

June 6, 1950

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MINE TIMBER

2,510,593

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2 Sheets-Sheet 1

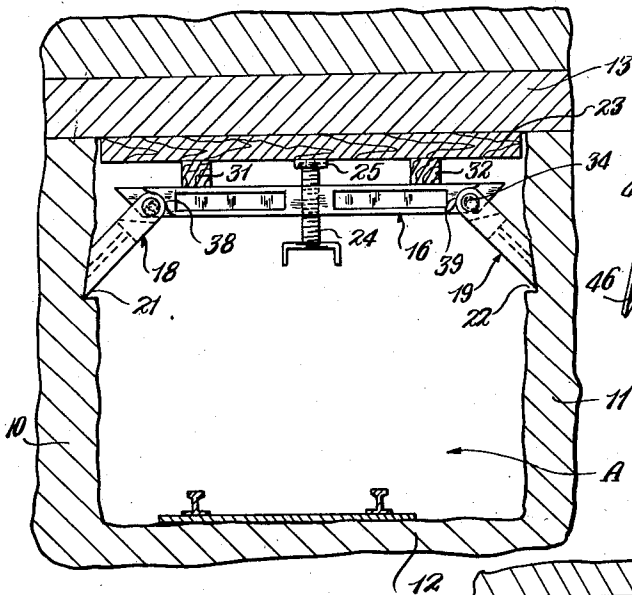


FIG. 1

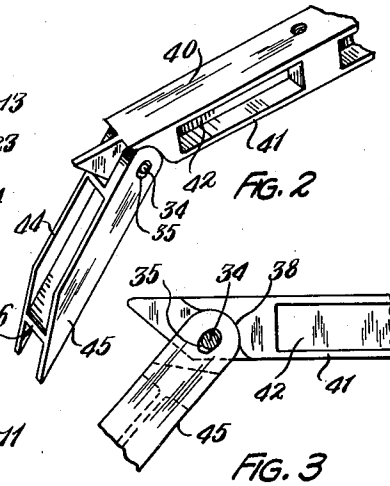
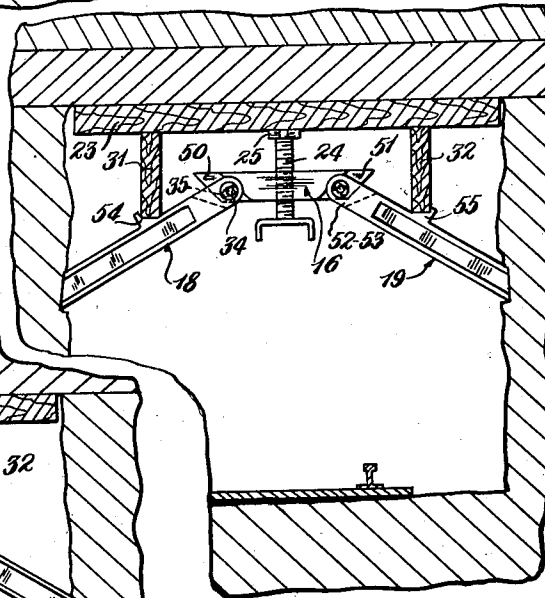


FIG. 4

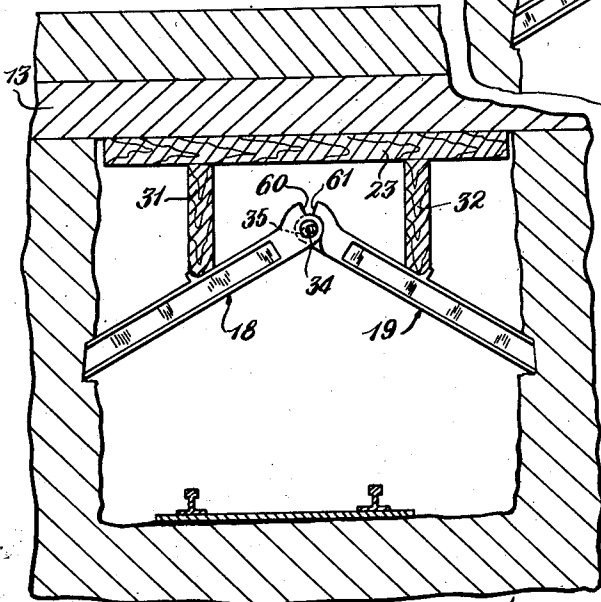


FIG. 5

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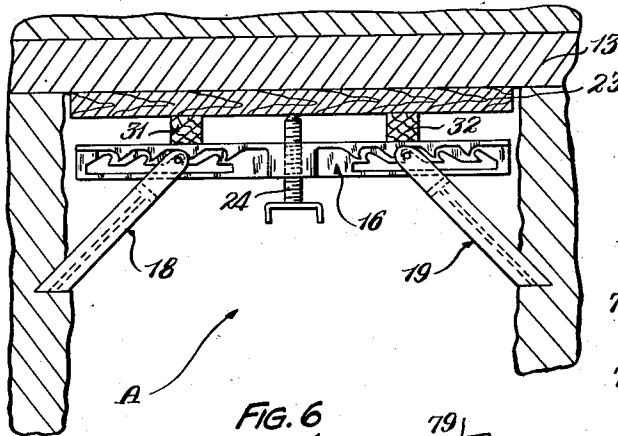
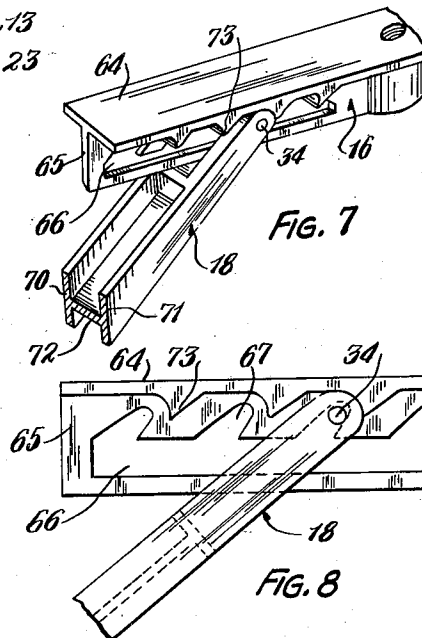
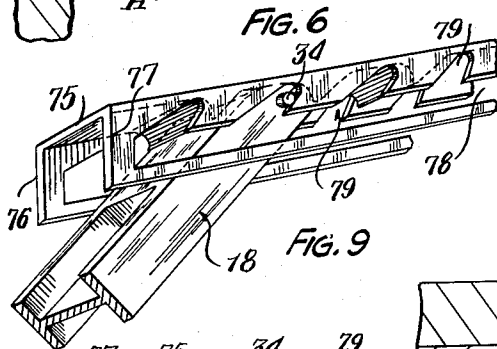
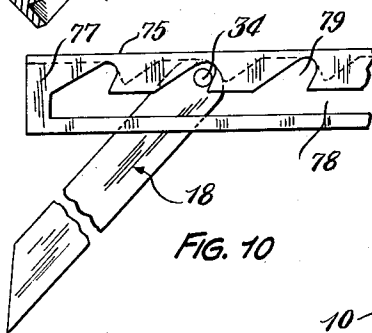
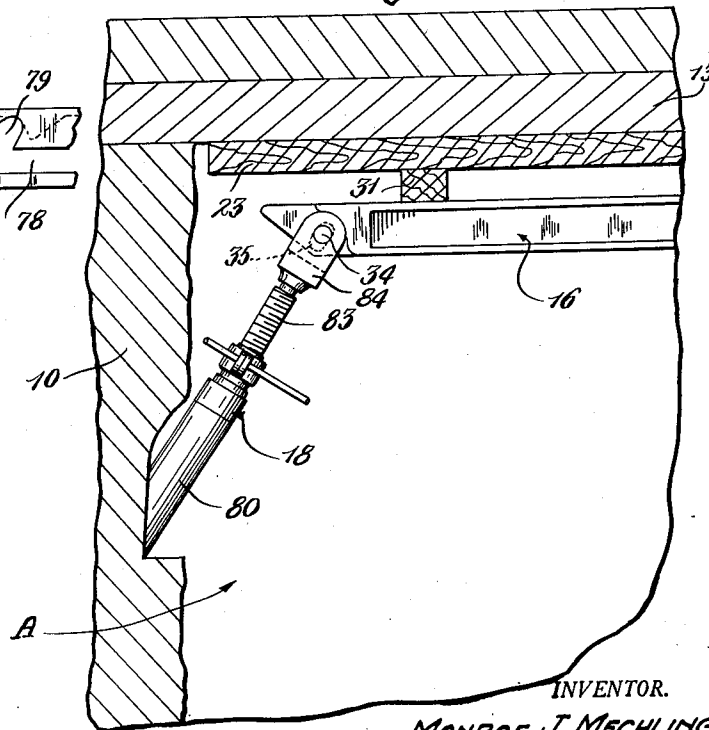


FIG. 11

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MINE TIMBER

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15 Claims. (Cl. 61-45)

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This invention relates to mine timbers and, more particularly, to prefabricated mine timbers for supporting the roofs of underground entries, passageways, excavations, or tunnels hereinafter referred to as shafts.

The object of this invention is the provision of a new and improved mine timber which is simple in structure, physically strong, easily and simply installed, and adjustable both in width and height for adaptation to a maximum number of variable conditions.

Another object of this invention is the provision of a new and novel mine timber for supporting the roofs of underground shafts which utilizes the lateral stability of the walls of the shaft for supporting the roof and maintains the floor of the shaft free from the usual roof supporting obstructions.

Another object is the provision of a new and novel mine timber for supporting the roofs of underground shafts which has articulated members for supporting the roof, the members having relatively large interengaging load transferring surfaces whereby the danger of failure of the articulated joint is lessened.

A further object is the provision of a new and improved mine timber of the type referred to having adjusting means for facilitating positioning of the timber for obtaining an initial supporting action.

Still another object is the provision of a new and novel supporting means for the roofs of underground shafts which is self-adjusting for shafts of different widths.

Still another object of this invention is the provision of a new and improved load transferring joint for articulated members comprising means for maintaining the members in assembled relationship, and mating surfaces for transferring the load from one member to the other independently of the means for maintaining the members assembled.

The invention resides in certain constructions and combinations and arrangements of parts, and further objects and advantages will be apparent to those skilled in the art to which it relates from the following description of the preferred embodiment described with reference to the accompanying drawings forming a part of this specification, and in which:

Fig. 1 shows a cross-sectional view of a mine shaft having installed therein a mine timber embodying the present invention;

Fig. 2 is an enlarged perspective view of a portion of the timber;

Fig. 3 is an enlarged side view of a portion of the timber;

Fig. 4 is a view similar to Fig. 1 showing a modification;

Fig. 5 shows another modification;

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Fig. 6 is yet another modification;

Fig. 7 is an enlarged perspective view of a portion of the timber shown in Fig. 6;

Fig. 8 is an enlarged side view of a portion of the timber shown in Fig. 6;

Fig. 9 is an enlarged perspective view of a portion of a modified mine timber;

Fig. 10 is a side view of the modification shown in Fig. 9; and

Fig. 11 is a fragmentary view of a section of a mine shaft having mounted therein another modification of a mine timber embodying the present invention.

Generally speaking, the invention comprises a roof or other overhead structure support which bears at its ends in opposing walls, is fully adjustable, and tends to lengthen when the weight to be supported is applied thereto, utilizing the lateral stability of the walls for giving increased security of support. While the invention is described with particular reference to the supporting of the roofs of underground shafts such as mine shafts, it will be appreciated that the invention is also applicable to other uses wherein a maximum of supporting strength is required with a minimum of weight and materials in the supporting elements.

Referring to the drawings where a number of embodiments of the invention are shown, Figs. 1, 4, 5, 6, and 11 show cross-sectional views of a mine shaft A having vertical side walls 10, 11, a floor 12, and a roof 13 to be supported, each with a different roof support or mine timber B positioned therein in supporting relationship with the roof 13. In the embodiments shown, the mine timber B comprises a horizontal roof supporting member or beam 16 positioned transversely of the shaft A and in substantial parallel relationship with the roof 13 and relatively short beam supporting members 18, 19, each articulated at one end to an end of the beam 16 and extending outwardly and downwardly on an angle into artificially made niches 21, 22 in the walls 10, 11 respectively where the entire weight of the roof is borne.

For transferring the weight of the roof structure 13 to the mine timber B, a wooden beam 23 is preferably positioned between the transverse beam 16 and the roof 13 providing a wide bearing area for the material of the roof and a suitable non-frangible material against which means for transferring the weight on the beam 23 to the transverse beam 16 may bear. In the embodiment shown, these means may comprise a jack shaft 24 threadably engaged in the transverse beam 16 at its midpoint, and extending vertically upwardly where it engages the beam 23 through a bearing plate 25 suitably mounted on the upper end of the jack shaft 24 such that the plate 25 remains stationary while the

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jack shaft 24 is screwed into supporting engagement with the beam 23. As shown, a pair of blocks 31, 32 which may be slightly wedge-shaped for facilitating insertion may be positioned intermediate the ends of the supporting member 16 and the ends of the beam 23 for supporting the ends of the beam 23 and relieving some of the weight on the jack shaft at the center of the beam 16. These blocks may be driven into place after the mine timber is otherwise installed and the jack shaft 24 operated so as to transfer the weight on the beam 23 to the supporting member 16 and thence through the supporting members 18, 19 to the walls 10, 11.

In the timber shown, articulation of the members 18, 19 relative to the transverse beam 16 effects a lengthening or shortening of the overall longitudinal length of the timber B and facilitates installation of the same sized timber in mine shafts of different widths. Variations in the over-all vertical height of the timber caused by articulation of the members 18, 19 in compensating for the different widths of the mine shaft may be compensated for by suitable adjustment of the jack shaft 24. In addition, adjustment of the jack shaft 24 provides a compensating means for differences in the height of the niches 21, 22 from the level of the roof 13 or for different thicknesses of supporting beams 23 or blocks 31, 32, or both.

As shown, the outer or lower ends of the members 18, 19 may have their upper or outer surfaces cut on a longitudinally diagonal plane providing a sharp edge on that end of the member for engaging in the niches 21, 22 and transferring the weight of the roof on the timber B to the walls 10, 11. It will be appreciated that this weight can become quite large and impose a considerable supporting burden on all the members, and particularly on the articulated joint between the members 18, 19 and the transverse beam 16. This invention contemplates providing surfaces other than those retaining the members in articulated relationship for bearing this load between the members. In the embodiment of the invention shown, the members 18, 19 are held in articulated assembled relationship with the transverse beam 16 by means of a transverse horizontal pin 34 fixedly mounted in each end of the supporting beam 16 and journaled in suitable holes 35 in the upper or inner end of the supporting members. The pin 34 must of necessity have a diameter somewhat less than the width of the member in which it is mounted or journaled and is not capable of transferring a large amount of weight from the roof supporting member 16 to the depending members 18, 19 due to the relatively small cross-sectional areas which can be brought into engagement to transfer this load, the stress here involved being directly proportional to the load and inversely proportional to the diameter of the pin 34. If the load becomes great enough, the possibility arises that either the pin 34 may shear off or the member in which it is journaled or mounted fail and give way. Accordingly, in the embodiment of the invention shown it is preferred that the pin 34 only retain the members in articulated relationship and that other surfaces of a much larger area be provided for bearing or transferring the load from the supporting member 16 to the depending members 18, 19. Surfaces 38, 39 are provided at each

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end of the roof supporting member 16 against which the surfaces of the articulated ends of the depending members 18, 19 respectively may engage, and the diameter of the hole 35 in which the pin 34 is journaled is made sufficiently greater than the diameter of the pin 34 such that the ends of the depending members 18, 19 may engage their respective surfaces when a load is placed on the roof supporting member 16. It is preferable that the angle between the depending members 18, 19 and the roof supporting member 16 be fully variable so as to compensate for different shaft widths and insure that the surfaces always transmit at least the major proportion of the load. Accordingly, these surfaces are made curved and preferably arcuate with a center of curvature approximately coincident with the axis of the pin 34 whereby the members 18, 19 may be articulated through a maximum swing with the surfaces still bearing the major proportion of the load. Alternatively, a ball and socket joint could be provided, although possibly with a slight sacrifice of the lateral stability from that obtainable with the structure shown.

The articulated joint described facilitates manual articulation of the members while the timber is being installed and enables further articulation even when the timber is under relatively heavy loads. Any weight bearing on the members tends to effect a longitudinal lengthening of the timber, which lengthening is resisted by the body of the material forming the wall and its lateral stability whereby the lateral stability of the wall contributes materially to supporting the timber in position and the roof in place. With the structure shown, the vertical component of the weight of the roof on the timber is directed by virtue of the articulated joint in an angular direction coincident with the axis of the supporting members 18, 19 deep into the walls 10, 11. Any crushing or failure of the walls adjacent the point of insertion of the lower and outermost ends of the members 18, 19 merely serves to make the wall denser at this point and increases its ability to resist the forces on the timber and thus to support the roof 13. While the members 18, 19 may have any relative angle to the horizontal, it is preferred for best results to take advantage of the lateral stability of the walls 10, 11 that this angle be somewhere between 30 to 60°, although it may be more or less.

The members 16, 18, 19 may be formed in any suitable manner to give the maximum amount of strength for a minimum weight of timber. Thus, in the embodiment shown in Fig. 1, the roof supporting member 16 is an I-beam having top and bottom horizontal flanges 40, 41 joined by an intermediate spacing web 42, while the depending members 18, 19 may be formed from an H-beam having vertical flanges 44, 45 and an intermediate transverse web 46. When such structural shapes are utilized to form the members, the web 42 may extend beyond the flanges 40, 41 at each end of the member 16 and provide a central mounting support for the pin 34. The surfaces 38 may be provided by welding or otherwise securing suitable shaped pieces of metal or other material intermediate the flanges 40, 41 and on both sides of the web 42. Similarly, other material may be welded between these flanges and on either side of the web adjacent the middle of the member 16 to provide a suitable threaded support for the jack shaft 24 and, if necessary, to provide increased strength at this point. In

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this embodiment of the invention the beam 16 is relatively long and the depending members 18, 19 relatively short and supported in niches 21, 22 high on the wall so that the timber obstructs a minimum area of the shaft.

In the embodiment of the invention shown in Fig. 4, the roof supporting member 16 is relatively short compared to the transverse width of the shaft A while the depending members 18, 19 are relatively long and engage the walls at points further spaced from the roof than the embodiment shown in Fig. 1. The member 16 may be formed from a block of solid material suitably cut away at the ends to leave central vertical webs 50, 51 in which the pin 34 may be mounted, while the depending members may be formed from an I-beam. Spaced vertical flanges 52, 53 having the enlarged openings 35 for receiving the pin 34 and rounded on their ends for engagement against the arcuate surfaces on the beam 16 are fixed to one end of the I-beams and form the articulating means for the members 18, 19. Stops 54, 55 may be provided on the upper surface of each depending member 18, 19 having a substantially horizontal surface upon which blocks, in this instance vertically elongated, may rest in supporting relationship between the members 18, 19 and the beam 23.

Fig. 5 shows another modification of the invention wherein the beam 16 has been entirely eliminated and the depending members 18, 19 are articulated relative to each other to form the mine timber. In this embodiment of the invention, the articulated end of the member 19 has a central web for mounting the pin 34 and the articulated end of the member 18 has spaced vertical plates or flanges with the openings 35 formed therein for loosely journaling the pin 34. Abutting arcuate surfaces having a center of curvature substantially aligned with the pin 34 for bearing the forces involved independently of the pin 34 are provided as shown in the figure. The members 18, 19 have radial transverse abutments 60, 61 on their upper surface which limit the articulating movement of the members 18, 19 in a downward direction. In a similar manner to the embodiment shown in Fig. 4, the embodiment shown in Fig. 5 has suitable stops midway of the length of the members for receiving the supporting blocks 31, 32, which in this embodiment transfer all the weight of the roof 13 on the beam 23 to the mine timber.

In the embodiment of the invention shown in Fig. 6, the point of articulation of the roof supporting member 16 and the depending members 18, 19 is adjustable longitudinally of the beam 16. As shown, the member 16 is a T-beam with an upper horizontal flange 64 and a depending vertical flange or web 65 having therein adjacent its lower edge a longitudinally extending opening 66 with a plurality of notches 67 extending angularly upwardly therefrom so as to be inclined toward the center line of the member. The depending members 18, 19 are of H-beam construction having vertical flanges 70, 71 and a horizontal web 72 therebetween, the web 72 being cut away at the articulated end to provide clearance for the web 65. In this embodiment the pin 34 is fixedly mounted adjacent the articulated ends of the members 18, 19 in the flanges 70, 71, the ends of which are rounded having a center of curvature approximately aligned with the axis of the pin 34. The roof supporting member 16 has a plurality of longitudinally spaced transversely extending abutments 73 depending

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from the lower surface of the flange 64 on each side of the web 65 and so positioned that when the pin 34 is in any one of the slots 67 the surfaces of the abutments will engage the rounded edges of the flanges 70, 71, thus transmitting the load on the beam 16 to the depending members 18, 19. Adjustment may be effected by disengaging the pin 34 from any notch 67 and sliding it in the longitudinal openings 66 to any other notch desired, a different abutment 73 being provided for each notch. In this embodiment of the invention, the jack shaft 24 is provided on its upper end with a conical surface for engaging the supporting beam 23 and providing a second adjustment.

Fig. 9 shows another modification of the invention wherein the member 16 is in the form of an inverted U-shaped channel having a base 75 and depending flanges or webs 76, 77. Each flange has a longitudinally extending opening 78 adjacent the lower edge similar to the opening 66 in the web 65 and with a plurality of longitudinally spaced upwardly extending slots 79. The member 16 has suitable longitudinally spaced transversely extending abutments between the flanges 76, 77 so positioned that when the pin 34 is positioned in any pair of slots, the rounded end of the member 18 may engage the adjacent abutment, the width and depth of the slots 79 being such that engagement will occur before the pin 34 engages the sides thereof. Thus in the embodiments shown in Figs. 6 to 9, the mine timbers may be placed in position and a point of articulation chosen for the depending members 18, 19 relative to the supporting member 16 such as will facilitate installation of the timber and provide full and safe support for the roof of the shaft.

In the embodiment of the invention shown in Fig. 11, the depending members 18, 19 are made adjustable in length and as shown comprise a base 80 pointed on its lower end for engagement in a niche of the wall 10; a threaded shaft 83 having on its upper end a member 84 for articulation with the supporting member 16, and a collar on the base 80 threadably engaged with the shaft 83, rotation of which either extends or retracts the shaft 83 and adjusts the length of the member 18.

To install the mine timber shown in the figures, the niches 21, 22 are first cut in the walls 10, 11 at a suitable height above the floor 12, which height is not critical. The mine timber is then hoisted substantially into position with the jack shaft 24 screwed down as far as it will go, and the lower ends of the members 18, 19 are positioned in the niches 21, 22. The beam 23 is positioned above the timber and in substantially parallel relationship with the supporting member 16. The supporting member 16 is then moved longitudinally so as to position it as closely as possible to the transverse center of the shaft A, and the jack shaft 24 is screwed upwardly until it forces the beam 23 into firm engagement with the roof 13 of the shaft A, at which time the mine timber is properly in position. When so installed the friction between the plate 25 and the beam 23 prevents further longitudinal movement of the supporting member 16 and holds the mine timber securely in position. The blocks 31, 32 may then be installed. Any weight exerted on the supporting member 16 as a result of the roof 13 of the shaft A sagging will be transmitted to the depending members 18, 19 through a surface of substantial bearing area and thence

to the relatively firm and substantial side walls 10, 11 at an angle such that a substantial component of the weight attempts to push the side walls 10, 11 laterally. This lateral component, which may be otherwise described as a tendency for the timber to lengthen longitudinally, is resisted by the lateral stability of the side walls whereby the timber may take advantage of this stability for producing a support which is structurally capable of preventing the disastrous cave-ins so common in mine shafts.

Thus it will be seen that the invention described accomplishes the objects thereof and provides a mine timber which is simply installed, adjustable to mine shafts of different widths, and which tends to lengthen as a result of bearing a weight whereby the lateral stability of the walls of the mine shaft may be utilized for aiding in the support of the roof.

It will be appreciated that modifications and alterations differing materially in appearance and structure will occur to others skilled in the art upon a reading and understanding of this specification, and it is my intention to cover all such modifications and alterations insofar as they are within the scope of the appended claims.

Having thus described my invention, I claim:

1. A mine timber adapted to be positioned in a mine shaft to transmit the load of the roof to the side walls thereof, the said timber comprising a plurality of elongated members loosely pivotally connected together with the free ends of said timber being adapted to be received in niches in opposite side walls of the shaft, the over-all length of said timber being greater than the width of the shaft so that the members of said timber whose ends are received in said niches extend angularly inwardly and upwardly with respect to the side walls of the shaft when the timber is in place therein, the pivotal connection of adjacent members including a pivot pin mounted in one of the members and received in an enlarged opening in the other of the members, and complementary surfaces on each of said members adjacent the pivotal connection therebetween adapted to interengage when the load of the roof of said shaft is applied to said timber, the said interengagement occurring before the pivot pin engages the side wall of the cooperating enlarged opening so that the said load is transmitted to the side walls of the shaft through the said complementary surfaces with substantially none of the load being transmitted through the pivot pin.

2. A mine timber as defined in claim 1 and in which the said complementary surfaces are arcuate whereby variations in the angularity between said members does not interfere with the interengagement of said surfaces for the transmission of load therethrough.

3. A mine timber adapted to be positioned in a mine shaft to transmit the load of the roof to the side walls thereof, the said timber comprising a first member adapted to extend substantially parallel with the roof of said shaft, a pair of spaced members the lower ends of which are adapted to be respectively received in niches formed in the opposite side walls of the shaft, means loosely pivotally connecting the other ends of said pair of members to said first-mentioned member adjacent opposite ends of the latter, the said pivotal connections being so located that the said pair of members extend angularly inwardly and upwardly with respect to the side walls of the shaft when the timber is in

place therein, and complementary surfaces on each of said members adjacent their pivotal connections adapted to interengage when the load of the roof of the shaft is applied to said first-mentioned member and effect transmission of that load to said pair of members thereby substantially relieving the pivotal connections of said load.

4. A mine timber as defined in claim 3 and in which the said complementary surfaces are arcuate whereby variations in the angularity between said members does not interfere with the interengagement of said surfaces for the transmission of load therethrough.

5. A mine timber as defined in claim 3 and further comprising means carried by said first-mentioned member and vertically adjustable relative thereto to effect engagement with the roof of the shaft in which the timber is positioned and to transmit at least a part of the load of the latter to said timber.

6. A mine timber as defined in claim 3 and further comprising a jack screw cooperating with a threaded opening in the first-mentioned member intermediate the ends of the latter, the said jack screw having its axis substantially vertical when the timber is in place in a mine shaft and being adjustable relative to the first-mentioned member to effect engagement with the roof of the shaft and transmit at least a part of the load of the latter to said timber.

7. A mine timber as defined in claim 3 and in which at least one of said pair of members includes means for adjusting the length thereof.

8. A mine timber as defined in claim 3 and further comprising means for varying the lengths of said pair of members.

9. A mine timber adapted to be positioned in a mine shaft to transmit the load of the roof to the side walls thereof, the said timber comprising a first member adapted to extend substantially parallel with the roof of said shaft, a pair of spaced members the lower ends of which are adapted to be received in niches formed in the opposite side walls of the shaft, means loosely pivotally connecting the other ends of said pair of members to said first-mentioned member adjacent opposite ends of the latter, the combined length of said members being greater than the width of the shaft and the distance between the pivotal connections being less than the width of the shaft so that the said pair of members extend angularly inwardly and upwardly with respect to the side walls of the shaft when the timber is in place therein, and complementary surfaces on each of said members adjacent their pivotal connections adapted to interengage when the load of the roof of the shaft is applied to said first-mentioned member and to effect transmission of that load to said pair of members thereby substantially relieving the pivotal connections of said load.

10. A mine timber adapted to be positioned in a mine shaft to transmit the load of the roof to the side walls thereof, the said timber comprising a first member adapted to extend substantially parallel with the roof of said shaft, a pair of spaced members the lower ends of which are adapted to be received in niches formed in the opposite side walls of the shaft, means loosely pivotally connecting the other ends of said pair of members to said first-mentioned member adjacent opposite ends of the latter, the said means each including a pivot pin mounted in one of said members and received in an enlarged opening in the adjacent member, the said pivotal connec-

tions being so located that the said pair of members extend angularly upwardly and inwardly with respect to the side walls of the shaft when the timber is in place therein, and complementary surfaces on each of said members adjacent their pivotal connections adapted to interengage when the load of the roof of said shaft is applied to the first-mentioned member, the said interengagement occurring before the corresponding pivot pin engages the side wall of the cooperating enlarged opening so that the said load is transmitted from the first-mentioned member through the complementary surfaces and the said pair of members to the side walls of the shaft and substantially none of the load is transmitted through the said pivot pins.

11. A mine timber adapted to be positioned in a mine shaft to transmit the load of the roof to the side walls thereof, the said timber comprising a first member adapted to extend substantially parallel with the roof of said shaft, a pair of spaced members the lower ends of which are adapted to be received in niches formed in the opposite side walls of the shaft, means loosely pivotally connecting the other ends of said pair of members to said first-mentioned member adjacent opposite ends of the latter, the combined lengths of said members being greater than the width of the shaft and the distance between the pivotal connections being less than the width of the shaft so that the said pair of members extend angularly upwardly and inwardly with respect to the side walls of the shaft when the timber is in place therein, the said means each including a pivot pin mounted in one of said members and received in an enlarged opening in the adjacent member, and complementary surfaces on each of said members adjacent their pivotal connections adapted to interengage when the load of the roof of said shaft is applied to the first-mentioned member, the said interengagement occurring before the corresponding pivot pin engages the side wall of the cooperating enlarged opening so that the said load is transmitted from the first-mentioned member through the complementary surfaces and the said pair of members to the side walls of the shaft and substantially none of the load is transmitted through the said pivot pins.

12. A mine timber adapted to be positioned in a mine shaft to transmit the load of the roof to the side walls thereof, the said timber comprising a first member adapted to extend substantially parallel with the roof of said shaft, a pair of spaced members the lower ends of which are adapted to be respectively received in niches formed in the opposite side walls of the shaft, means loosely pivotally connecting the other ends of said pair of members to said first-mentioned member adjacent opposite ends of the latter, means to adjust the over-all length of said timber, the said pivotal connections being so located and the length of said timber being so adjusted that the said pair of members extend angularly inwardly and upwardly with respect to the side walls of the shaft when the timber is in place therein, and complementary surfaces on each of said members adjacent their pivotal connections adapted to interengage when the load of the roof of the shaft is applied to said first-mentioned member and effect transmission of that load to said pair of members thereby substantially relieving the pivotal connections of said load.

13. A mine timber adapted to be positioned in a mine shaft to transmit the load of the roof

to the side walls thereof, the said timber comprising a first member adapted to extend substantially parallel with the roof of said shaft, the said member having a pair of spaced elongated longitudinally extending openings therein with each opening having spaced recesses extending obliquely therefrom, a pair of spaced members the lower ends of which are adapted to be respectively received in niches formed in the opposite walls of the shaft, a separate pivot pin carried by the other end of each of said pair of members with each pivot pin received in one of the slots of said first-mentioned member and adapted to selectively enter the said recesses so that the said pair of members extend angularly inwardly and upwardly with respect to the side walls of the shaft when the timber is in place therein, the first-mentioned member having surfaces adjacent each of said recesses which are complementary with surfaces provided on the said other ends of said pair of members, the said complementary surfaces being adapted to interengage before the said pivot pins have contacted the ends of said recesses whereby the load of the roof of said shaft is transmitted through said complementary surfaces and said pair of members to the side walls of said shaft.

14. A mine timber adapted to be positioned in a mine shaft to transmit the load of the roof to the side walls thereof, the said timber comprising a pair of members loosely pivotally connected together with the free ends of said timber being adapted to be received in niches in the opposite side walls of the shaft, the over-all length of said timber being greater than the width of the shaft so that the said members extend angularly inwardly and upwardly with respect to the side walls of the shaft when the timber is in place therein, the pivotal connection of said members including a pivot pin mounted in one of the members and received in an enlarged opening in the other of the members, and complementary surfaces on said members adjacent their pivotal connection adapted to interengage when the load of the roof of said shaft is applied to said timber, the said interengagement occurring before the pivot pin engages the side wall of the enlarged opening so that the said load is transmitted to the side walls of the shaft through the said complementary surfaces with substantially none of the load being transmitted through the pivot pin.

15. A mine timber as defined in claim 14 and further comprising means on each of said members adapted to provide a seat for the lower end of a thrust member interposed between a member of the timber and the roof of said shaft.

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