

June 8, 1954

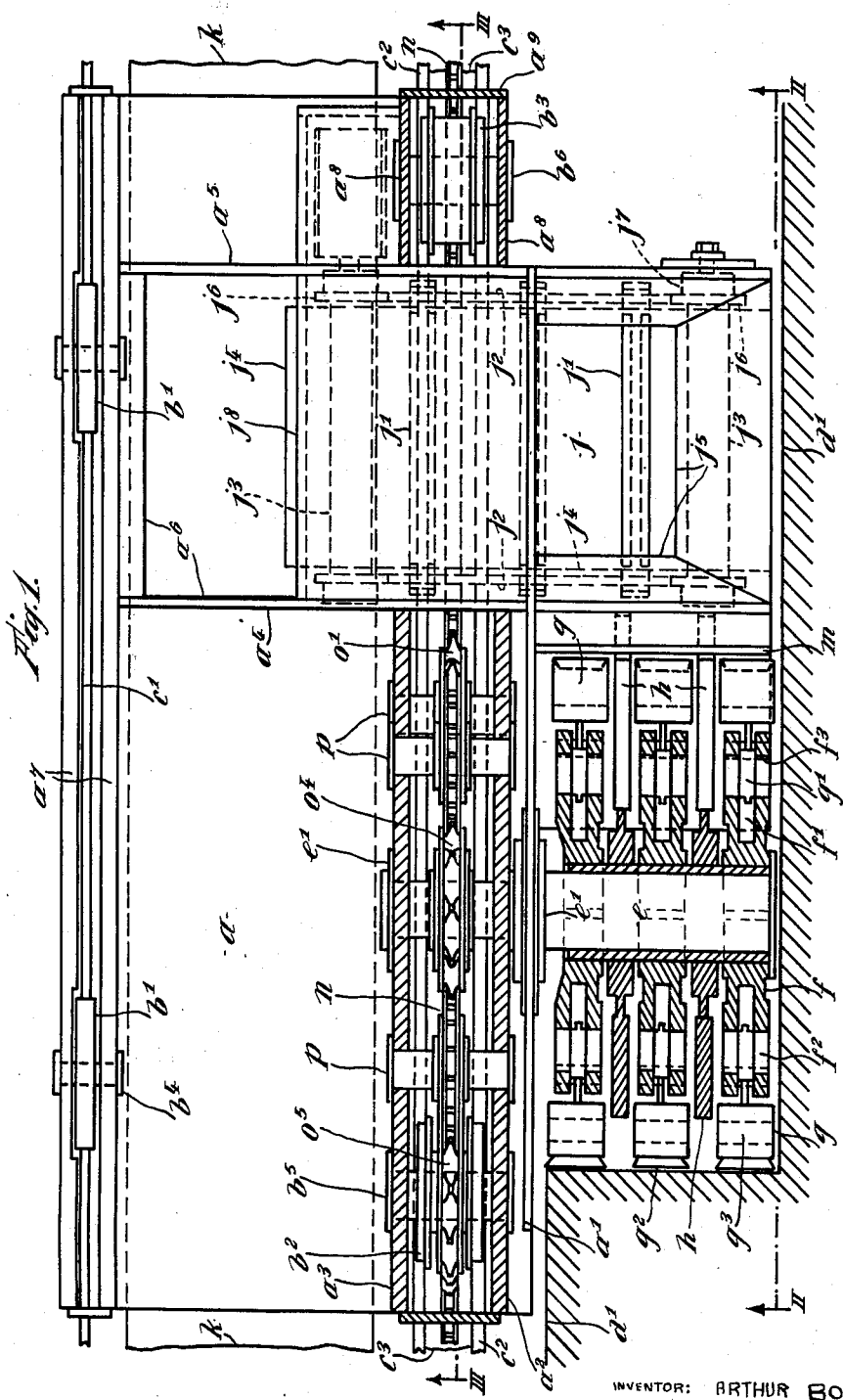
A. BOLTON

2,680,606

IMPACT MACHINE FOR THE MINING OF COAL

Filed June 7, 1948

3 Sheets-Sheet 1



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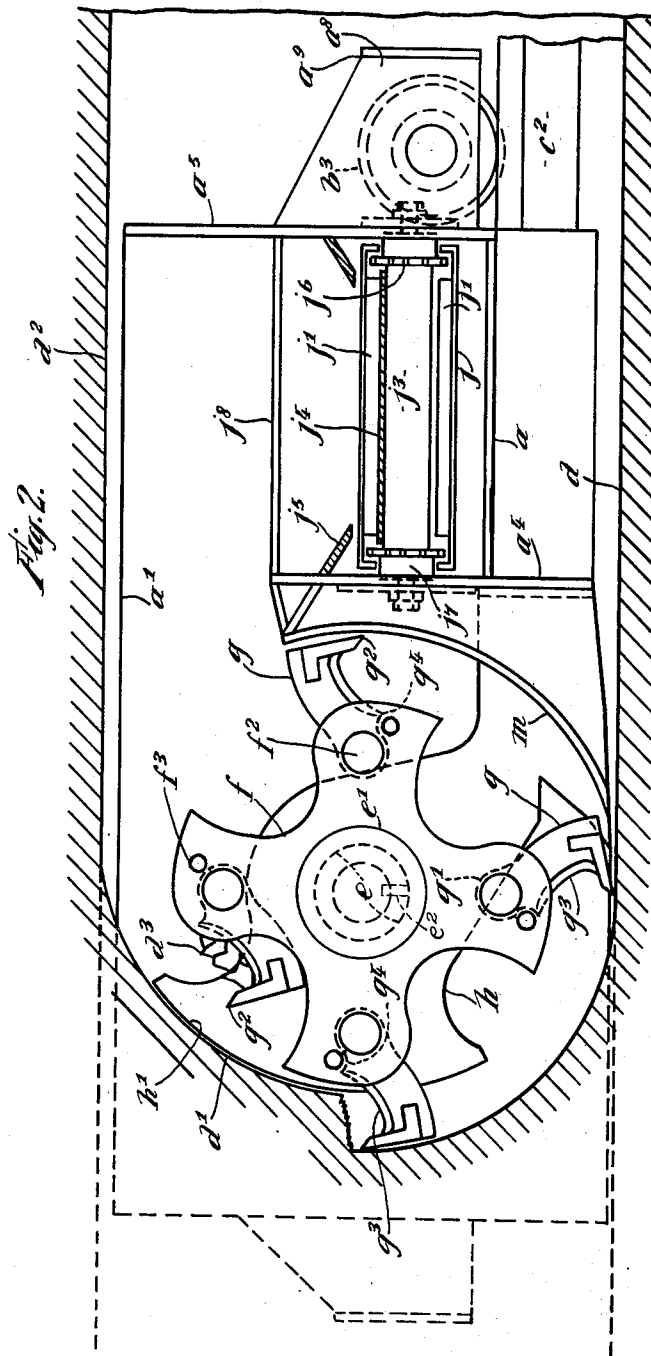
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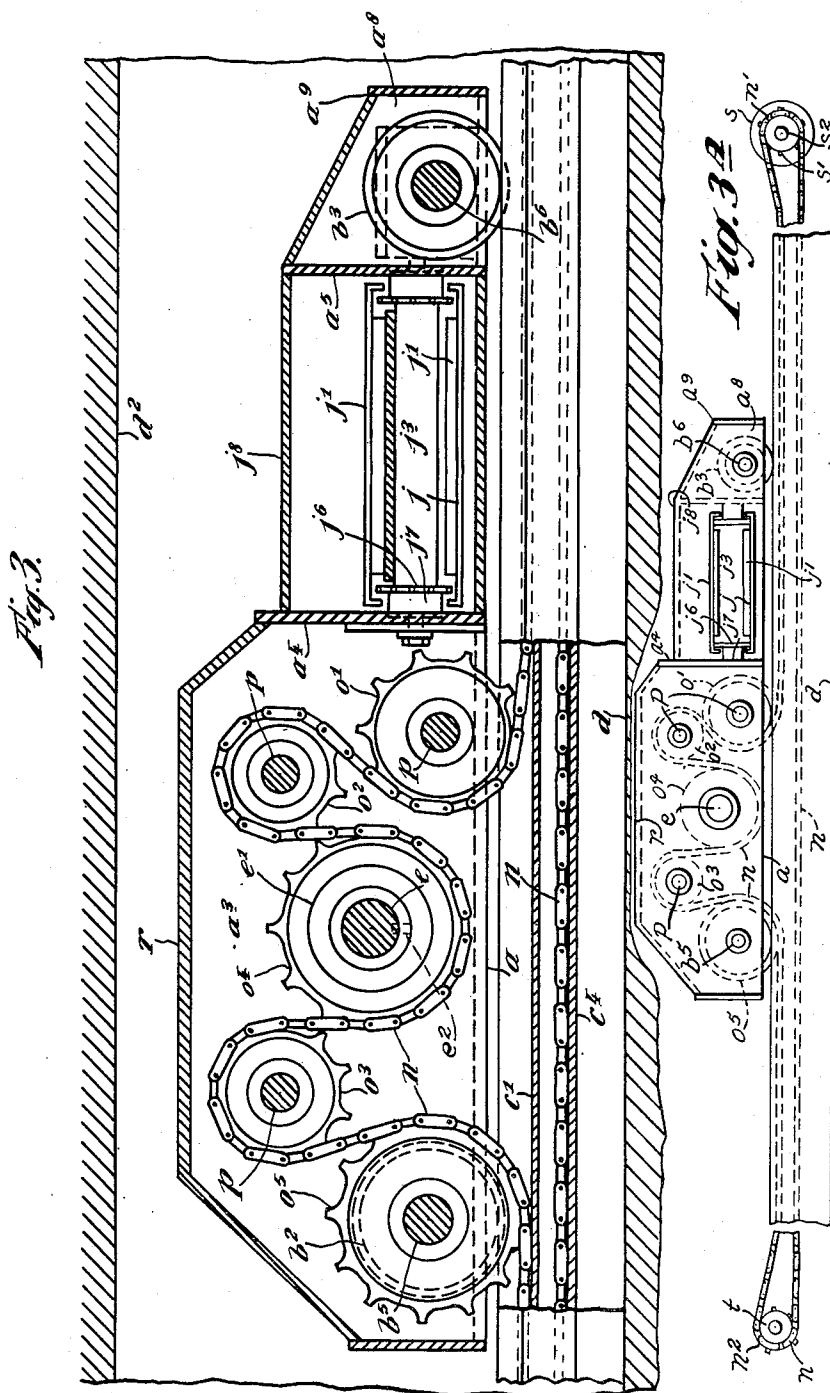
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IMPACT MACHINE FOR THE MINING OF COAL

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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

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IMPACT MACHINE FOR THE MINING
OF COAL

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Application July 7, 1948, Serial No. 37,343

Claims priority, application Great Britain
July 9, 1947

2 Claims. (Cl. 262—14)

1

This invention relates to machines for the mining of coal and the like, and has for its object to provide an improved machine capable of cutting and breaking down coal or the like as it is travelled along and discharging the cut material onto a conveyor or chute. A further object of the invention is to provide percussive cutting means actuated by centrifugal force produced by a rotary shaft, and to employ said cutting means for ejecting the cut material.

With these and other objects in view, my invention consists of the novel features of construction herein described and illustrated and specifically set out in the appended claims.

The accompanying drawings show one construction of coal mining machine in accordance with this invention. In the drawings:

Fig. 1 is a partly sectional plan view of the machine proper, showing the same without its operating motor;

Figs. 2 and 3 are side elevations partly in section respectively on the lines II—II and III—III of Fig. 1; and

Fig. 3A is a view similar to Fig. 3, but showing the complete machine on a smaller scale and illustrating the connection of the driving chain with the motor and idle sprocket respectively at opposite ends of the machine.

Referring to the drawings, in the example therein illustrated, the machine comprises a wheeled carriage *a* constructed of steel plating welded together and mounted on wheels *b*¹, *b*², *b*³ on which it can be travelled on the rails *c*¹, *c*² of a track laid on the floor *d* of a mine gallery along the coal face which is indicated at *d*¹. A horizontal transverse shaft *e* is supported in bearings *e*¹ in parallel upright plates *a*¹, *a*², *a*³ fixed lengthwise of the carriage *a*. One end of the shaft *e* projects beyond the plate *a*¹ and has keyed on it by keys *e*² a number of cruciform hubs *f* each of which has a deep peripheral recess *f*¹ bridged by four pins *f*² spaced 90° apart forming the pivots for the shanks *g*¹ of a series of percussive picks *g*. Each pick is provided with a detachable cutting edge *g*² and a scoop-shaped head *g*³, its shank being provided on one side with a shoulder *g*⁴ co-acting with a stop pin *f*³ on the hub adjacent to each pivot pin *f*². The cutting edges *g*² are interchangeable to facilitate sharpening and re-setting. Stationary stop plates *h* having arcuate frontal edges *h*¹ are interposed between the hubs *f*, the rear ends of said plates being attached to the lower projecting portion of a transverse vertical plate *a*⁴ fixed on the carriage *a*.

2

Although shown in alignment in Figs. 1 and 2 for clearness, the hubs *f* are preferably angularly displaced regularly around the shaft *e* so that the picks of the series come into operation in succession.

In operation, the shaft *e* is revolved at say 200 revs. per minute, and the resulting centrifugal force causes the picks *g* to swing outwards from the axis of the shaft, their outward swing being limited by the stop pins *f*³ to a predetermined maximum radius. As the picks travel around the shaft, their cutting edges *g*² strike the coal face in succession and cut therein to detach an arcuate layer therefrom. The shaft *e* is rotated in clockwise direction, the picks thus cutting upwards from the bottom of the coal seam. The effective arc described by the picks extends the full thickness of the seam from the floor *d* to the roof *d*² of the gallery. The depth of the cut in the direction of the travel of the machine along the face is relatively light, say three to six inches. This depth is controlled by setting back the frontal edges of the stop plates *h* to correspond. The depth of the cut into the face is determined by the width of the picks *g* multiplied by the number of hubs *f* provided on the shaft *e* plus clearances and the width of the stop plates *h* between the hubs.

The impact of the cutting edges *g*² of the picks on the coal face causes each pick in turn to recoil about its pivot pin *f*² to a minimum radius wherein it lies against its hub *f* and clears the uncut coal face. Coal indicated at *d*³ cut from the face is received in and carried by the scoop-shaped pick heads, the collection of the cut coal being facilitated by the adjacent stop plates *h* between which the pick heads function as shovels. Centrifugal force rapidly causes the picks to swing outwards again until the shoulders *g*⁴ on their shanks strike the stop pins *f*³ and the consequent arrest of their outward swing ejects the carried coal. The picks are off-set from the face plate *a*¹ of the carriage to an extent which provides adequate clearance between the machine and the coal face *d*¹ and permits the machine to follow-on without obstruction from the face.

The cut coal raised by the picks *g* is thrown by them onto a transversely-disposed conveyor *j* provided with scrapers *j*¹ carried by chains *j*² running over sprocket wheels *j*⁶ on end rollers *j*³. The scrapers travel over a plate *j*⁴ extending between the rollers, and spill plates *j*⁵ direct the coal onto said plate. The rollers are mounted in bearings *j*⁷ in the transverse plate *a*⁴ and in a parallel plate *a*⁵ on the carriage of the machine,

the rear roller being driven through suitable gearing from the shaft *e* or from one of the sprockets *o*¹, *o*² hereinafter described. The conveyor *j* discharges the cut coal through an aperture *a*⁶ in the back portion of the carriage onto a belt conveyor *k* of standard type running parallel with the coal face between the rails *c*¹, *c*² of the track on which the carriage travels. The transverse conveyor is boxed in as indicated at *j*⁸ to prevent escape of dust except at its discharge end where it is buried in the relatively large volume of cut coal discharged onto the belt conveyor *k*.

To prevent spillage of cut coal in the way of the picks *g*, a curved guard plate *m* is provided of width equal to the depth of the cut into the coal face, the plate *m* fitting closely to the path of the cutting edges *g*² of the picks and ensuring that cut coal not ejected onto the conveyor *j* by the picks is retained by the latter until ejection occurs. The guard plate *m* is supported by the transverse plate *a*⁴ and extends downwards from the upper edge of the forward spill plate *j*⁵ to a level just clear of the floor of the cut. The face plate *a*¹ extends from close to the floor to close to the roof *d*² of the gallery and from the transverse plate *a*⁵ to a line in advance of the cut, thereby shielding the carriage from the picks, the plates *a*¹ and *m* co-operating to minimise the escape of dust in operation. They may be edged with flexible material making contact with the floor and roof.

The carriage of the machine is supported by a pair of unflanged wheels *b*¹ running on the single rail *c*¹ of the track and carried by spindles *b*⁴ mounted between plates *a*⁷ running lengthwise of the back of the carriage, by twin flanged wheels *b*² on a spindle *b*⁵ mounted between the plates *a*², *a*³ on the carriage parallel with the face plate *a*¹ and extending from the transverse plate *a*⁴, and a broad flanged wheel *b*³ on a spindle *b*⁶ mounted between the side plates *a*⁸ of a box *a*⁹ at the right-hand end of the carriage, the wheels *b*² and *b*³ running on the double rail *c*² and guiding the carriage in its travel.

In the preferred arrangement the machine is driven by an endless chain *n* running the full length of the coal face, said chain being travelled by passing its right-hand loop *n*¹ around a sprocket wheel *s*¹ on the driving shaft *s*² of a stationary electric motor *s* and its left-hand loop *n*² around an idle sprocket *t*. The chain is employed to revolve the shaft *e* on which the pick-carrying hubs *f* are keyed by keys *e*² as aforesaid, and also to travel the carriage *a*. For this purpose, sprocket wheels *o*¹, *o*², *o*³ are provided on spindles *p* supported by the parallel plates *a*², *a*³ a sprocket wheel *o*⁴ is keyed by a key *e*³ on the shaft *e*, and a sprocket wheel *o*⁵ is provided on the spindle *b*⁵ of the twin wheel *b*². A cover *r* protects the sprocket wheels. The upper driving run and the lower return run of the chain *n* are supported by bars *c*³, *c*⁴ running lengthwise of the gap between the members of the double rail *c*² and forming troughs therewith. The driving run of the chain *n* engages the wheel *o*¹ and rises over the wheel *o*² to engage around the lower half of the wheel *o*⁴ on the shaft *e*, the chain rising again over the wheel *o*³ and engaging below the wheel *o*⁵ which returns it to its trough in the double rail. The sprocket wheel *o*⁵ does not drive the twin rail wheels *b*², which revolve freely. The direction of the upper run of the chain in Fig. 3 is from right to left.

It will be seen that, there being no driving connection between the wheels *b*¹, *b*², *b*³ and the

sprocket wheels *o*¹, *o*², *o*³, *o*⁴, *o*⁵, the machine is movable on its rails *c*¹, *c*², without rotation of the sprocket wheels. The chain exerts a pressure on the machine through the temporarily stationary sprocket wheels which moves the machine forward so long as the resistance of the machine to movement is less than the resistance of the sprocket wheels to rotation, the latter, because of the heavy pick-carrying hubs, being considerable. On the stop plates *h* coming against the coal face, the resistance of the machine to movement is enormously increased and the drive of the chain is then perforce applied to the sprocket wheels and overcomes their resistance to rotation, whereupon the hubs are revolved and, when they develop the necessary speed to apply centrifugal force to the pivoted picks, the picks swing out beyond the stop plates and cut into the frontal layer of the coal face as hereinbefore described, the pressure of the stop plates on the frontal layer of the coal face being maintained. The said pressure assists in splitting the frontal layer into pieces and the splitting and detachment of the coal by the picks removes the resistance in the way of the stop plates against the forward movement of the machine and allows it intermittently to "jump" forward until the stop plates again bear on solid coal. The power of the chain drive is thus applied to move the machine forward when the resistance of the frontal layer of the coal face collapses and becomes less than the resistance of the sprocket wheels to rotation, and to revolve the sprocket wheels and the hubs when the resistance of the machine to forward movement is greater than the resistance of the sprocket wheels to rotation.

To recapitulate: The endless driving chain *n* running in the forward direction (so far as its operative run is concerned) encircles the sprocket wheels *o*¹ to *o*⁵. The machine being mounted on freely-revolving track wheels *b*¹ to *b*³, the pull of the chain on the machine is sufficient to travel it against normal resistance. However, the sprocket wheels can revolve only when the inertia of the shaft *e* and its hubs *f* has been overcome, and the resistance of the shaft *e* to rotation is more than the normal resistance of the machine to travelling on its rails. Thus, while the resistance to travel is normal, there is no relative movement between the chain and the sprocket wheels, so that the effect is as though the chain was fixedly attached to the machine, whereby the machine and chain travel forward as a unit. As soon as the resistance to travel is increased (for example when the stop plates *h* strike an uncut shoulder of the coal face as in Fig. 2) to the point where said increased resistance exceeds the resistance of the shaft *e* to rotation, the inertia of the shaft is overcome and the sprocket wheels and the hubs *f* commence to rotate. During the stoppage of the forward travel of the machine, the drive of the chain *n* is applied wholly to the rotation of the hubs *f*, and the picks *g* are caused to hammer against the uncut shoulder of the coal face. Soon the shoulder breaks down so that the resistance to the forward travel of the machine is temporarily decreased. The machine therefore moves forward, but again the stop plates *h* strike an uncut portion of the coal face, whereupon travel of the machine stops, and the hubs come into action again.

At one or both ends of the coal face a chamber is cut to accommodate the machine, and convenient mechanical means are provided for

5

supporting the roof d^2 and for moving the carriage a , its track c^1 , c^2 and the belt conveyor k bodily forward up to the coal face d^1 at the completion of each traverse in preparation for the succeeding cut.

It will be understood that, while I have herein described and illustrated a coal mining machine having a rotary pick-carrying shaft e at one end only, a similarly mounted, fitted and driven shaft e may be provided at each end of the carriage a to enable the machine to operate in each direction alternately. Vertical adjustment of the cutting arc of the percussive picks g may be provided for by eccentrically mounting the forward wheels of the carriage.

What I claim and desire to secure by Letters Patent is:

1. A mining machine comprising a movable carriage, a shaft mounted for rotation in bearings carried by said carriage, power-driven means for rotating said shaft, hubs fixed on said shaft and off-set from a side of said carriage, pivots carried by said hubs in parallel relation to said shaft, a percussive pick mounted on each of said pivots and adapted to swing outward under the influence of centrifugal force during rotation of the hub, stops on said hubs adjacent to said pivots to limit the projection of said picks from the hub, and relatively stationary stop plates carried by the carriage and extending between adjacent pairs of pick-carrying hubs, said stop plates projecting in advance of said hubs but short of the picks when the latter are in their position of maximum projection from the hubs.

2. A mining machine comprising a movable carriage, a shaft mounted for rotation in bearings carried by said carriage, power-driven means for rotating said shaft, hubs fixed on said shaft

6

and off-set from a side of said carriage, pivots carried by said hubs in parallel relation to said shaft, a percussive pick mounted on each of said pivots and adapted to swing outward under the influence of centrifugal force during rotation of the hub, stops on said hubs adjacent to said pivots to limit the projection of said picks from the hub, and relatively stationary stop plates carried by the carriage and extending between adjacent pairs of pick-carrying hubs, said stop plates projecting in advance of said hubs but short of the picks when the latter are in their position of maximum projection from the hubs, the percussive picks being provided with scoop-shaped heads to receive the pieces of coal cut by the picks, said heads operating in conjunction with the stop plates to convey said pieces and ejecting said pieces when the picks swing outwards and strike the stops adjacent to their pivots.

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