July 21, 1942. R. JOHNSON 2,290,824

COAL BREAKING MACHINE

Filed Sept. 17, 1940 2 Sheets-Sheet 1

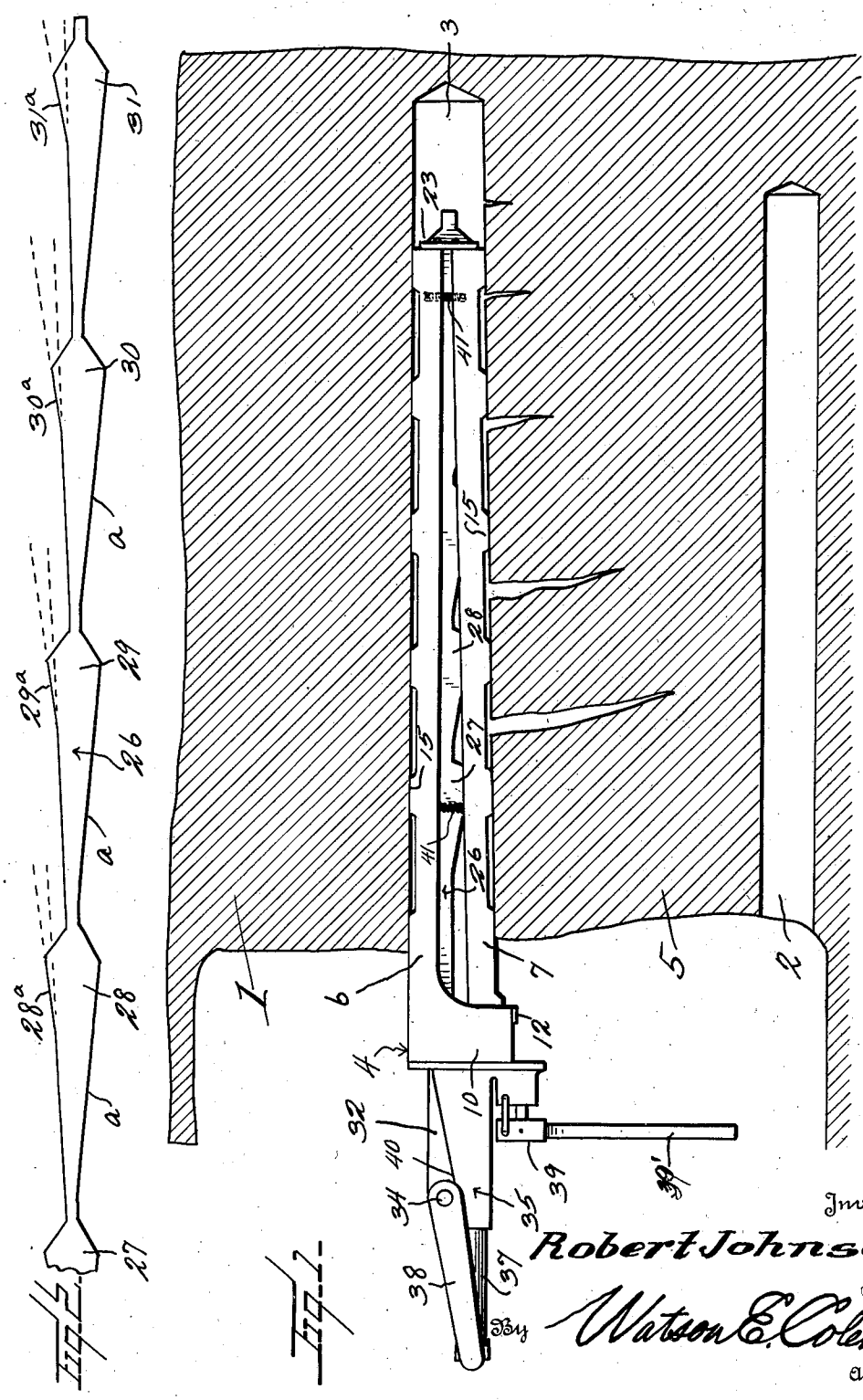


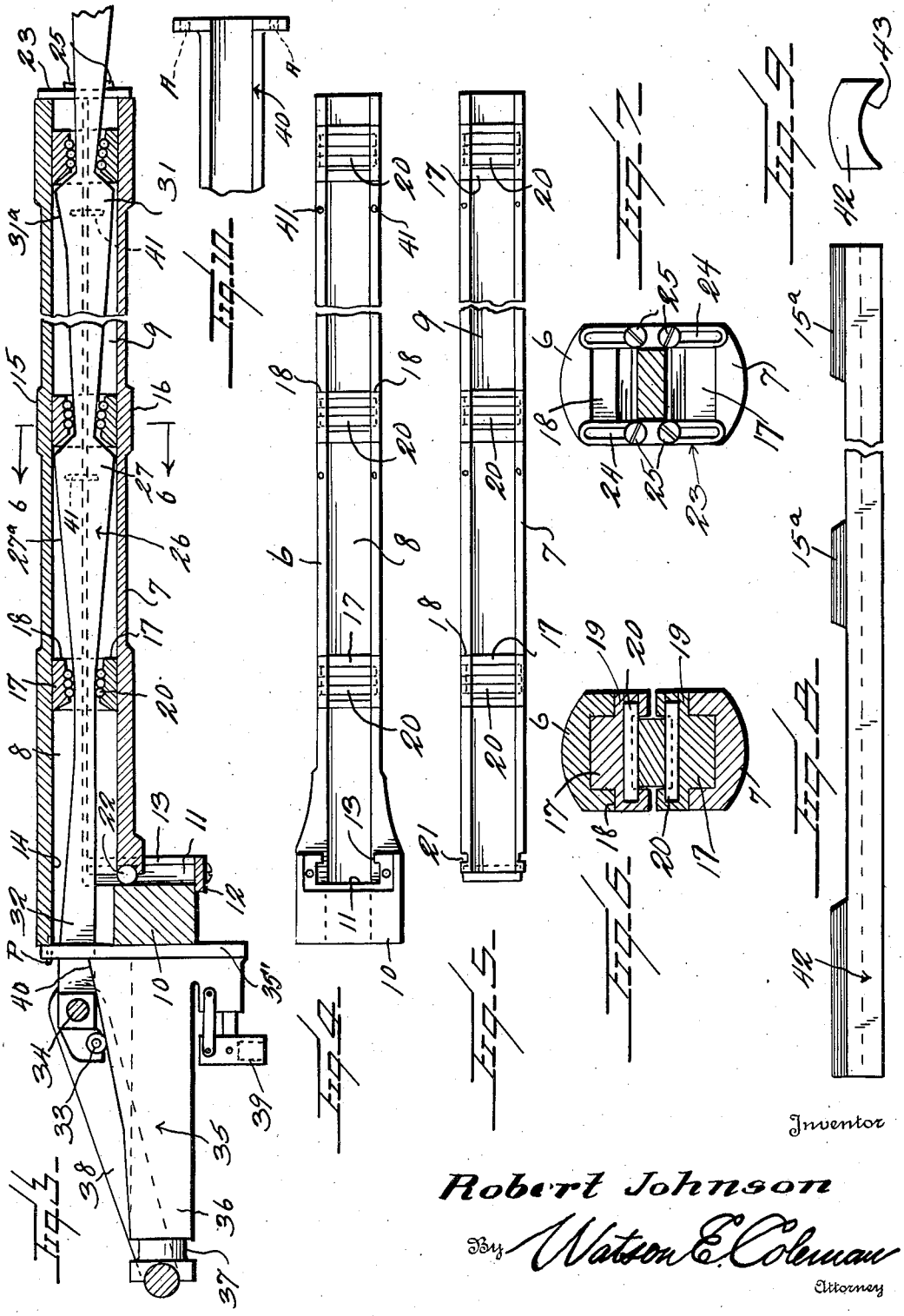
Fig. 1

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Patented July 21, 1942 2,290,824

UNITED STATES PATENT OFFICE

2,290,824

COAL BREAKING MACHINE

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Application September 17, 1940, Serial No. 357,171

5 Claims. (Cl. 262—12)

This invention has to do with implements or devices used in coal mining and pertains particularly to a device designed for employment in breaking out bodies of coal which have been undercut.

In the operation of mining coal, the procedure is sometimes followed of cutting into the lower part of a bed or seam of coal and then applying pressure to the upper part of such bed at some selected position above the undercut so as to force the body of coal downwardly and thereby crack or break out the mass which can be removed in large lumps. Different means are at present employed for applying the desired pressure to the undercut body or block of coal and in some cases, the use of explosives is resorted to to remove desired masses. The use of explosives is extremely dangerous in addition to adding to the expense of mining, therefore, the use of mechanical means for breaking out the coal body is preferred, however, the devices which are at present employed for breaking out a mass of undercut coal are not particularly efficient in operation due to the fact that they are not designed to start the fracture of the coal body at the proper points as a result of which greater resistance is offered by the coal body to breaking and considerable more power is required to accomplish the desired results than is necessary.

The present invention has for its primary object to provide a coal breaker which is so designed that the pressure which is applied to the coal body is applied progressively from the front of the undercut mass toward the rear, with the result that the mass is broken down quickly and with a minimum consumption of power.

Another object is to provide a coal breaker, comprising an elongated two-part body with means interposed between the parts of the body for forcing such parts away from one another so as to accomplish the desired action of applying the necessary strain to a mass of coal to crack or break the mass to facilitate its easy removal from the bed, the said means employed for separating the parts of the body being so designed that the separation occurs progressively from one end of the body to the other rather than uniformly between the parts.

A still further object is to provide a coal breaking device of the character stated which is of unitary construction in that the power unit employed for effecting the forced separation of the parts of the body constitutes an integral part of the body structure, therefore, the entire breaker device may be easily shifted from place to place and mounted in position in bores formed in the coal bed with a minimum of effort.

Still another object is to provide a coal breaker of the character stated, wherein the two parts in which the main body portion of the device is formed are so designed that they will contact the coal bed at spaced points through which the desired pressure is transmitted to the bed to more effectively crack or break the undercut coal mass into individual sections.

The invention will be best understood from a consideration of the following detailed description taken in connection with the accompanying drawings forming part of this specification, with the understanding, however, that the invention is not to be confined to any strict conformity with the showing of the drawings but may be changed or modified so long as such changes or modifications mark no material departure from the salient features of the invention as expressed in the appended claims.

In the drawings:

Fig. 1 is a view of the device embodying the present invention, showing the same in side elevation and in operating position within a body of coal.

Fig. 2 is a view in side elevation of the expander bar.

Fig. 3 is a longitudinal sectional view of the breaker device with a portion of the same broken away.

Fig. 4 is a view looking at the inner side of the top shell.

Fig. 5 is a view looking at the inner side of the bottom shell.

Fig. 6 is a sectional view on the line 6—6 of Fig. 3.

Fig. 7 is a view in end elevation of the breaker device.

Fig. 8 is a side elevation of the fill out member.

Fig. 9 is a view in end elevation of the fill out member.

Fig. 10 is a fragmentary top plan view of the rear portion of the jack structure showing the supporting tracks or flanges for the breaker bar.

Referring now more particularly to the drawings, Fig. 1 illustrates a device in operative position in an undercut body of coal, such body being generally indicated by the numeral 1 and the undercut formed therein being indicated at 2. At a suitable distance above the undercut 2, the seam or mass of coal is provided with the bore 3 for the reception of the breaker device embodying the present invention. This breaker device

is indicated as a whole by the numeral 4 and when it has been put into operation, it causes the mass of coal lying between the undercut 2 and the bore 3 and indicated by the numeral 5, to crack vertically along spaced lines so as to reduce the mass to lumps which may be readily removed from the seam.

The breaker device 4 consists of a relatively long body which is longitudinally divided into the upper and lower shell sections 6 and 7, respectively. These shell sections are externally of circular or arcuate cross-sectional design and each is interiorly longitudinally channeled, as indicated by the numerals 8 and 9. The breaker body, when assembled, has the two sections 6 and 7 disposed in longitudinal alinement with the open or channeled sides thereof in opposed relation.

The upper shell body at one end is enlarged to form a transversely extending head portion 10 and the inner side of this head portion has a recess 11 formed therein which opens through the rear side of the head and through the laterally directed face and also into the channel 8. The outer end of this recess 11 is covered or closed by the plate 12 which functions in the manner hereinafter more fully described, to assist in maintaining the shells in assembled relation. The opposite longitudinal faces of the channel 11 have guide ribs 13 formed therealong which cooperate with the movable shell portion 7 to maintain the latter in working position.

The channel 8 of the shell 6 extends in the form of a passage 14 through the head 10.

The outer transversely curved surfaces of the two shells 6 and 7 are formed to provide the transverse break shoulders 15 and 16, respectively, for the two shell portions 6 and 7. These shoulders provide the pressure transmitting parts through which desired pressure is applied to the encircling body of coal when the breaker is placed in the bore 3, so as to bring about the cracking of the mass 5 which lies below the breaker, along spaced lines, thus resulting in breaking up the mass into a number of pieces.

At spaced intervals the channels 8 and 9 of the shells have roller supporting webs 17 formed thereacross and the sides of the shells adjacent these webs are cut out to form recesses 18 in which are positioned blocks 19 which have rotatably set or mounted therein the ends of rollers 20. Thus a roller assembly consists of two blocks 19 and the group of rollers mounted between the blocks and when these blocks are placed in opposite recesses 18 of a shell, the rollers extend transversely of the shell along and bear against the adjacent roller supporting web 17 in the manner illustrated. There are thus provided in each shell a number or series of groups of transversely extending rollers and the groups of rollers of one shell are parallel with and in opposed relation with corresponding groups of rollers of the other shell.

The shell 7 at one end is provided with transversely extending guide grooves 21 which are arranged upon opposite sides of the shell and which are formed to receive the guide ribs 13 of the head 10, which is carried by the main or stationary shell 6. Mounted across that end of the shell 7 adjacent which the grooves 21 are formed is a bearing roller 22 which bears against the inner surface of the channel 11, thus facilitating the movement of the shell 7 relatively to the shell 6, the ribs 13 functioning to guide the movable shell and maintain it in the desired coupled relation with the fixed shell. The ends of the shells remote from the head 10 are flush one with the other and these ends are connected together by a pair of coupling frames 23 which position against the ends of the shells at opposite sides of the passages therethrough and to extend across the space between the shells, the space between the frames permitting the hereinafter described expander to extend beyond the rear ends of the shells. These frames are each provided with the alined guide slots 24 and there extends through each of these slots a pin 25 secured in the adjacent shell end and having a head which covers the outer side of the slot, the frames thus coupling the two shells together.

It will be readily apparent that in the assembling of the shells 6 and 7, the keeper plate 12 must be taken off so that the slotted end of the movable shell 7, carrying the bearing roller 22, may be inserted into the channel 11, and after this assembly has been accomplished, the plate 12 is replaced and will function to keep the shells from separating.

Extending longitudinally through the breaker between the shell portions 6 and 7 of the body thereof is an expander bar, which is indicated generally by the numeral 26. This bar is shaped to provide a series of relatively long camming wedges which are separately designated by the numerals 27, 28, 29, 30 and 31, and which are strung together in a line, the narrow end of one wedge being directly joined to the wider or head end of an adjacent wedge. These wedges correspond in number with the number of oppositely disposed or opposing pairs of roller groups carried by the two shells, and when the shells are in their closest relation, the constricted or narrower end of each cam wedge will be between a pair of opposed roller groups.

The expander bar at one end is extended to provide the pull arm 32 which passes through the passage 14 and beyond the adjacent face of the head 10 and this extended end of the arm is provided with a roller 33 upon both side faces and a removable transversely extending pull pin 34 by means of which the expander rod is coupled with the power unit, hereinafter described, which effects the reciprocal movement of the rod for the operation of the breaker.

The cam wedges upon one side of the breaker rod have the roller contacting surfaces or faces all at the same angular disposition with respect to the longitudinal center of the rod, these faces being upon the underside of the rod so as to bear against the movable shell 7 and all being designated by the character *a*. The opposite or upper bearing faces of the camming wedges have progressively varying angles or inclinations with respect to the longitudinal center of the rod. The upper bearing surface or face for the wedge 27 is indicated by the numeral 27ª and is relatively long and of a constant degree of inclination throughout its length while the upper bearing surface of the next wedge 28 has a portion at the rear or wider end of the cam at a slightly greater angle of inclination to the longitudinal center of the rod, as indicated at 28ª. The upper surfaces of the following wedges 29, 30 and 31 have the portions 29ª, 30ª and 31ª of constantly or progressively increasing angularity with respect to the longitudinal center of the rod, but it will be noted that following the wedge surface 27ª, the other surfaces from 28ª to 31ª are short and all are at the rear or wider ends of their respective cam wedges with the result that when the rod is pulled

forwardly between the shells, the long wedging surface 28a will come into operation to force the forward or outer ends of the shells apart before the succeeding surfaces 28a, 29a, etc. begin to force apart the opposing roller units between which they are located. Consequently the separation of the shells 6 and 7 will not be uniform from end to end at the starting of the movement of the expander rod forwardly, but will be progressive from the forward end of the breaker to the rear end. Because of this, it will be readily seen that the undercut body 5 will first be forced downwardly at its outer side or near the outer part thereof, so that the breaking of the undercut body will progress from the outer side to the inner side and the breaking operation can be effected more rapidly and with a minimum expenditure of power.

Actuation of the expander rod is accomplished by the employment of a power unit here indicated as a whole by the numeral 35 which is in the form of a hydraulic jack having a base portion 35' which is placed against the forward side of the head 10. The base is provided with a pair of apertures A which receive supporting pins P, which are secured in the head 10 and extend forwardly therefrom, as shown in Fig. 3. This jack unit is of a standard construction and in itself forms no part of the present invention. It is shown as having a cylinder 36 from one end of which a ram 37 extends which is pivotally coupled with an end of a yoke 38, the other end of the yoke being pivotally connected by means of the pin 34 with the adjacent end of the expander rod.

The numeral 39 indicates a conventional pump means for actuating the jack ram, which includes a removable handle or lever 39'. Since the jack is of standard construction and in itself forms no part of the invention, no description or illustration of the details of construction thereof are given or considered necessary.

The cylinder portion 36 of the jack has extending longitudinally thereof a pair of spaced guide or track ribs between which the forward end of the expander rod works and upon which ride the rollers 33 which are carried by the expander rod.

In order that the shells forming the body portion of the breaker may be caused to return to their normal positions or, in other words, that the body may be caused to contract to its minimum diameter when the expander is shifted inwardly through the body, there are employed coupling springs 41 which connect the shells together and which are expanded or stretched when the shells are forced apart. By this means, the shells will always be drawn back together when the expander rod is returned to its inoperative or non-working position.

In order to extend the action of the breaker in places where it may occur that one operation or expansion of the breaker is insufficient to break down the undercut body of coal, there is provided a filler unit which is indicated generally by the numeral 42 and which comprises an elongated body having arcuate inner and outer longitudinal surfaces. This body has the transversely curved or arcuate inner surface 43 formed to receive the top of the upper or stationary shell 6 so that the body may saddle on this shell and the outer surface of the filler body 42 is also transversely curved as stated, and is provided with transverse shoulders 15a which function in the same manner as the shoulders 15 of the shell 6.

From the foregoing, it will be readily seen that with the breaker device of the present invention, a means is provided whereby the breaking down of undercut bodies of coal in a seam or bed may be easily and quickly accomplished primarily, because of the fact that the breaker is designed to separate the two shell portions thereof progressively from the outer to the inner ends rather than uniformly in one movement as is the case in coal breakers of other types. Also because of the provision of the break shoulders upon the two shell portions, the pressure is concentrated at certain points or locations so that the cracking and breaking of the undercut body of coal is accomplished more easily than would be the case if the shell bodies contacted the coal body throughout the length of their outer surfaces.

What is claimed is:

1. A coal breaker of the character described, comprising an elongated body formed of two channeled portions disposed with the channels in opposed relation, means coupling said portions and limiting their separatory movement, a laterally extending head fixed to one of said portions at one end of the same, said head having a slot extending transversely of the body, the other portion having sliding connection at one end in said slot, resilient means normally urging said portions together, a series of members within and extending transversely of the channel of each of said body portions and having blocks engaging in recesses in the sides of the channel, a bearing element carried by each member, the bearing element of one portion being opposed to the bearing element of the other portion, an expander bar extending longitudinally between the body portions and between the opposed bearing elements, said bar being formed to provide a series of elongated tapering sections forming camming wedges all having their tapered ends directed toward one end of the bar, each of said camming wedges being arranged to move between a pair of opposed bearing elements when the bar is longitudinally shifted in one direction, and said camming wedges in the order of their arrangement longitudinally of the bar being provided with bearing surfaces of progressively increasing angularity with respect to the longitudinal center of the bar.

2. A coal breaker of the character described, comprising an elongated body formed of two channeled portions disposed with the channels in opposed relation, means coupling said portions and limiting their separatory movement, a laterally extending head fixed to one of said portions at one end of the same, said head having a slot extending transversely of the body, the other portion having sliding connection at one end in said slot, resilient means normally urging said portions together, a series of thrust receiving members disposed in the channel of each of said body portions and transversely of the same, the thrust members of one portion being opposed to the thrust members of the other portion, an expander bar extending longitudinally between the body portions and lying in the channels thereof, and between the opposed thrust members, said bar being formed to provide a series of tapering sections forming elongated camming wedges all having their tapered ends directed toward one end of the bar, each of said camming wedges being arranged to move between a pair of opposed thrust members when the bar is longitudinally shifted in one direction, and said camming wedges in the order of their arrangement longitudinally of the bar being provided with bearing surfaces of progressively increasing angularity

with respect to the longitudinal center of the bar.

3. A coal breaker of the character described, comprising a pair of elongated channel members disposed in parallel relation with the channel sides opposed, means coupling said members permitting limited separatory movement, means in each channel forming a thrust bearing, the bearings of one channel being directly opposite the bearings of the other channel and a bar member extending longitudinally between the channel members and lying in the channels and formed to provide a plurality of end to end elongated wedges each having opposite faces inclined with respect to the longitudinal center of the bar for engagement with opposite thrust bearings, the angles of the faces of one wedge being different from the angles of the faces of each of the other wedges to obtain a progressive separation of the channel members from one end of the same to the other upon longitudinal movement of the bar in one direction, one of the angled faces of each wedge being more sharply angled through a portion of its length from the wider end of the wedge than the remaining portion thereof.

4. A coal breaker comprising a pair of elongated channel members disposed in parallel relation with the channels opposed, means at one end of one member forming an integral laterally extending head extending across the adjacent end of the other member, said head having a recess to receive the said one end of the other member, said recess having opposed guide slots extending in a direction transversely of the members, a pair of bearing elements carried by the said one end of the other member and engaging in the guide slots, means coupling the channel members together at the ends remote from the head, said last means and the bearing elements and slots permitting limited separatory movement of the members, a plurality of thrust bearings extending transversely within each channel, the thrust bearings of one channel being opposite those in the other channel, a bar extending longitudinally between and lying in the channels, said bar being formed to provide a plurality of wedging members lying between the opposed thrust bearings, and means supported upon said head and operatively coupled with the adjacent end of the bar for effecting longitudinal movements of the bar.

5. A coal breaker as set forth in claim 4 in which said last means comprising a jack secured to said head and having a reciprocal element and a yoke pivotally coupled at one end of the said end of the bar and connected at its other end with said reciprocal element.

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