

July 7, 1959

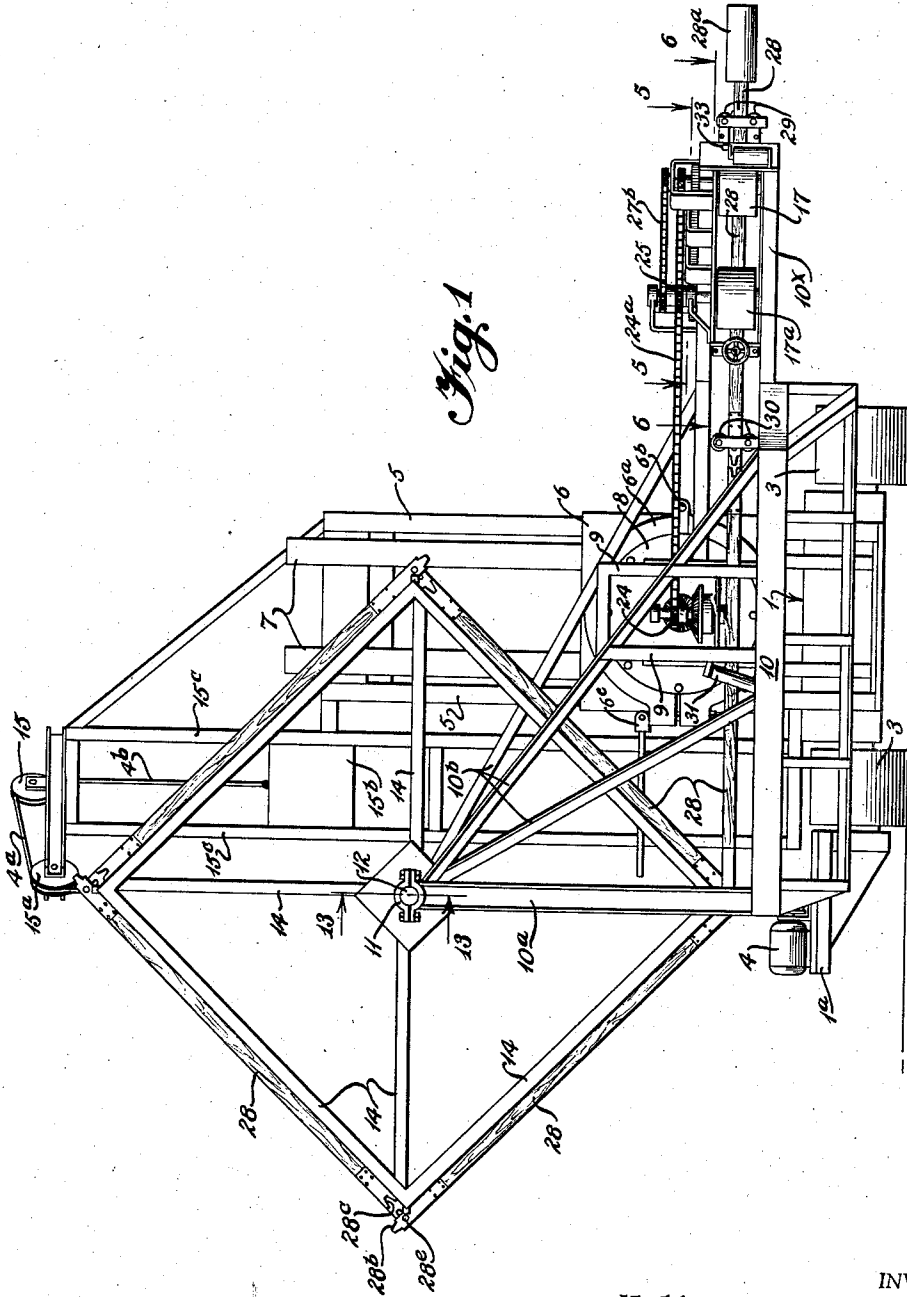
H. S. PAYNE

2,893,285

BLAST HOLE LOADER AND TAMPER

Filed Jan. 12, 1956

5 Sheets-Sheet 1



INVENTOR

Hollis Sanders Payne

BY *Alexander & Dowell*
ATTORNEYS

July 7, 1959

H. S. PAYNE

2,893,285

BLAST HOLE LOADER AND TAMPER

Filed Jan. 12, 1956

5 Sheets-Sheet 2

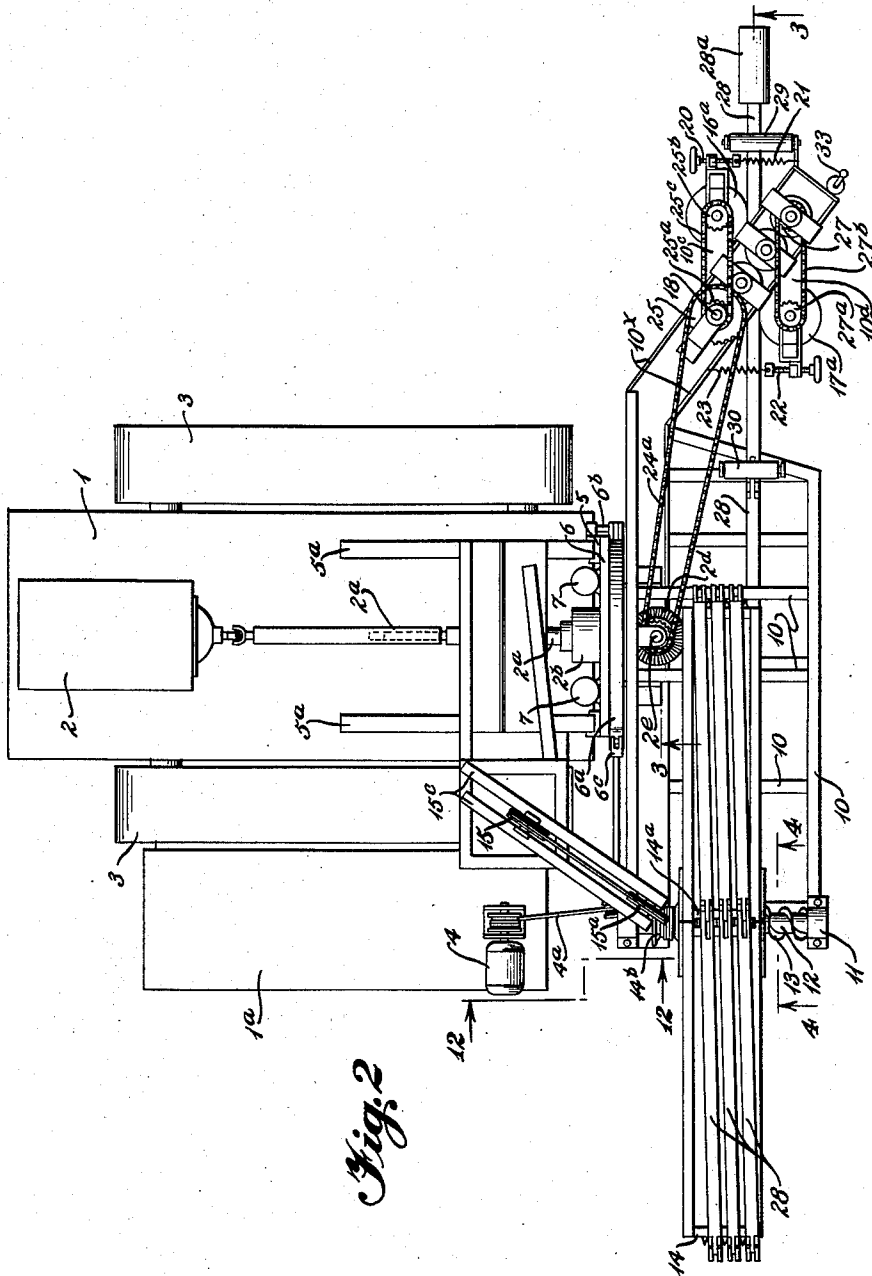


Fig. 2

INVENTOR

Hollis Sanders Payne

BY Alexander S. Duvall

ATTORNEYS

July 7, 1959

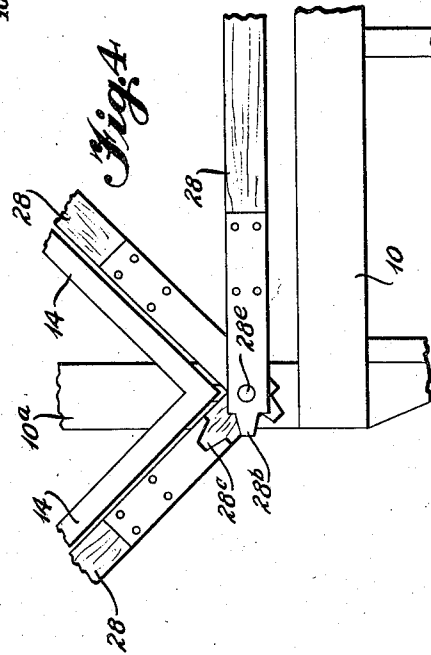
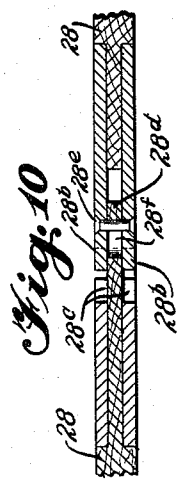
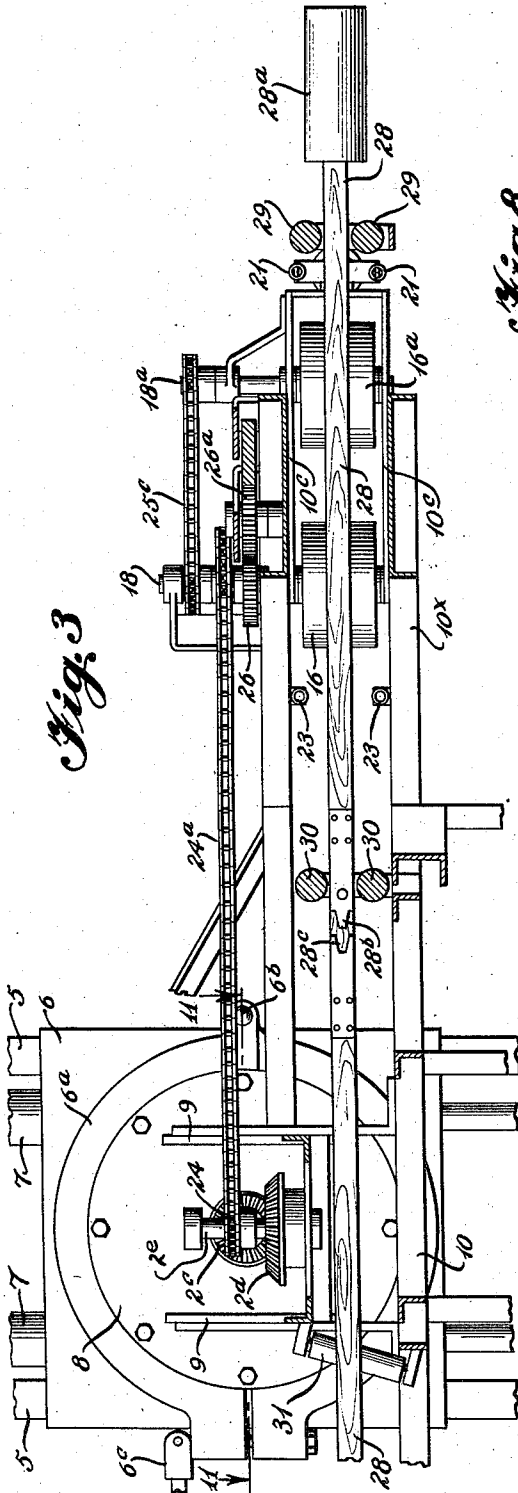
H. S. PAYNE

2,893,285

BLAST HOLE LOADER AND TAMPER

Filed Jan. 12, 1956

5 Sheets-Sheet 3



INVENTOR
Hollis Sanders Payne

BY *Alexander & Dowell*
ATTORNEYS

July 7, 1959

H. S. PAYNE

2,893,285

BLAST HOLE LOADER AND TAMPER

Filed Jan. 12, 1956

5 Sheets-Sheet 4

Fig. 5

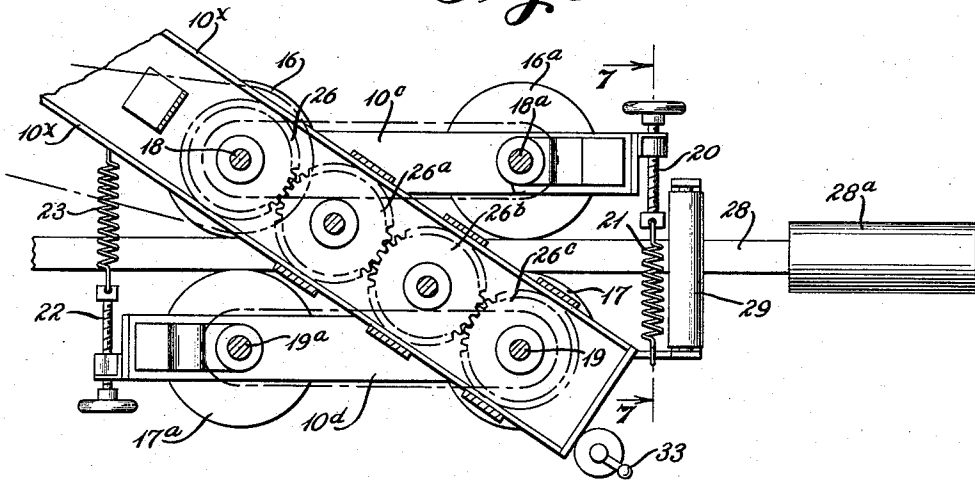


Fig. 6

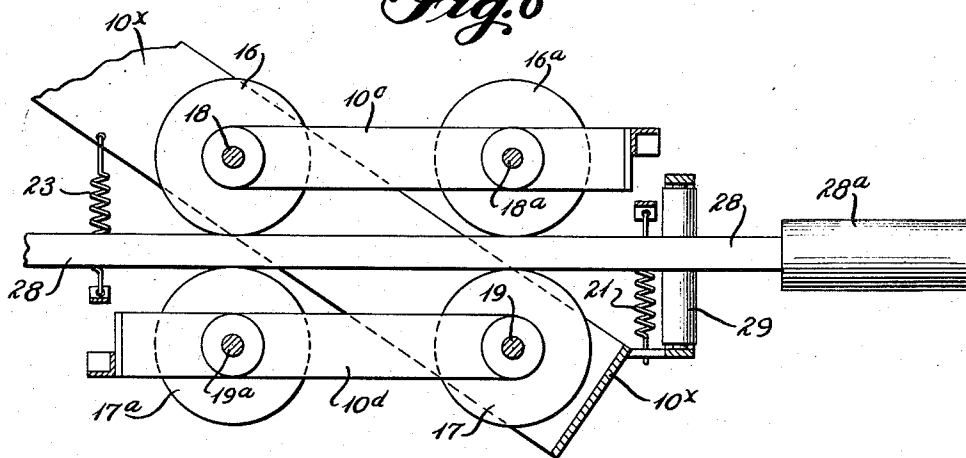
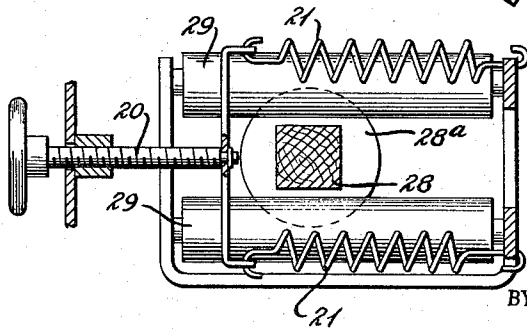


Fig. 7



INVENTOR

Hollis Sanders Payne

BY

Alexander & D. M. D. M.

ATTORNEYS

July 7, 1959

H. S. PAYNE

2,893,285

BLAST HOLE LOADER AND TAMPER

Filed Jan. 12, 1956

5 Sheets-Sheet 5

Fig. 11

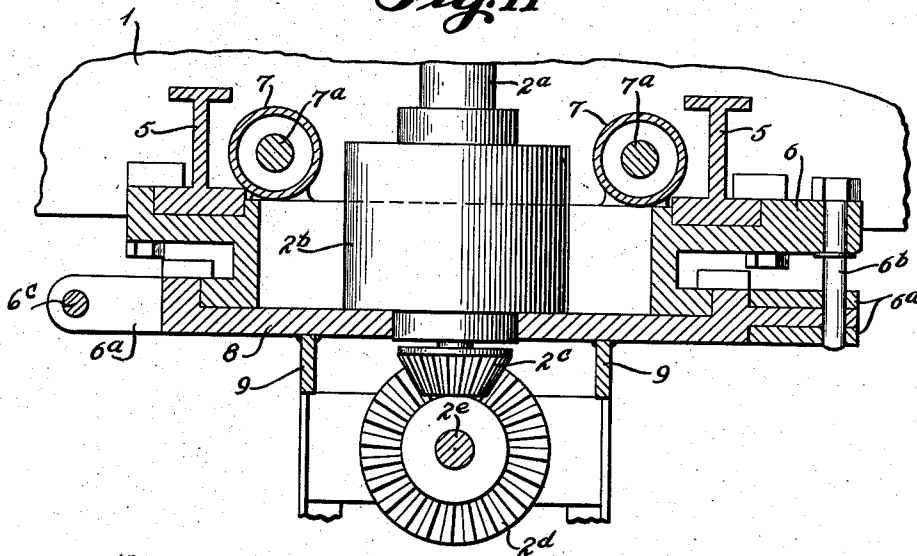


Fig. 12

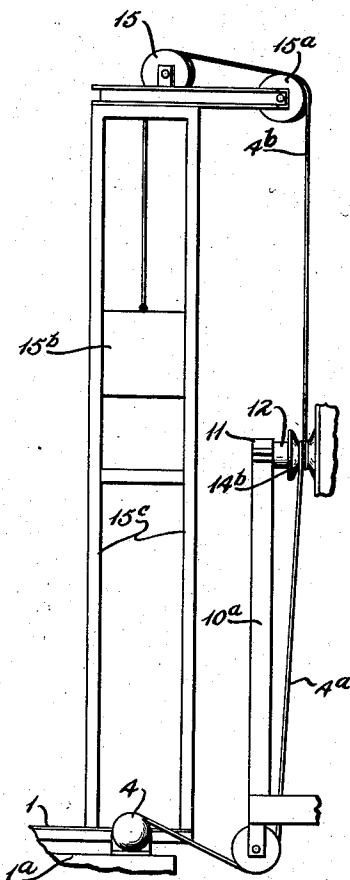
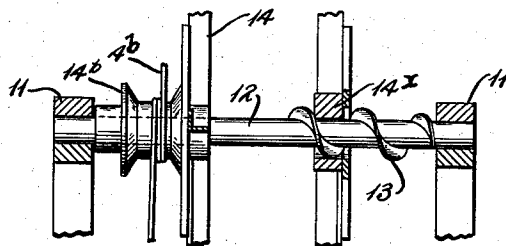


Fig. 13



INVENTOR

Hollis Sanders Payne

BY

Alexander F. Dwell

ATTORNEYS

1

2,893,285

BLAST HOLE LOADER AND TAMPER

Hollis Sanders Payne, Boonville, Ind.

Application January 12 1956, Serial No. 558,668

12 Claims. (Cl. 86—20)

My invention relates to mechanical blast hole loaders, and more particularly is an improved device for loading and tamping side-wall blast holes, for example, of the type encountered in strip mining and in quarries.

In particular, my invention provides a machine including a jointed ramrod, or pole, and including drive means for propelling the pole into the blast hole, storage means for storing the pole when it is in retracted position, and mounting means for supporting and positioning the pole and drive means for the purpose of aligning the latter with the blast hole intended to be tamped.

It is the principal object of my invention to provide a mobile mechanical loader which can be operated by a single person to perform the complete loading and tamping of the blast hole. It is the object of this invention to provide a self-powered mechanical loader with controls whereby the loader may be raised or lowered, or tilted to any desired angle so as to permit the ramrod to be aligned with the axis of the blast hole to be loaded.

It is another very important object of my invention to provide a mechanical ram capable of loading a very deep hole in one continuous operation without the necessity of intervening manual steps carried out by the operator. The present invention contemplates a mechanical loader wherein the pole, or ramrod, is divided into jointed sections, which sections are automatically locked together to form a substantially rigid ramrod as the latter is driven into the blast hole, and which jointed pole sections are automatically rendered non-rigid as the pole is backed out of the blast hole so that the pole sections may articulate with respect to each other to permit them to be automatically wound up on a polygonal reel.

It is another major object of my invention to provide a self-contained machine wherein the jointed pole sections of the ramrod are stored within the physical limits of the machine to provide a compact unit which can be efficiently used in confined areas of operation. It frequently happens during mining operations that a blast hole must be loaded at a location where there is very little room between the wall in which the blast hole is drilled and the other side of the mine. In such a case it is important to provide a machine which is sufficiently compact that it may operate within a confined area without interference with the wall on the other side of the mine.

It is another very important object of my invention to provide a mechanical loader which not only tightly compacts the explosive and the wadding within the blast hole, but which in addition compacts and tamps the explosive and wadding to a uniform degree in various blast holes regardless of the depth of the holes or the angles of the axes thereof. I have therefore provided a mechanical ram wherein the propelling force applied to the ram is delivered through adjustable friction means, the adjustability of which permits the operator to compensate for different ram resistances encountered in holes of different depths or encountered under unusually wet or dry operating conditions. In addition it is important to provide a friction

2

drive for a mechanical ram which will permit slippage of the latter when the ram bottoms in the blast hole.

It is another important object of my invention to provide a polygonal reel capable of winding up and storing the jointed rod sections as they are retracted from the blast hole, the reel being so mounted that it travels laterally along the axis on which it rotates so as to index the periphery of the reel into alignment with the friction drive means which drives the pole into the blast hole, the reel being provided at all times with a torque tending to rotate it in a direction to wind up the pole on the reel, so that the portion of the pole located on the same side of the friction drive as the reel at any particular time will be under tension so as to disengage the special joints between the pole sections to permit the pole to articulate.

Other objects and advantages of my invention will become apparent during the following discussion of the drawings, wherein:

Figure 1 is a side elevation of my mechanical loader.

Fig. 2 is a plan view of my mechanical loader.

Fig. 3 is an enlarged view taken in section along line 3—3 of Fig. 2.

Fig. 4 is an enlarged elevation view of the jointed pole illustrating the manner in which the latter may be stored on the reel, this view being taken from a position along line 4—4 of Fig. 2.

Fig. 5 is an enlarged section view taken along lines 5—5 of Fig. 1.

Fig. 6 is an enlarged section view taken along line 6—6, Fig. 1.

Fig. 7 is a further enlarged section view taken along line 7—7, Fig. 5.

Figs. 8 and 9 are enlarged views of a rod joint, the joint being in articulating position in Fig. 8 and in rigid position in Fig. 9.

Fig. 10 is a section view along line 10—10 of Fig. 8.

Fig. 11 is an enlarged section view taken along line 11—11 of Fig. 3.

Fig. 12 is an enlarged view taken along line 12—12 of Fig. 2.

Fig. 13 is an enlarged section view taken along line 13—13 of Fig. 1.

Referring now to the drawings, in Figs. 1 and 2 it will be seen that I have provided my invention with a vehicle chassis 1 supporting a motor 2 and capable of propelling itself on caterpillar tracks 3, the drive from the motor to the caterpillar tracks and the controls thereof being of well-known type and therefore not illustrated in the present drawings. The chassis 1 may also include a small extension platform 1a which supports a torque motor 4 which serves a purpose to be hereinafter explained. On the front end of the chassis is rigidly mounted an A-frame having vertical track members 5, as shown in Figs. 1 and 11, and having rearwardly extending brace members 5a, as shown in Fig. 2, the A-frame serving as a support for the frame members which support the ram mechanism.

Mounted on the track members 5 of the A-frame is a disc-supporting assembly 6 to which are attached a pair of hydraulic rams 7 having their piston rods 7a, Fig. 11, secured to the A-frame, the connection not being shown. When the hydraulic rams 7 are actuated the disc-supporting member is caused to travel vertically on the track members 5.

As can be most clearly seen in Figs. 1, 3 and 11, the disc-supporting member 6 is provided with a ring clamp 6a which is pivotally connected to the member 6 by a pin 6b and which ring clamp 6a is provided with a locking means 6c passing through the slotted end of the ring clamp 6a and serving the purpose of clamping the upper and lower halves of the ring together for the purpose hereinafter stated. The disc-supporting member 6 and the clamping ring 6a attached thereto support and main-

tain in adjusted position a mounting disc 8, Figs. 1, 3 and 11. This mounting disc can be rotated within the clamping ring 6a when the latter is unclamped by appropriate actuation of the locking means 6c. The mounting disc 8 has secured to its face as by welding additional supporting members 9, to which are in turn attached the frame members which comprise the supporting frame for the mechanical ram, reel and drive assemblies. The members 9 are welded to the face of the disc 8 and in turn are welded to the members of the ram-supporting frame which will be generally designated by the numeral 10. The frame 10 includes a pair of spaced upright members 10a which are braced by diagonal structural members 10b for the purpose of making the structure rigid.

At the top of each of the vertical members 10a is an axle clamp 11 for the purpose of supporting in horizontal position an axle 12 on which is journaled the polygonal reel, which will be generally designated by the numeral 14. The reel 14 is mounted on a hub 14a which is free to turn on the axle 12 and which has an internal restriction 14x as shown in Fig. 13 adapted to engage and turn on the lead screw 13 attached to axle 12 for the purpose of causing the reel 14 to index or translate in a lateral direction with respect to the frame 10 and along the axle 12 when the reel is rotated.

At one end of the reel is located a small drum 14b which is secured to one side of the reel 14, as is best illustrated in Figs. 1, 12 and 13. The torque motor 4 applies a constant tension to a cable 4a which passes around the drum 14b and transmits a torque to the drum in such a direction that the drum is continuously attempting to rewind the jointed pole on its periphery. Another cable 4b is also fastened to the drum 14b and then over several pulleys 15 and 15a, and finally is attached at its other end to a counterweight 15b which is free to travel up and down in a guide frame 15c, by which means a continuous tension is maintained on the cable 4b, which supplements the torque transmitted by cable 4a.

The ram-supporting frame 10 has an extension 10x on which a plurality of friction drive rolls are mounted. This assembly can be best seen in plan view in Figs. 2, 3, 5 and 6. Near the outer end of the frame extension 10x are two friction rollers 16 and 17, which rollers are rigidly journaled in the frame extension 10x, and are each located opposite a partner roller. For instance, the roller 16 is located opposite a partner roller 16a, and the roller 17 is located opposite a partner roller 17a, which partner rollers are respectively mounted in subframes 10c and 10d, which subframes are pivotally connected to the extension frame 10x. By inspection of Figs. 5 and 6 it will be seen that the subframe 10c is pivotally connected to the extension frame 10x at the stub axle 18; whereas the subframe 10d is pivotally connected to the extension frame 10x at the stub axle 19.

Each of the subframes 10c and 10d is provided at its outer end with an adjustable screw connected to a spring which in turn is attached to a member rigidly connected to the extension frame 10x. The screw 20 and associated springs 21, Fig. 7, permit adjustment of the tension which tends to pull the roller 16a in the direction of the roller 17, likewise the screw 22 and springs 23, Fig. 5, permit adjustment of the tensile force tending to pull the roller 17a toward the roller 16.

By reference to Fig. 2 it may be seen that the motor 2 drives a telescoping shaft 2a which passes through a bearing 2b and drives a beveled gear 2c fixed to its outer end. The beveled gear 2c meshes with a vertically-mounted beveled gear 2d carried on a stub shaft 2e to which is also attached a sprocket 24. The sprocket 24 lies opposite another sprocket 25 which can best be seen in Fig. 2. The sprocket 25 is mounted on the stub shaft 18 and, in addition, carries another smaller sprocket 25a located opposite another sprocket 25b which is carried on the stub shaft 18a by which the friction roller 16a is journaled in the subframe 10c.

Mounted on the stub shaft 18 and secured thereto is also a gear 26 which meshes with gears 26a, 26b and 26c to form a train of drive gears the latter of which is keyed to the stub shaft 19 which carries the roller 17.

In addition, the stub shaft 19 also carries a sprocket 27 which lies opposite another sprocket 27a and is joined thereto by a chain 27b. In addition there is a chain 25c joining the sprockets 25a and 25b on the other side of the friction drive mechanism.

By this assembly it can be seen that when the motor 2 is rotated, drive is transmitted therefrom through the telescoping shaft 2a journaled in the bearing 2b, and is thence transmitted by the beveled gears 2c and 2d to the sprocket 24 and to the chain 24a by which this sprocket transmits drive to the sprocket 25. When the sprocket 25 rotates, it in turn rotates the stub shaft 18, the sprocket 25a, the drive gears 26, 26a, 26b and 26c, and the friction drive roller 16. This drive is also furnished to the gear 26c through 26 and to the stub shaft 19, which in turn drives the roller 17 and the sprocket 27. The drive from the sprocket 27 is transmitted to the sprocket 27a and thence to the friction drive roller 17a by the chain 27b.

As stated above in the objects of this invention, the ramrod comprises a plurality of joined pole sections 28 which in the present illustration are of rectangular cross section. The outer pole terminates in an enlarged taper 28a. As can be clearly seen in Figs. 4, 8, 9 and 10, the pole sections 28 are made of wood and are provided with complementary male and female joints 28b and 28c. In addition, each of the rods is provided with a tongue 28d, as shown in Fig. 10, which passes between opposite portions of the male joint 28b and is captivated by a pin 28e. As shown in Fig. 9, when two pole sections 28 are pushed together, the male member 28b of the joint engages with the female member 28c to form a relatively rigid joint. However, because of the slot 28f in the tongue 28d, when two pole sections 28 are pulled apart, as shown in Fig. 8, the male and female sections are disengaged, and the pole sections are free to articulate about the pin 28e, as is illustrated in Fig. 4. It is thus possible to wind up the pole sections on the reel 14, as shown in Figs. 1 and 2. However, when the mechanism is reversed and the ramrod 28 is drawn outwardly and to the right in Fig. 1, the pole joints become engaged to form a relatively rigid rod.

As can be clearly seen in Fig. 1, at least three sets of guiding rolls are provided for the purpose of insuring that the ramrod 28 will pass between and remain centered with respect to the pairs of friction rolls 16—16a and 17—17a. The outermost set of guide rolls 29 guides the pole sections 28 as they leave the last pair of opposed rolls 16a and 17. In addition, there is another pair of guide rolls 30 just preceding the first set of friction rolls 16 and 17a. The rod is further guided between the reel 14 and the first set of rolls 16—17a by an additional set of guide rolls 31.

Operation

As stated above in the objects, the entire machine is mounted in a mobile chassis 1, which chassis has a motor 2 and travels on caterpillar type tracks 3. When a blast hole is to be loaded, the entire machine may be oriented so that the ramrod 28 will line up with the axis of the blast hole in the azimuth plane by appropriate operation of the caterpillar tracks 3. In other words, the entire vehicle is moved in order to point the axis of the ramrod in the correct azimuth direction. The elevational angle of the frame 10 which supports the ramrod assembly may be altered by loosening the lock 6c and permitting the ring 6a to spread at the lefthand joint thereof. Spreading of the ring by releasing of the lock 6c permits the mounting disc 8 to be rotated about the axis of the bearing 2b. When the disc is rotated the support members 9 are likewise rotated and the frame

10, attached to the support members 9, is also rotated so that the elevational angle of the ramrod may be adjusted to directly line up with the axis of the blast hole. In addition, the entire frame 10 may be raised or lowered by actuation of the hydraulic rams 7 so as to cause the disc-supporting member 6 to travel up and down on the tracks 5 which comprise a part of the A-frame 5-5a by which the disc-supporting assembly is attached to the chassis 1. By these adjustments it becomes possible to align the axis of the ramrod with any particular bore hole falling within the range of adjustment of the present machine. Once the axis of the ramrod 28 is lined up with the bore hole, the motor 2 is caused to rotate in such a direction as to cause the rollers 16-16a and 17-17a to drive the ramrod off of the reel and into the blast hole.

A switch 33 is provided on the extension frame 10x to control the motor 2. When the switch 33 is turned in one direction the motor 2 is energized and the drive rollers 16-16a and 17-17a are driven in such a direction as to extend the ramrod into the blast hole. In another position of the switch 33 the motor 2 is turned off, and in a third position of the switch 33 the motor 2 is caused to rotate in the opposite direction so as to retract the ramrod 28 from the blast hole.

During the interval of time when the rotation of the motor 2 is in such a direction as to cause the rollers 16-16a and 17-17a to drive the ramrod into the blast hole, the pole sections 28 are fed off of the reel which in Fig. 1 is rotating counterclockwise. By inspection of Fig. 2 it can be seen that during such counterclockwise rotation the entire reel will travel on the lead screw 13 to translate or index along the axle 12 in a direction away from the chassis 1 of the machine. The lead screw 13 is so designed that for all positions of the reel 14, the rod sections 28 which are wound thereon will be axially aligned to pass between the pairs of drive rollers 16-16a and 17-17a.

While the ramrod is being fed off of the reel and into the blast hole, the cable 4b, as shown in Fig. 12, will be wrapped around the drum 14b in such a direction as to raise the counterweight 15b. Conversely, when the direction of the friction drive rollers 16-16a and 17-17a is reversed and the ramrod is being retracted from the blast hole, the counterweight 15b will provide a steady pull on cable 4b and the torque motor 4 will be operated so as to provide a steady pull on the cable 4a, which pulls will cause the reel 14 to rotate in such a direction as to wind up the respective pole sections 28 as they are retrieved from the blast hole by the friction drive rollers.

The pole sections 28 and their respective joints are purposely built to have considerable flexibility so that they may be used in blast holes which are not drilled perfectly straight. The guide rolls 29 and 30 however, have a tendency to keep the pole sections in axial alignment until they pass into the blast hole. The principal purpose to be served by the guide rolls 31 is to assist in reeling and unreeling the pole sections 28.

I do not limit my invention to the form of the illustration shown in the drawings, for obviously changes may be made therein within the scope of the claims.

I claim:

1. A blast-hole loader and tamper comprising a frame; a reel having polygonal peripheral sides and journaled on said frame; a ramrod comprising pole sections each of length substantially equal to the length of one side of the polygonal reel; two-position joints between said pole sections disengaged when the sections are in tension permitting the ramrod to articulate to wind up on the periphery of said polygonal reel but engaged to form rigid joints when the sections are under axial compression; at least one pair of frictional drive rollers on said frame and mutually spaced apart to permit the ramrod to pass therebetween; spring means yieldably urging the mutually spaced rollers toward each other to grip the ramrod there-

between; and motor means connected to power drive said rollers to reciprocate the ramrod; and torque means connected to said reel and yieldably urging the latter to rotate in a direction to wind up the ramrod on the reel.

2. In a device as set forth in claim 1, said joints each comprising a two-part hinge with a pin passing through a bore therethrough; interfering male and female complementary abutments on said parts, and said bore being elongated in a direction axial of said pole sections to permit limited mutual reciprocation of the sections, the pole sections being free to articulate at the joints when the latter are under tension but being rendered rigidly aligned by said abutment when the joints are under compression.

3. In a device as set forth in claim 1, a plurality of guide rolls grouped in spaced pairs on the frame and along the path of the ramrod to align the latter with the drive rollers and the periphery of the reel.

4. In a device as set forth in claim 1, said reel being journaled on an axle supported by said frame, the axle having a helical lead screw along its length, and the reel having a hub engaging said lead screw to cause the reel to translate along the axle when rotated, said ramrod winding up around the periphery of the reel in axially spaced convolutions, and the translating motion of the reel causing the last convolution to lie in a plane including the portion of the ramrod passing between said drive rollers.

5. A blast-hole loader and tamper comprising a vehicle chassis, a supporting member carried by said chassis and vertically adjustable thereon; a frame attached to said supporting member and capable of tilting about a horizontal axis with respect thereto; a reel having polygonal peripheral sides and journaled on said frames; a ramrod comprising pole sections each of length substantially equal to the length of one side of the polygonal reel; joints between said pole sections permitting the ramrod to articulate to wind up on the periphery of said polygonal reel; at least one pair of frictional drive rollers on said frame and mutually spaced apart to permit the ramrod to pass therebetween; spring means yieldably urging the mutually spaced rollers toward each other to grip the ramrod therebetween; motor means connected to power drive said rollers to reciprocate the ramrod; torque means connected to said reel and yieldably urging the latter to rotate in a direction to wind up the ramrod on the reel, said joints each comprising a two-part hinge with a pin passing through a bore therethrough; interfering male and female complementary abutments on said parts, and said bore being elongated in a direction axial of said pole sections to permit limited mutual reciprocation of the sections, the pole sections being free to articulate at the joints when the latter are under tension but being rendered rigidly aligned by said abutments when the joints are under compression.

6. A blast-hole loader and tamper comprising a vehicle chassis; a motor on said chassis; vertically disposed track means fixed on said chassis; a disc supporting member vertically positionable on said track means; a disc occupying a vertical plane and rotatably connected to said supporting member; means for locking said disc against rotation; a frame fixed to and supported by said disc; a reel having polygonal peripheral sides and journaled on said frame; a ramrod comprising pole sections each of length substantially equal to the length of one side of the polygonal reel; joints between said pole sections permitting the ramrod to articulate to wind up on the periphery of said polygonal reel; at least one pair of frictional drive rollers on said frame and mutually spaced apart to permit the ramrod to pass therebetween; and transmission means between said motor and said rollers to power drive said rollers to reciprocate the ramrod.

7. In a device as set forth in claim 6, two pairs of friction drive rollers in said frame, including a first and a second drive roller on one side of the ramrod and a

third and a fourth drive roller on the other side, said transmission means driving the first drive roller keyed to a first stub shaft journaled in the frame, positive drive means between said first and third drive rollers, the third drive roller lying opposite the ramrod from the second roller and being keyed to another stub shaft journaled in said frame; two subframes disposed parallel to each other and to the ramrod and each pivotally connected to the frame by one of said sub-shafts, the second and the fourth rollers being respectively journaled in the free ends of opposite subframes; and means for transferring drive from the first roller to the second roller and from the third roller to the fourth roller.

8. In a device as set forth in claim 7, tension spring means between the frame and the free end of each subframe for urging the second and fourth rollers toward the third and first rollers, respectively; and means for adjusting the spring tension.

9. In a device as set forth in claim 6, a ground-engaging caterpillar means on said chassis and driven by said motor.

10. In a device as set forth in claim 6, power operated drive means between said track means and said supporting member for vertically positioning the latter with respect to the former.

11. In a device as set forth in claim 6, said means for

locking the disc comprising two semi-circular clamp ring members mutually pivoted together and connected at one end to the supporting member, and said ring members surrounding said disc; and clamp means between the other ends of the ring members for drawing them together to grip the disc.

12. In a device as set forth in claim 6, said transmission means comprising a bearing through the center of said disc; a first shaft passing through said bearing; gear means fixed on the end of the shaft toward the frame; another shaft extending outwardly from the motor and non-rotatably engaging said first shaft in a telescoping joint; and chain and sprocket drive means extending from said gear means to said drive rollers.

References Cited in the file of this patent

UNITED STATES PATENTS

912,679	Hollander	Feb. 16, 1909
1,059,884	Link	Apr. 22, 1913
1,468,771	Arnold	Sept. 25, 1923
2,617,542	Styles et al.	Nov. 11, 1952

FOREIGN PATENTS

29,325	Great Britain	Sept. 12, 1906
130,405	Sweden	Dec. 19, 1950