Jan. 1, 1952 J. C. SPROUL 2,581,052

HAULAGE APPARATUS FOR MINING MACHINES

Filed April 27, 1949 4 Sheets-Sheet 1

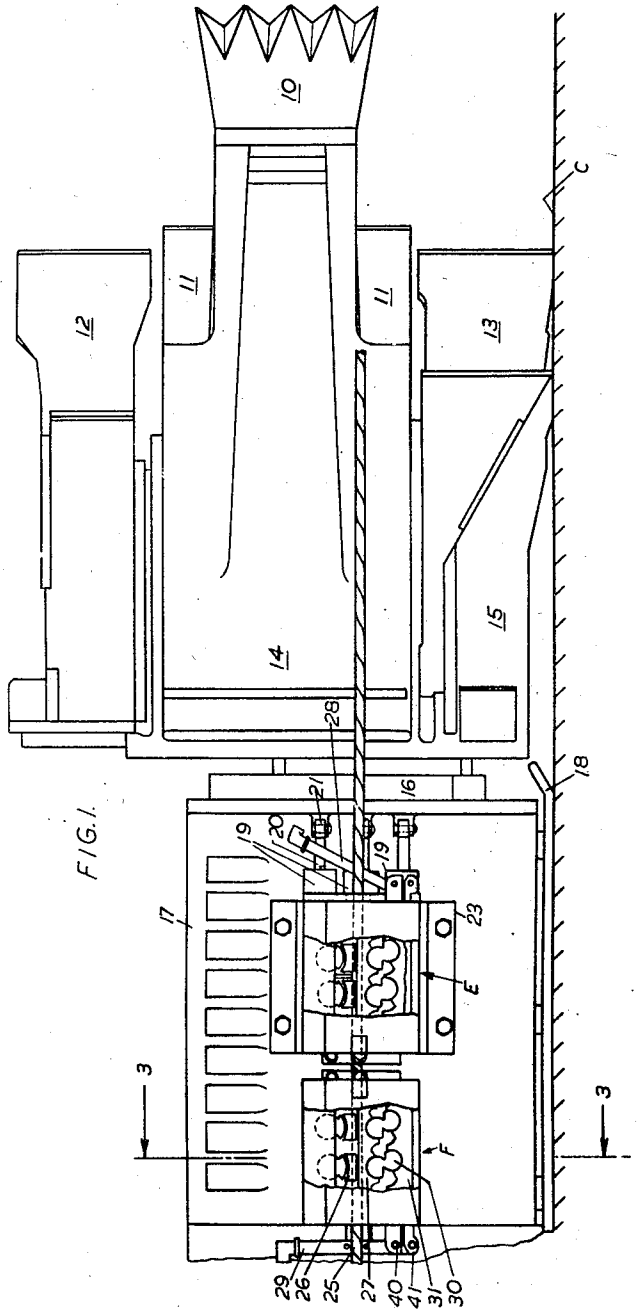


FIG. 1.

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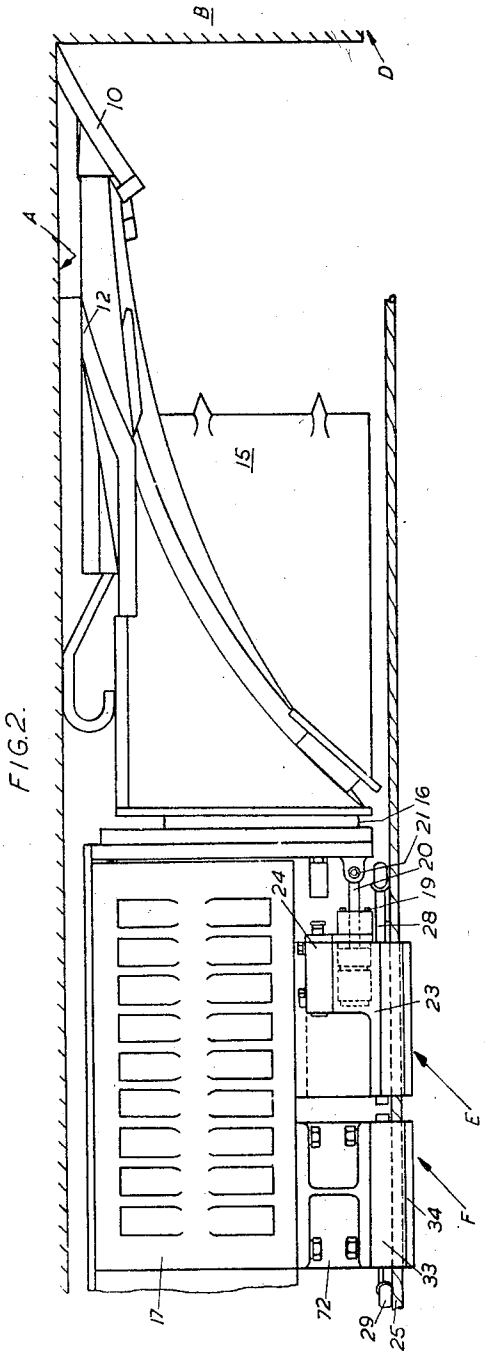


FIG. 2.

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HAULAGE APPARATUS FOR MINING MACHINES

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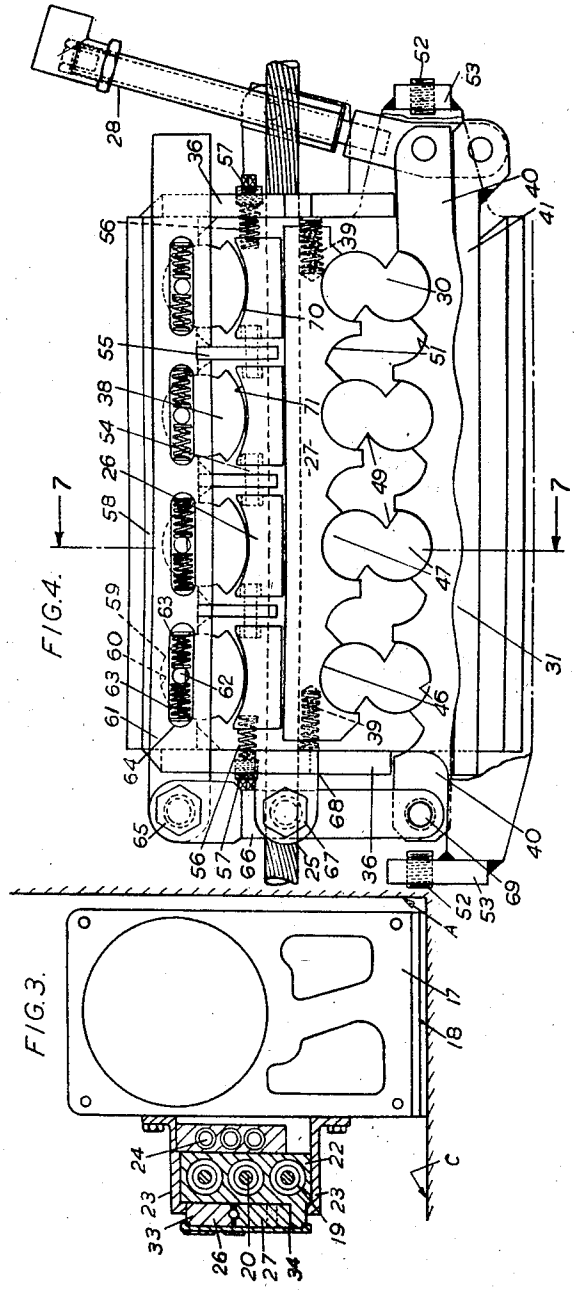


FIG. 4.

FIG. 3.

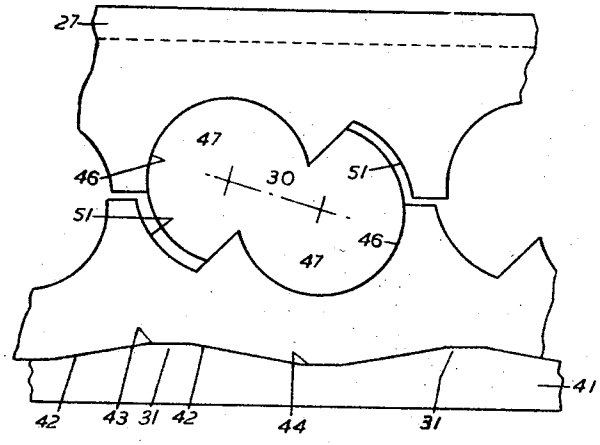
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HAULAGE APPARATUS FOR MINING MACHINES

Filed April 27, 1949 4 Sheets-Sheet 4

FIG.5.



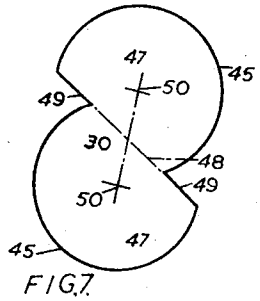


FIG. 6.

FIG.7.

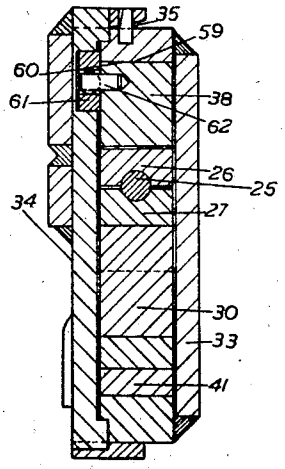
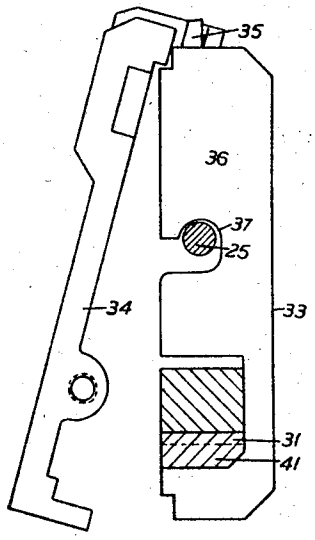


FIG.8.



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UNITED STATES PATENT OFFICE

2,581,052

HAULAGE APPARATUS FOR MINING MACHINES

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7 Claims. (Cl. 254—135)

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This invention relates to haulage apparatus for machines for mining coal and other minerals, such for instance as coal cutters, which travel by means of a haulage rope as they move along the face of the mineral seam.

An object of the invention is to provide an improved gripper for a mining machine haulage rope, said gripper having jaws that exercise the gripping action under the constraint of a toggle mechanism which acts to tighten the grip with increase in the tension of the rope in one direction and to relieve the grip in the opposite direction.

Another object of the invention is to provide an improved haulage assembly for use with a mining machine haulage rope, said assembly comprising a pair of grippers which are adapted to grip the rope alternately and a power unit which moves one of the grippers back-and-forth relatively to the other gripper in time with the alternate periods of movement and stoppage in the travel of the machine, each gripper automatically releasing the rope as the other grips it.

Another object of the invention is to provide an improved haulage assembly for a mining machine, said assembly comprising rope grippers adapted to act alternately upon a haulage rope and a reciprocating power unit adapted to impart working strokes to the machine, one of the grippers engaging the rope during each working stroke to provide an abutment against which the power unit reacts to advance the machine and the other gripper engaging the rope to maintain it taut whilst the power unit forces the first-mentioned gripper to free itself and return in order to take a fresh grip of the rope.

The movable gripper of a pair may be called the "working gripper" and the other may be called the "stop gripper."

According to the invention, in order to comply with practical requirements, the gripper or grippers is or are reversible; that is to say, the grippers can each be set in one or other of two positions respectively to suit opposite directions of travel in relation to the rope.

The power unit preferably comprises a hydraulic cylinder-and-ram unit, one component of said unit being secured to the machine or other support and the other component being secured to the working gripper or rope. Such a unit may be designed to impart a heavy force at slow speed during the working stroke and a lighter force at quicker speed during the return stroke.

The invention will now be described by way of

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example with reference to the accompanying drawings, in which:

Fig. 1 is an elevation, with parts broken away, of a coal-mining machine to which the invention is applied; Fig. 2 is a plan corresponding to Fig. 1; and Fig. 3 is a sectional elevation, the section being on the line 3—3 of Fig. 1.

Fig. 4 is an elevation drawn to a larger scale of a gripper incorporated in the haulage assembly with which the machine is equipped. Fig. 5 is an elevation to a still larger scale of components of the gripper shown in a position different from the Fig. 4 position. Fig. 6 shows a toggle of the form incorporated in each gripper. Fig. 7 is a section of the same gripper on the line 7—7 of Fig. 4 and Fig. 8 is a corresponding end elevation of the gripper showing its cover opened.

The coal-mining machine to which the invention is shown applied by way of example belongs to a previously proposed kind having a set of coplanar cutters 10, 11, 12 and 13 which function like large chisels with their edges all in the same vertical plane A (Fig. 2). These cutters include an intermediate cutter 10 which projects far ahead of the others to plough out a preliminary furrow in the coal seam B, and this cutter is associated with upper and lower cutters 11, which are provided on the same heavy cutter head 14. This head also carries top and bottom cutters 12 and 13 the latter of which is associated with a shovel-like horizontal cutter 15. The cutters 11, 12 and 13 serve to strip off coal left outstanding above and below the intermediate furrow. The floor cutter 15 strips off and lifts coal from the floor C and deflects it sidewise to an appropriate conveyor (not shown). The machine has a similar head and cutters at the opposite end, these parts not being shown.

In Fig. 2, D indicates the face of the seam B from which coal has to be stripped along the plane A when the machine hauls itself along the face.

The cutter head 14 is connected at 16 to a central chassis 17 provided with a base plate 18 formed like a skid for movement over the mine floor C.

The haulage power is derived from a haulage unit. In the example this unit comprises an assembly of three superposed hydraulic cylinders 19, the double-acting rams of which are indicated by 20. These rams are connected, as at 21, to the chassis 17. The cylinders 19 form the movable component of the hydraulic unit, and they are incorporated in a body 22 (Fig. 3) which is slidable between guides 23 on the chassis. Pis-

ton valves controlling the supply of hydraulic liquid to the cylinders 19 are indicated by 24. The other components of the hydraulic system, comprising a motor-driven pump, a reservoir for the liquid, conduits between the various components and appropriate valves, may be of conventional form and therefore are not shown. They are all incorporated in or mounted on the chassis 17.

The haulage rope is indicated by 25. It is secured at both ends to anchorages in the mine.

The haulage assembly comprises a pair of grippers, both shown in Figs. 1 and 2, the working gripper being indicated generally by E and the stop gripper by F in these two views. Each of the two grippers comprises a pair of upper and lower rope-gripping jaws 26 and 27 which grip the rope 25 under the powerful action of toggle devices if the gripper tends to move in one direction, namely towards the left, in relation to the haulage rope and which automatically free the rope if the gripper moves in the other direction. In the example, each gripper is reversible, and so the toggle devices are movable by a hand lever 28 or 29 into one or other of two settings, corresponding to the respective directions of travel of the machine. The toggle devices of each gripper are provided as toggles 30 that are supported by wedge devices 31 which are displaceable to effect control of the lower jaw 27, including withdrawal of that jaw into an inoperative position in which the rope 25 is removable from the gripper.

In the example, each gripper includes a casing 33 which is closed on one vertical side by a movable cover 34 fitting against the body of the casing. The cover 34 is shown moved into open position in Fig. 8. The cover is attached at its upper side to pins 35 (one only of these pins is shown) on the casing top. The ends 36 of the casing are each formed with a slot 37 (Fig. 8) having approximately the form of a so-called bayonet-joint slot, through which the haulage rope 25 passes horizontally from the casing 33 to its terminal anchorages in the mine.

The upper and lower jaws 26, 27 are each formed with an arcuate groove, as shown in Fig. 7, the rope 25 being gripped in the grooves of both jaws when they are forced together. The lower jaw of each gripper, in the example, is a single member supported by a series of four toggles 30. The upper jaw, in the example, comprises a train of four members respectively bearing against a series of four cams 38 (see Fig. 4). It is by operation of these toggles 30 and cams 38 that the jaws 26, 27 are constrained to grip the rope 25 and are permitted to relieve their grip. Moreover, by full displacement of the toggles 30, namely displacement into the reclining position in which one of them is shown in Fig. 5, the lower jaw 27 can be lowered into an inoperative position permitting the rope 25 to be removed from the casing or to be entered therein by way of the slots 37. The toggles 30 and the cams 38 of each gripper are operated by the hand lever 28 or 29, which is movable from a neutral position (Fig. 4) into either of two operative positions, described hereinafter, corresponding respectively to the opposite directions of relative movement between the gripper and the rope.

The single member of which the lower jaw of each gripper is composed rests upon the toggles 30 and is acted upon at opposite ends by centralising springs 39 re-acting against the ends 36 of the casing. The toggles are supported by a

horizontal support bar 40 which is seated upon a wedge bar 41 incorporating the previously mentioned wedge devices 31. The adjacent surfaces of the support bar and wedge devices are of wave form, the one surface mating with the other. Each wave formation has flat inclined sides 42 (see Fig. 5) and a flat summit 43 and the interwave troughs have flat bottoms 44. The arrangement is such that when relative longitudinal movement between the bars 40 and 41 takes place, the support bar 40 changes the angularity of the toggles 30.

Each toggle, as Fig. 6 shows, is formed with arcuate surfaces 45. These surfaces seat in mating seats 46 in the jaw 27 above and the support bar 40 below. Each toggle consists of two segments 47, each somewhat larger than a semicircle, and the segments are laterally offset from one another, each merging integrally into the other at a line 48 (Fig. 6) which is part of a common chord defining both segments. The toggle therefore presents two flats 49 at opposite ends of the chord. The toggle is in effect a link, the centres 50 (represented by crossing lines in Figs. 6 and 7) of the segments being the centres of the joints between the link and the jaw 27 above and the support bar 40 below. The jaw and the support bar have arcuate formations 51, additional to the seats 46, in which the toggles nest when by appropriate displacement of the support bar and wedge bar the toggles adopt a reclining position (Fig. 5). Each toggle, when in neutral position (Fig. 4) has its centres in vertical alignment. When the toggle is in either operative position, hereinafter described, the line of centres is inclined to one or other side of vertical. When the toggle is in the reclining position (Fig. 5) its line of centres is inclined upwardly to horizontal.

The support bar of each gripper is movable endwise by the hand lever 28 or 29 to a short extent defined by adjustable limit stops 52 co-operating with its opposite ends. These stops are pins screwed through brackets 55 on the casing 33. Each of the hand levers 28 and 29 is floating, being pivotally connected to adjacent ends of both the support bar 40 and the wedge bar 41. The arrangement is such that, when the hand lever is moved to one or the other side of neutral, it moves the support bar 40 against one or other of the limit stops 52; and thereafter, with the engaged limit stop as fulcrum, the lever moves the wedge bar 41 longitudinally below the support bar, thus raising the support bar and toggles by the wedge action and bringing the lower jaw 27 into operative relationship with the rope 25.

The train of members of which the upper jaw 26 of each gripper is composed are supported by intermediate thrust pins 54 (Fig. 4) which are slidable in lugs 55 on the casing and which permit vertical movement of the jaw members 26. The outer members of the train are pressed inwards by centralising springs 56 reacting against adjustable screws 57 in the casing ends 36. Each jaw member 26 co-operates with one of the previously mentioned cams 38. Each cam is pivotally mounted in the top of the casing 33. The pivotal mounting consists of a large segment 59 on the cam and a mating seat 60 in the casing top. The cams are associated with a cam bar 61 which is slidable lengthwise in the casing 33, the cam bar having a pin-and-slot connection with each cam. Each connection consists of a pin 62 on the cam and centralising

springs 63 between it and the ends of the associated slot 64 in the cam bar. The cam bar is pivotally connected at one end by a pin 65 to the top of an approximately vertical lever 66 which is fulcrumed between its ends, at 67, to a bracket 68 on the casing 33 and is pivotally connected at the bottom by a pin 69 to the support bar 40. The arrangement therefore is such that, when the hand lever 28 or 29 is moved as previously described, the cam bar is forced to move lengthwise and urges the cams 38 to pivot in their pivotal mountings. Each cam has an arcuate eccentric cam surface 70 which cooperates with a surface 71 of somewhat greater radius formed in the associated jaw member 26. The cam action is therefore such that, when the cam bar 61 is moved in one or other direction, the cams urge the associated jaw members to exert an initial grip on the rope 25.

Consider the working gripper E as used when the machine is set to work from left to right as viewed in Figs. 1, 2 and 4. This gripper is mounted on the slidable body 22 in which the hydraulic cylinders 19 are incorporated. The hand lever 28 of the working gripper must be pulled towards the right of neutral. This action pulls the support bar 40 to its righthand limit and therefore tilts the toggles 30 so that their lower portions lie towards the right, as shown in Fig. 1. When the toggles are so positioned, and the hydraulic unit 19, 20 is operated to extend itself, the toggles 30 tend to straighten—that is, tend to turn towards their vertical position—and thus tighten their grip upon the rope 25. Accordingly, the working gripper E serves temporarily as an abutment against which the hydraulic unit reacts as it pushes the machine forwards to perform a working stroke.

That is to say, by virtue of the toggle action, when the gripper engages the rope against movement in one direction (namely movement of the gripper E towards the left) the initial grip is tightened, the tightness of the final grip being proportional to the force applied by the unit; that is to say, the greater the force the tighter the final grip.

On the other hand, if the force is applied in the other direction, the action of the toggles is such that relative movement between the rope and the gripper is permitted. In short, the gripper acts as a one-way lock or clutch on the rope. Thus, when the hydraulic unit 19, 20 is operated to contract, the working gripper E releases its grip on the rope and is pulled forwards towards the right in readiness to take a new grip on the rope preparatory to the next advance of the machine.

The stop gripper F, although similar constructionally to the gripper E, is arranged in the example to the opposite hand and instead of being slidable on the machine chassis 17 is bolted rigidly to a bracket 72 thereon (Fig. 2). Therefore, the hand lever 29 is pushed towards the right in order to set its toggles at the same inclination as those of the gripper E. When the gripper E is being pulled forwards by the contracting hydraulic unit 19, 20, the gripper F grips the rope 29 and holds it taut. When the gripper E grips the rope during the advance of the machine, the gripper F frees itself from the rope and advances with the machine.

The hand lever of each gripper may, if desired, be provided with means whereby it is locked in one or other of its operative positions, and provision may be made for adjustment of these positions, for instance in order that the working positions of the support bar 40 can be regulated to compensate for wear of the parts.

In order that the rope 25 can be removed from or entered into the gripper, the cover 34 is moved from the body of the casing 33 (Fig. 8) following which the wedge bar 41 and support bar 40 are displaced longitudinally to bring the toggles 30 into their reclining position (Fig. 5). In this position, the upper jaw 26 is clearly below the rope so that the rope can be moved laterally through the slots 37 provided for the purpose in the end plates 36.

In the example, the haulage assembly is mounted on a mining machine as a working part thereof and moves with the machine along a stationary rope.

In an alternative arrangement, the haulage assembly is arranged in a stationary location on the mine floor and the end of the haulage rope is attached to the machine, the arrangement being such that the power unit reciprocates the working gripper so that it pulls in the rope stroke after stroke through the stop gripper, which remains stationary.

In another alternative arrangement, a reciprocating power unit is arranged in a stationary location in the mine, a single haulage-rope gripper is provided on the machine, and a rope-returning device (say a spring anchorage) is also arranged in a stationary location in the mine. The power unit pulls the rope in one direction, thus giving it a working stroke, and the rope-returning device keeps the rope taut and gives it the return stroke. During each working stroke of the rope, the gripper grips it and advances the machine. During each return stroke of the rope, the gripper releases its hold and remains stationary, taking a fresh grip at the beginning of each successive working stroke.

I claim:

1. A gripper for mining machine haulage apparatus including means for effecting relative movement between the gripper and a haulage rope, the said gripper comprising a movable jaw to grip the rope, an adjustable support, toggle means interposed between said support and said jaw, means for moving said support both to-and-from said jaw and also lengthwise of the jaw between alternative positions at opposite sides of a neutral position, the toggle means in said alternative positions being set at mutually opposite inclinations to the jaw, so that the toggle means will constrain the jaw to exercise its grip on the rope in either of two propulsion directions but will free the jaw in the return direction.

2. A gripper according to claim 1 in which the means for moving the support comprises a member formed with a wave-like series of inclined faces arranged in two sets inclined in mutually opposite directions and said support is formed to engage co-operatively with said faces, and a hand lever for moving said support relative to said member in either direction through the neutral position to the alternative positions in each of which said faces displace the support towards the jaw.

3. A gripper according to claim 1 in which the toggle means include a toggle both ends whereof are arcuate and in which said jaw and said support respectively have arcuate seats in which said ends are turnably mounted, so that the toggle is turnable between an upright position and a reclining position.

4. A gripper for mining machine haulage ap-

paratus including means for effecting relative movement between the gripper and a haulage rope, the said gripper comprising first and second co-operating jaws to grip the rope, an adjustable first support, toggle means interposed between said support and said first jaw, an adjustable second support, cam means interposed between said second support and said second jaw, means for moving both of said supports lengthwise of the jaws and also for moving said first support to-or-from said first jaw, said supports being movable between alternative positions at opposite sides of a neutral position, the toggle means in said alternative positions being set at mutually opposite inclinations to the first jaw and said cam means act wedgewise on said second jaw so that both jaws will exercise their grip on the rope in either of two directions but will free the rope in the return direction.

5. A gripper according to claim 4 in which the means for moving the first support comprises a member formed with a wave-like series of inclined faces arranged in two sets inclined in mutually opposite directions and said support is formed to engage co-operatively with said faces, and a hand lever for moving said first and second supports lengthwise in either direction through the neutral position to the alternative positions in each of which said faces displace the first support towards the first jaw and the toggle means and cam means hold the first and second jaws respectively in rope-engaging positions.

6. A gripper according to claim 4 in which the cam means include a cam pivotally mounted in the second support and having an arcuate face which depresses the second jaw when the second support is displaced in either direction from the neutral position.

7. A gripper according to claim 4 in which the cam means include a cam having an arcuate portion turnably mounted in an arcuate seat in the second support.

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