Sept. 14, 1965 W. C. CAGLEY 3,206,187

SWINGING CHECK CURTAIN

Filed Jan. 12, 1962 2 Sheets-Sheet 1

FIG. 1.

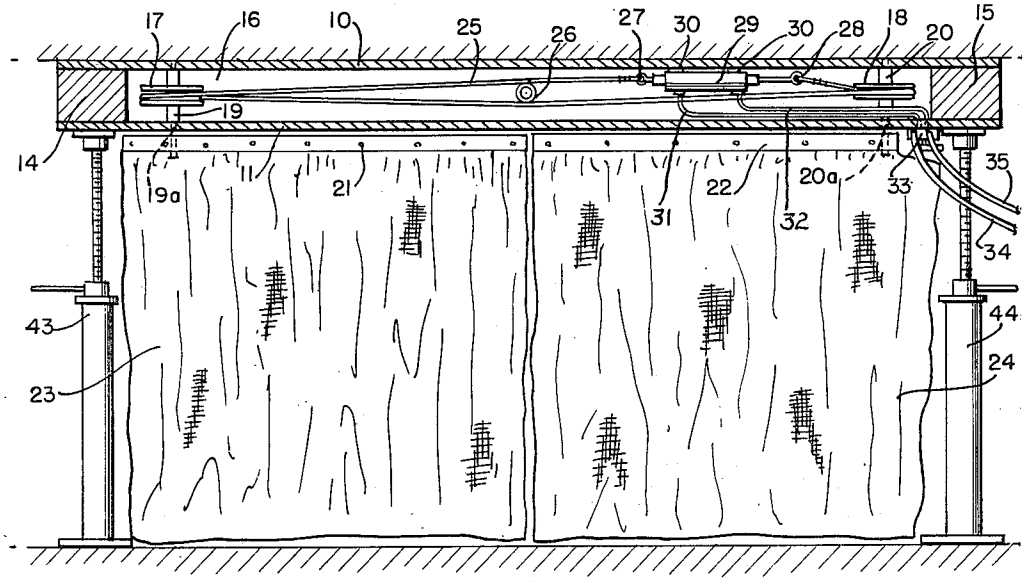


FIG. 2.

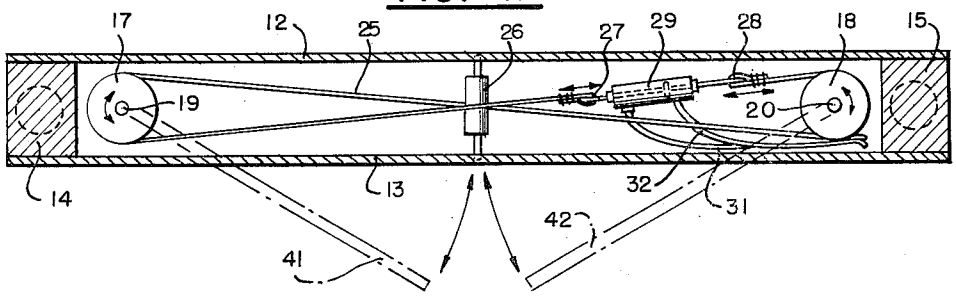
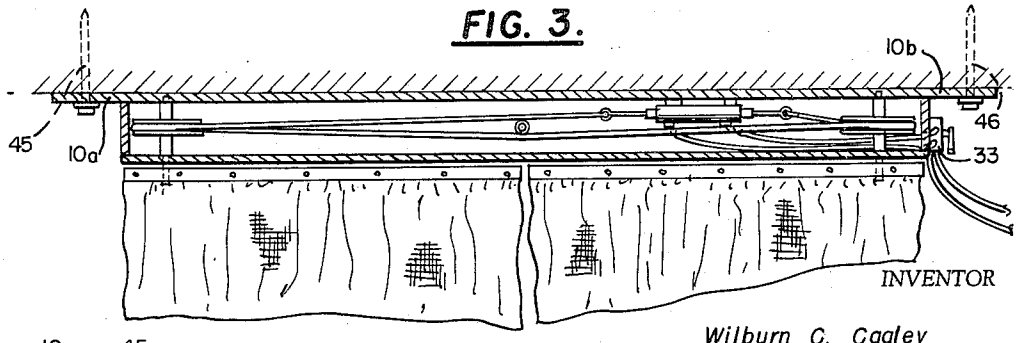


FIG. 3.



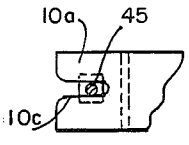


FIG. 3A.

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Sept. 14, 1965 W. C. CAGLEY 3,206,187

SWINGING CHECK CURTAIN

Filed Jan. 12, 1962 2 Sheets-Sheet 2

FIG. 4.

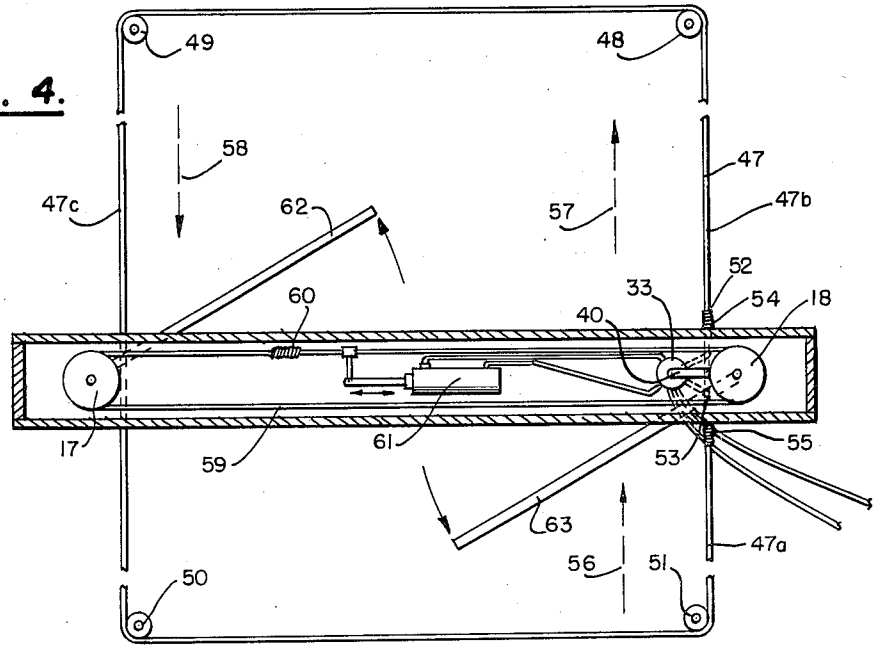
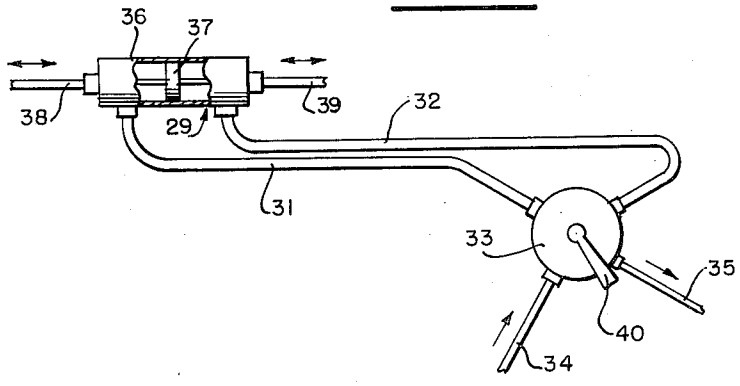


FIG. 5.



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SWINGING CHECK CURTAIN

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7 Claims. (Cl. 268—64)

The present invention relates to check curtains and the like adapted to be installed in mines, especially coal mines; and is more particularly concerned with an improved supporting structure for such check curtains arranged to be readily movable during a mining operation and embodying a unitary supporting and operating structure for check curtains associated therewith.

As is well known at the present time, check curtain and line brattices are necessary to effect proper ventilation of working areas in mines, especially in coal mining operations. Such check curtains and line brattices are variably disposed within a mining area to direct air into the mine, along various face areas being worked, and thereafter away from said face areas. The check curtains themselves are normally fabricated of flexible sheet materials, and are preferably arranged to be movable from one location to another in the mine as the mining operation progresses.

The utilization of check curtains in mines, while important to assure proper ventilation, has in practice been found to raise a number of problems, particularly relating to safety of operation. In a typical mining operation, as coal or other minerals are extracted from the working areas, it must be hauled by some means, usually a shuttle car, to a loading point where it can then be transferred to a conveyor belt. The typical disposition of such a conveyor belt in relation to the mine faces being worked and in relation to the check curtains normally employed, ordinarily requires that one or more check curtains be positioned between the working faces and the loading point or conveyor belt. As a result, shuttle cars traveling from the working faces to the conveyor belt must pass through one or more of said check curtains.

The type of check curtain most commonly employed at the present time comprises a support member having flexible sheet material hanging therefrom; and a shuttle car, in passing through such a curtain, normally does so by merely displacing the flexible material of the curtain. In this type of operation the curtain may well drag over the top of the car as the car progresses therethrough; and it has become a rather common practice for shuttle car operators to shield their face and head with a forearm, as the shuttle car moves through the curtain, to prevent eye injuries and to keep the curtain from dragging the operator's cap and cap lamp from his head. Operators have, upon occasion, become confused, and have thereby at least partially lost control of their car as it passes through the curtain. As a result, the shuttle car has, upon occasion, collided with supporting timbers disposed on the remote side of the curtain being traversed, and this in turn has not only caused damage to the car and injury to the operator, but has, upon occasion, dislodged the supporting timbers thereby causing sections of the mine roof to fall. In addition, the type of check curtain commonly employed at the present time tend to obscure projecting roof rock or low cross timbers which may be hidden from view, on the other side of the curtain as the shuttle car traverses the curtain; thereby raising still further possibilities of injury to the car operator.

Further difficulties have been found. By way of example, it sometimes occurs that the curtain catches on a portion of the car as the car traverses the same; and the curtain is thereby torn down. This in turn tends to short circuit circulating air away from the working area, resulting in the possibility of accumulation of explosive gas in that working area, with the attendant hazard of

mine explosion. In addition, explosion hazards are augmented by the fact that the check curtain, as it drags over the car, tends to drag some coal off of the shuttle car; and this coal may thereafter become pulverized under the wheels of the shuttle car or other mobile equipment present in the mine.

In view of these recognized difficulties of known check curtains, it has been suggested heretofore that the permanently hanging curtains conventionally employed be somehow replaced by movable barriers. Such movable barriers sometimes suggested heretofore, have taken the form of doors or the like associated with an operator mechanism adapted to permit said doors to be opened and closed. As a general matter, however, these alternative structures have not found wide acceptance inasmuch as the door or barrier structures are relatively massive, thereby preventing their ready movement from one mine location to another; and inasmuch further as these alternative barrier structures have normally been extremely complex and costly in construction thereby raising serious maintenance problems as well as initial installation cost problems. As a result, mine operators have been reluctant to expand the considerable sums needed to install these complex movable barrier structures, and draped flexible check curtains have continued to be the most prevalent form of structure in actual use.

The present invention, recognizing these difficulties and characteristics of structures suggested heretofore, is accordingly concerned with an improved from of check curtain arrangement which is relatively simple in construction, inexpensive to install and maintain, and which provides a readily openable barrier, thereby to eliminate the safety hazards prevalent heretofore, in a structural arrangement well within the financial means of even small mining operators. To this effect, the present invention contemplates the provision of an improved curtain support and operating structure similar in form to a conventional beam or cross timber, but containing therein a unitary operating and reversing mechanism associated with curtain supports. Movement of the supporting timber or beam thus simultaneously accomplishes movement of the curtain support and curtain operating mechanisms forming a unitary portion thereof. The over-all support and operating structure may be moved from one location to another, as a mining operation advances, with no more difficulty than is required in the moving of any timber; and the movement of the structure may in fact be accomplished with even less difficulty than conventional timber movements, inasmuch as the structure is substantially lighter than conventionally solid timbers.

It is accordingly an object of the present invention to provide an improved supporting and operating structure for mine check curtains.

A further object of the present invention resides in the provision of a movable beam and curtain combination which includes, as a unitary portion thereof, a self-contained operating and reversing mechanism.

Another object of the present invention resides in the provision of an improved mining check curtain which can be readily opened as desired to permit passage of a shuttle car or other equipment therethrough, and otherwise readily closed to effect appropriate ventilation of a working face.

A still further object of the present invention resides in the provision of an improved relatively fool-proof operator structure for mine check curtains which is simple and inexpensive to install and maintain.

Still another object of the present invention resides in the provision of an improved mine check curtain supporting an operating mechanism designed to eliminate safety hazards commonly present in mines employing check

curtains normally used heretofore, and effecting this elimination of safety hazards by means of a structure well within the financial limitations of even small mine operators.

The foregoing objects, advantages, construction and operation of the present invention will become more readily apparent from the following description and accompanying drawings, in which:

FIGURE 1 is a front view, in partial section, of an improved check curtain supporting and operating structure constructed in accordance with one embodiment of the present invention;

FIGURE 2 is a top view, in partial section, of the arrangement shown in FIGURE 1;

FIGURE 3 is a front view, in partial section, of an alternative embodiment constructed in accordance with the present invention;

FIGURE 3A is a detail view of a portion of the structure shown in FIGURE 3;

FIGURE 4 is a top view in partial section of another embodiment of the present invention; and

FIGURE 5 is a detail view of a fluid or pneumatic pressure operator such as may be employed in the various embodiments of the present invention.

Referring first to FIGURES 1 and 2, it will be seen that an improved check curtain supporting and operating mechanism may, in accordance with the present invention, comprise a single unit supported in much the same manner as a cross timber or beam conventionally employed in mining locations. This beam type supporting and operating mechanism comprises, in the embodiment of FIGURES 1 and 2, an assembled elongated rectangular structure comprising a pair of elongated substantially horizontal plates **10** and **11**, a pair of elongated substantially rectangular vertical plates **12** and **13**, and a pair of end spacer blocks **14** and **15**. The various elements **10** through **15** can, if desired, be fabricated of various materials, including metal; but for purposes of economy, a preferred material is wood. In such case, the elongated members **10** through **13** inclusive can take the form of planks; and when assembled around the end blocks **14** and **15**, the over-all structure appears from its external aspect to be a wooden beam.

The arrangement of the various elements **10** through **15** defines, as illustrated in FIGURES 1 and 2, a substantially hollow beam characterized by the provision of an elongated interior cavity **16**. It is in this cavity that the mine curtain operating mechanism is disposed, whereby this operating mechanism comprises a unitary portion of the beam which is therefore movable with the beam. The operating mechanism itself may take the form of a pair of pulleys or sheaves **17** and **18** disposed within, and adjacent the opposed ends of beam cavity **16**, and rotatably mounted therein on shafts **19** and **20** which extend into the upper and lower surfaces **10** and **11** of the supporting beam. Each of the shafts **19** and **20**, associated respectively with sheaves **17** and **18**, includes a portion, e.g., **19***a* and **20***a*, extending through the lower surface **11** of the beam. Any suitable known bearings may be provided for rotatably mounting the upper and lower ends of shafts **19** and **20** in upper and lower beam plates **10** and **11**. A pair of cantilever curtain supports **21** and **22** are attached, as illustrated, to the extending shaft portions **19***a* and **20***a* respectively. The cantilever curtain supports **21** and **22** preferably extend in a common plane from opposing ends of the beam **10–15**, generally along the bottom of the beam and toward one another (when the curtains are in closed position) terminating respectively in spaced close proximity to one another adjacent the center of the beam. Each curtain support **21**, **22** in turn has attached thereto a draped curtain section **23** and **24**, extending from the supports **21** and **22** to a region closely adjacent the floor of the mine.

It will be appreciated from the arrangement thus far described that, upon rotation of the sheaves **17** and **18** in one or the opposite direction, curtain supports **21** and **22** are similarly caused to move away from or toward one another thereby to effect an opening or closing of the draped curtains **23** and **24**. This rotation of the sheaves **17** and **18** can be provided by various means. However, in a preferred embodiment, the sheave rotation is effected by a cable arrangement movable under the control of a fluid pressure responsive actuator, particularly one responsive to water or pneumatic pressures since water and/or compressed air supplies are normally readily available at mining locations.

The arrangement shown in FIGURES 1 and 2, constructed in accordance with this preferred embodiment, comprises an elongated cable or rope **25** disposed in a generally figure-eight configuration, having the opposed loop ends thereof passing around the peripheries of sheaves **17** and **18** respectively. The crossing runs of said figure-eight configuration are, moreover, preferably separated from one another by an idler roller **26** rotatably supported within beam cavity **16** and serving to prevent excess friction in the region of the crossing runs.

A section of the cable **25** is severed to provide cable endings **27** and **28**; and a fluid pressure cylinder and piston actuator **29**, fixedly mounted on the interior of beam cavity **16**, as at **30**, is interposed between said cable ends **27** and **28**. Actuator **29** is associated with a pair of fluid lines **31** and **32**, for water or air, communicating with a manually operable control valve **33**, which is in turn associated with a pair of fluid lines **34** and **35**; and upon appropriate manipulation of valve **33**, actuator **29** will be caused to move in one direction or the other thereby to move cable **25** so as to effect rotation of the sheaves **17** and **18** with resultant opening or closing of the curtains **23** and **24**.

The fluid control portions of the system will become more readily apparent from the detail view of FIGURE 5. Valve **33** comprises a so-called directional four-way valve which is in itself well known in the art. The actuator **29** is of the so-called double-acting or two-way cylinder type, comprising a cylinder **36** having a piston **37** therein associated with piston rods **38** and **39**, extending from opposing ends of said cylinder **36**. The pair of fluid lines **31** and **32**, for water or air, extend from valve **33** to inlets in cylinder **36** disposed respectively adjacent opposite sides of piston **37**. Line **34** extends from valve **33** to a source of fluid pressure, such as water or air, while line **35**, leading away from valve **33**, comprises an exhaust or discharge line. (It is noted, however, that the actuator **29** may be a single rod type such as shown in FIGURE 4, which is hereinafter more fully discussed.)

The operation of four-way valve **33** is in itself well known, and various structures are commercially available. In general, however, the operation is such that the lines **31** and **32** can each act as either a supply or discharge line, depending upon the position of the manual handle **40** associated with valve **33**. In one position of said handle **40**, fluid, such as water or air, may be supplied via line **34** and thence via line **31** to the left side of piston **37** thereby causing said piston to move to the right; and any fluid in the cylinder region to the right of piston **37** will then be exhausted via line **32** and valve **33** to discharge line **35**. In a different position of handle **40**, water, air, or other fluids under pressure may be supplied via line **34** and valve **33** to line **32** thereby applying a force to the righthand side of piston **37** forcing the same to the left; and any fluid in cylinder **36** to the left of piston **37** will then be exhausted via line **31** and valve **33** to discharge line **35**.

Returning now to the arrangement shown in FIGURES 1 and 2, it will be seen that for the particular position of actuator **29**, its associated piston rods and cable **25**, illustrated, the curtain supports **21** and **22** can be considered as substantially in alignment with one another whereby curtains **23** and **24** are in closed position. Upon applica-

tion of fluid pressure via valve 33 to line 32, the piston in actuator 29 will be caused to move to the left. This effects a counter-clockwise rotation of sheave 18 (as viewed in FIGURE 2) and, due to the figure-eight configuration of cable 25, a clockwise rotation of sheave 17. As a result, the curtain supports 21 and 22 and the check curtains hanging therefrom, will be moved toward an open position as depicted by dotted lines 41 and 42. This operation can continue until the curtains are fully opened, at which time they may extend in generally parallel directions to one another, or may in fact open even further; and the limit positions of curtain opening can be predetermined by appropriate selection of the stroke of actuator 29. Upon reversal of the fluid supply, the curtains will be caused to swing into a closed position in the manner already described.

The particular arrangement of FIGURES 1 and 2 provides a unitary curtain supporting and operating structure which may be readily moved from one location to another in a mine, as required by advancement and progress of a mining operation. At any given desired location, the supporting beam and operator structure can be readily mounted in place by a pair of screw jacks (or conventional posts) 43 and 44 bearing against the lower surface of the beam in the region of spacer blocks 14 and 15. In the alternative, if desired, the beam may be supported (see FIGURES 3 and 3A) adjacent the roof of a mining location by means of roof bolts 45 and 46; and in this alternative arrangement, the upper surface of the beam may include a pair of prolongations 10*a* and 10*b* provided with elongated slots such as 10*c*, for receiving said roof bolts. The arrangement otherwise shown in FIGURES 3 and 3A corresponds to that already described in reference to FIGURES 1 and 2.

In order to provide a unitary support and operator structure of the type already described, it is preferred that the valve 33 be mounted on a portion of the supporting beam either adjacent an under or side surface thereof, as shown in FIGURES 1 and 2, or adjacent an end surface thereof, as shown in FIGURE 3. In either case, this positioning of the control valve requires that a shuttle car operator leave his shuttle car seat to operate the valve 33 to open and close the check curtains. It is preferable to provide some form of remote control so that the shuttle car operator can open the check curtains 23 and 24 before he reaches them, and then close the check curtains after passing through them, without leaving his seat on the shuttle car.

Various forms of remote control operators are readily capable of utilization with the arrangement of the present invention; and these can include devices which automatically respond to approach of a car toward the curtain, or in the alternative, devices which can be manipulated at a remote position by the operator of the car as he approaches the curtain. In order to reduce expenses as much as possible, thereby to make the structure of the present invention feasible for use in even small mines, it is preferred that the remote operator also take a relatively simple form; and a preferred such form is shown in FIGURE 4, it being understood, however, that this form of remote operator can be readily installed on the arrangements of FIGURES 1 and 3 as well.

The valve operating device shown in FIGURE 4 comprises an endless rope or cable 47 extending in a closed loop about pulleys or sheaves 48 through 51 inclusive adjacent both sides of the curtain supporting and operating mechanism. The closed loop cable 47 preferably extends for an appreciable distance away from the curtain on both sides thereof; and the various sheaves 48 through 51 can be mounted in either the walls or roof of the mining location thereby to present a length of cable to operators of shuttle cars approaching and leaving the curtained area. Endless cable 47 is preferably severed in the region of control valve 33 to provide a pair of spaced ends 52 and 53 which are attached by tension springs 54 and 55 to the operating handle 40 of valve 33.

As a shuttle car approaches the curtained region, e.g., in the direction of arrow 56, the shuttle car operator can grasp cable length 47*a* and, by pulling the same in a rearward direction, operate valve 33 to cause the check curtains to open. Upon passing through the curtains, and emerging therefrom, e.g., in the direction of arrow 57, the operator can then grasp cable portion 47*b* and, by pulling the same in a forward direction, reverse the valve, thereby to move the curtain back to its closed position. It will be appreciated that, by reason of the endless nature of cable 47, a shuttle car approaching the curtain from the opposite side thereof, i.e., in the direction of arrow 58 can, by pulling on cable section 47*c*, effect the same relative motion of the cable as was effected by a pulling of section 47*a*; and a similar operation occurs after the car passes through the curtain. Accordingly, by the arrangement illustrated, the curtain can be readily opened or closed from either side thereof and as cars are either approaching or leaving the curtained area.

While the arrangements described in reference to FIGURES 1 and 3 employ an operating cable in the form of a "figure-eight" to effect an opening or closing of both curtains 23 and 24 in the same direction, this is not mandatory. By using other cable configurations, the swinging curtains can be caused to open in opposite directions, as shown in FIGURE 4. In this alternative arrangement, the sheaves 17 and 18, rather than being associated with a figure-eight cable 25 of the type described in reference to FIGURES 1 and 2, can be associated with a simple loop cable configuration 59. A tension spring 60 is preferably interposed in said cable 59 to assure that it firmly engages the peripheries of sheaves 17 and 18. A double acting actuator 61, essentially similar to the actuator 29 already described, can be mounted as before within the beam cavity; and the bidirectional motion of the piston rod in this case causes the sheaves 17 and 18 to rotate in the same direction, i.e., both clockwise or both counter-clockwise depending upon the actual direction of piston rod movement. The curtains in this arrangement are thus caused to part by moving away from one another toward opposite sides of the beam as illustrated at 62 and 63; and upon being closed, move toward one another.

The term "fluid" used in the claims refers to suitable liquids or gases, such as water and air.

Still other modifications will be readily apparent to those skilled in the art, and it must therefore be understood that, while I have described preferred embodiments of the present invention, the foregoing description is meant to be illustrative only and should not be considered limitative of my invention. All such variations and modifications as are in accord with the principles described are meant to fall within the scope of the appended claims.

Having thus described my invention, I claim:

1. Unitary support and operator means for a mine check curtain comprising an elongated substantially rectangular wooden beam adapted to be removably supported adjacent the roof of a mining location, said beam having an elongated hollow cavity on the interior thereof, means releasably engaging the ends of said beam for securing said beam to the roof of a mine shaft, a pair of sheaves rotatably mounted within said beam cavity adjacent the opposite ends of said beam respectively, cable means extending around and between said sheaves within said beam cavity, operator means supported by said beam and coupled to said cable means for reversibly moving said cable means thereby to reversibly rotate said sheaves, each of said sheaves being coupled to shaft means extending from said cavity through a bottom exterior surface of said beam adjacent the opposite ends of said beam respectively, and a pair of elongated cantilever curtain supports supported by said pair of shaft means respectively, and extending along and adjacent the bottom

exterior surface of said beam, for movement toward and away from one another in a substantially single plane upon reversible movement of said sheaves and cable means.

2. The structure of claim 1, wherein said operator means includes cylinder and piston means mounted within said beam cavity and having the piston means thereof attached to said cable means, and means extending through a portion of said beam for supplying actuating fluid pressures to said cylinder means.

3. The arrangement of claim 1 wherein said cable means is disposed in a substantially figure-eight configuration between said sheaves within said cavity, and an idler roller rotatably mounted within said cavity between the crossing runs of said figure-eight cable configuration.

4. For a mine check curtain, a portable support beam adapted to be mounted adjacent a mine roof, removable support means coupled to the ends of said beam for removably supporting said beam against a mine shaft roof, a pair of cantilevers pivotally attached to the undersurface of said support beam, and actuating means recessed within said beam and at least partially encased thereby for reversibly moving said cantilevers relative to said beam.

5. The arrangement of claim 4 including operator means disposed external to said beam for remotely controlling said actuating means.

6. The arrangement of claim 4 wherein said actuating means include a fluid pressure responsive actuator disposed in a cavity within said beam, a fluid control valve mounted on an exterior surface of said beam, and fluid lines passing from said valve to said actuator through a wall of said beam.

7. The arrangement of claim 6 including an elongated control cord extending from said valve to a position remote from said beam for remotely controlling application of fluid pressures via said valve to said actuator.

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