a cut or strip has been made and it is required to advance the roof support E. Firstly then, the conveyor is pushed over by the chocks D as previously described. Due to the anchorage of the rams **37**, **39** to the conveyor by the shoe **43** and the flexible member **42**, this pushing over of the conveyor will extend the rams to the position shown in FIGURE 5.

The support E is then lowered from the roof, hydraulic pressure supplied to the ram **36**, **37** and as a result the foot **32** is advanced into the position **32***a* shown in dotted lines.

Hydraulic pressure is simultaneously supplied to the ram **38**, **39** so that the ram **39** is retracted and as a result the foot **32** is advanced still further, i.e. from the position **32***a* to the position **32***b* shown in chain lines. The support E is then set to support the roof by application of hydraulic pressure to the legs **12**.

Following the next cut or strip of the coal face a similar procedure to that just described takes place except that this time the foot F is advanced. Thus, the supports E, F alternately make two steps forwardly following each cut or strip of the coal face and it will be appreciated that this increased advance is achieved without any increase in the length of stroke of the rams and without the rams extending backwards beyond the rear of the support.

It will be understood that the support above described will incorporate valve means, preferably a single selector valve, which provides for the supply and cut-off of pressure fluid to the props and rams and the venting thereof as required.

The roof bar part **35** is articulated to the part **34** at **44** and is provided with a relief and loading valve similar to that described with reference to FIGURES 7 and 8. There are also other features in the intermediate supports similar to features of the chocks and where applicable like reference numerals have been used to designate like parts.

It should be understood that the operating sequence described above is only given by way of example and may be varied. For instance, the rams in the intermediate supports may be used to push over the conveyor.

It will be appreciated that whilst the chocks have been described as having three legs or props they may have more or less than this number and similarly the inter-

mediate supports may have more or less than two props or legs.

I claim:

1. The combination of a coal conveyor and a walking mine roof support system comprising a plurality of main supports arranged in a row and a plurality of intermediate supports arranged in two rows one row in advance of the other, there being a pair of such intermediate supports one from each row between each pair of main supports, the main supports comprising a base, a canopy, hydraulically extensible prop means mounted on said base and supporting said canopy, and a hydraulic ram in said base extending forwardly from the support whereby said ram is operative to push said conveyor over to the coal face, means securing said ram to the conveyor whereby said ram is operative to advance said base towards the conveyor, each intermediate support comprising a base member, a roofing bar, hydraulically extensible prop means on said base member and supporting said roofing bar, a hydraulic ram in said base member and a flexible member connecting the ram of each intermediate support of one row to the ram of its neighbouring intermediate support of the other row, said flexible member running over an anchorage on the conveyor whereby the rams of the intermediate supports are operative to advance said intermediate supports towards the conveyor two steps at a time.

2. The combination of a coal conveyor and a walking mine roof support system comprising a plurality of main supports arranged in a row and a plurality of intermediate supports arranged in two rows one row in advance of the other, there being a pair of such intermediate supports one from each row between each pair of main supports, the main supports comprising a base, a canopy, hydraulically extensible proper means mounted on said base and supporting said canopy, and a hydraulic ram in said base extending forwardly from the support whereby said ram is operative to push said conveyor over to the coal face, means securing said ram to the conveyor whereby said ram is operative to advance said base towards the conveyor, each intermediate support comprising a base member, a roofing bar, hydraulically extensible prop means on said base member and supporting said roofing bar, a hydraulic ram in said base member and a flexible member connecting the ram of each intermediate support of one row to the ram of its neighbouring intermediate support of the other row, said flexible member running over an anchorage on the conveyor, the hydraulic rams of the main supports, when extended to push the conveyor over towards the coal face, also extending by means of said flexible member, the hydraulic rams of the intermediate supports so that when pressure fluid is supplied to the hydraulic rams of the rearmost row of intermediate supports said row is advanced one step towards the coal face and when hydraulic fluid is supplied to the hydraulic ram of the foremost row said rearmost row of intermediate supports is advanced a further step towards the coal face.

3. The combination of a coal conveyor and a walking mine roof support system comprising a plurality of main supports arranged in a row and a plurality of intermediate supports arranged in two rows one row in advance of the other, there being a pair of such intermediate supports one from each row between each pair of main supports, the main supports comprising a base, a canopy, hydraulically extensible prop means mounted on said base and supporting said canopy, and a hydraulic ram in said base extending forwardly from the support whereby said ram is operative to push said conveyor over to the coal face, means securing said ram to the conveyor whereby said ram is operative to advance said base towards the conveyor, each intermediate support comprising a base member, a roofing bar, hydraulically extensible prop means on said base member and supporting said roofing bar, a hydraulic ram in said base member and a flexible member connecting the ram of each intermediate support of one row to the ram of its neighbouring intermediate support of the other row, said flexible member running over an anchorage on the conveyor whereby the rams of the intermediate supports are operative to advance said intermediate supports towards the conveyor two steps at a time, the intermediate supports having a retractable and extensible roof engaging bar which, when extended, provides immediate cover under newly exposed roof.

4. The combination of a coal conveyor and a walking mine roof support system comprising a plurality of main supports arranged in a row and a plurality of intermediate supports arranged in two rows one row in advance of the other, there being a pair of such intermediate supports one from each row between each pair of main supports, the main supports comprising a base, a canopy, hydraulically extensible prop means mounted on said base and supporting said canopy, and a hydraulic ram in said base extending forwardly from the support whereby said ram is operative to push said conveyor over to the coal face, means securing said ram to the conveyor whereby said ram is operative to advance said base towards the conveyor, each intermediate support comprising a base member, a roofing bar, hydraulically extensible prop means on said base member and supporting said roofing bar, a hydraulic ram in said base member and a flexible member connecting the ram of each intermediate support of one row to the ram of its neighbouring intermediate support of the other row, said flexible member running over an anchorage on the conveyor, the hydraulic rams of the main supports, when extended to push the conveyor over towards the coal face, also extending, by means of said flexible member, the hydraulic rams of the intermediate supports so that when pressure fluid is supplied to the hydraulic rams of the rearmost row of intermediate supports said row is advanced one step towards the coal face and when hydraulic fluid is supplied to the hydraulic ram of the foremost row said rearmost row of intermediate supports is advanced a further step towards the coal face, the intermediate supports having a retractable and extensible roof engaging bar which, when extended, provides immediate cover under newly exposed roof.

5. In combination with a coal conveyor, a self-advancing mine roof support located on one side of said conveyor and comprising two support members positioned in side-by-side relationship and movable independently towards the conveyor and each having hydraulically extensible prop means whereby it can be secured between floor and roof, a pair of hydraulic ram cylinders, means securing one of said ram cylinders to each of said support members, a ram proper working in each of said ram cylinders and directed for movement towards and away from said conveyor, an anchorage on the conveyor opposite said rams proper, and a flexible member connecting the two rams proper together and looped around said anchorage and having a length equal to the distance from the forward ends of the rams proper extending about the anchorage.

6. In combination with a coal conveyor, a self-advancing mine roof support located on one side of said conveyor and comprising two support members positioned in side-by-side relationship for independent movement towards said conveyor and each having hydraulically extensible prop means whereby it can be secured between floor and roof, a pair of hydraulic ram cylinders, means securing one of said ram cylinders to each of said support members, a ram proper working in each of said ram cylinders and directed for movement towards and away from said conveyor, a sheave pivotally supported on the conveyor opposite said rams, and a flexible member connecting the two rams proper together and looped around said sheave and having a length equal to the distance from the forward ends of the rams proper extending about the sheave.

7. In combination with a coal conveyor, a self-advanc-

ing mine roof support located on one side of said conveyor and comprising two support members each having a foot part, at least two hydraulically extensible props mounted on said foot part and extending vertically upwards therefrom, and a roofing bar mounted on said props, a pair of hydraulic ram cylinders, means securing one of said ram cylinders to each of said foot parts, a ram proper working in each of said ram cylinders and directed for movement towards and away from the conveyor, an anchorage on the conveyor opposite said rams proper, and a flexible member connecting the two rams proper together and looped around said anchorage and

having a length equal to the distance from the forward ends of the rams proper extending about the anchorage.

References Cited in the file of this patent

UNITED STATES PATENTS

2,780,067	Jacobi et al.	Feb. 5, 1957
2,795,934	Jenkins	June 18, 1957

FOREIGN PATENTS

784,217	Great Britain	1957
804,386	Great Britain	1958
1,201,143	France	July 1959