

(No Model.)

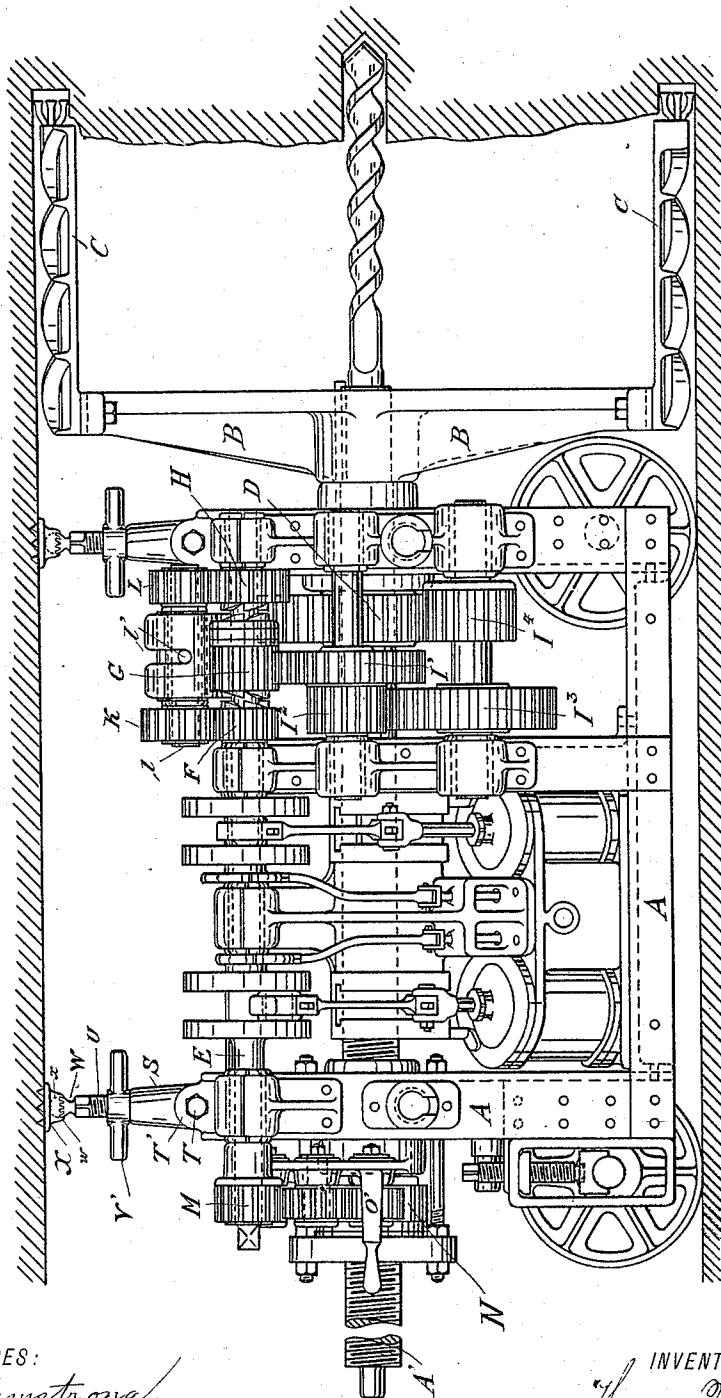
4 Sheets—Sheet 1.

T. W. FRY.  
TUNNELING MACHINE.

No. 540,306.

Patented June 4, 1895.

Fig. 1.



WITNESSES:

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BY

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his ATTORNEY.

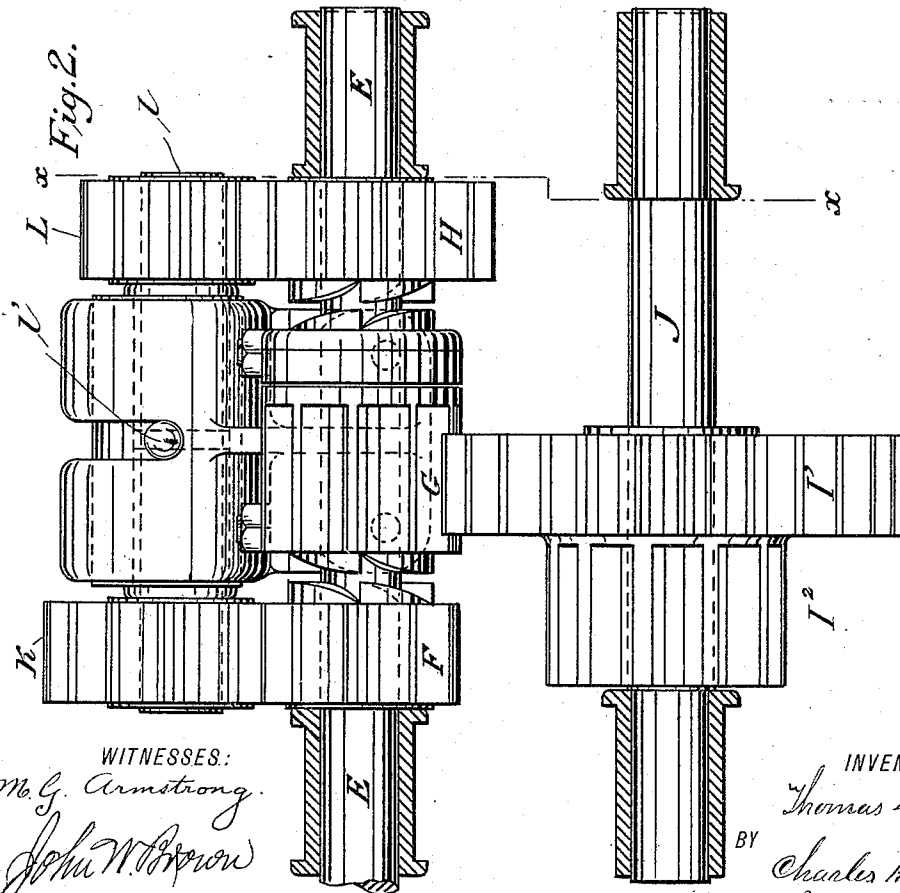
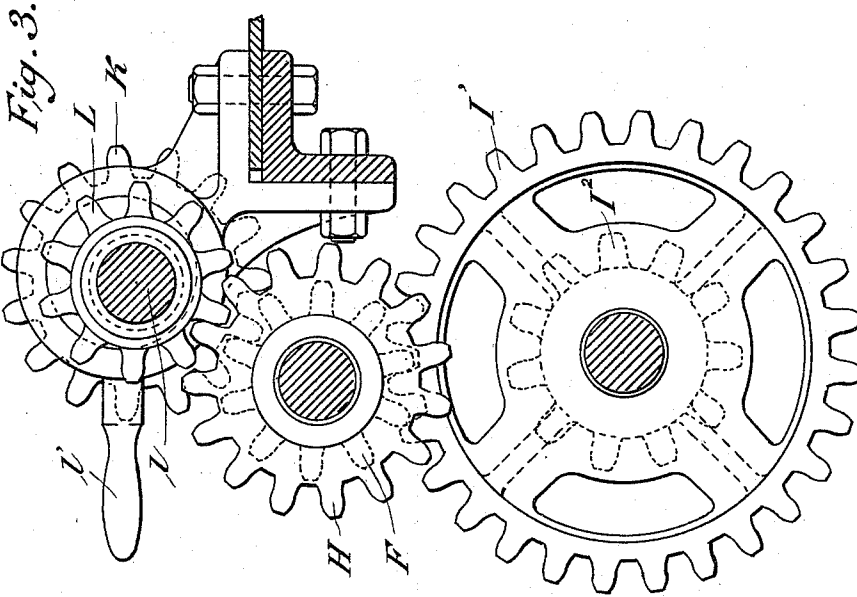
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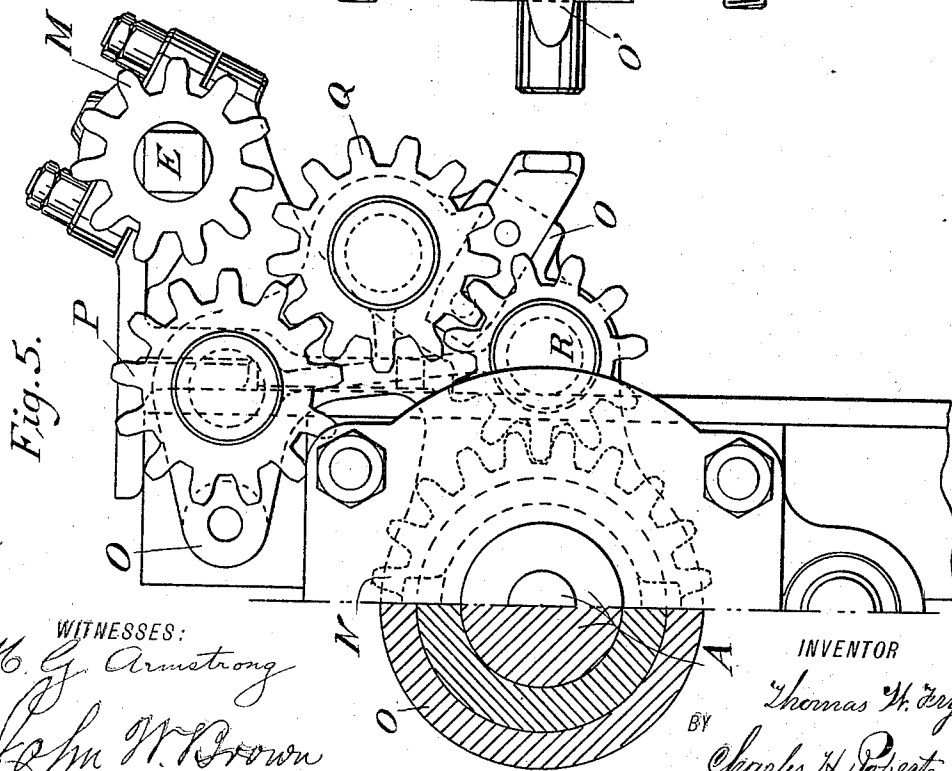
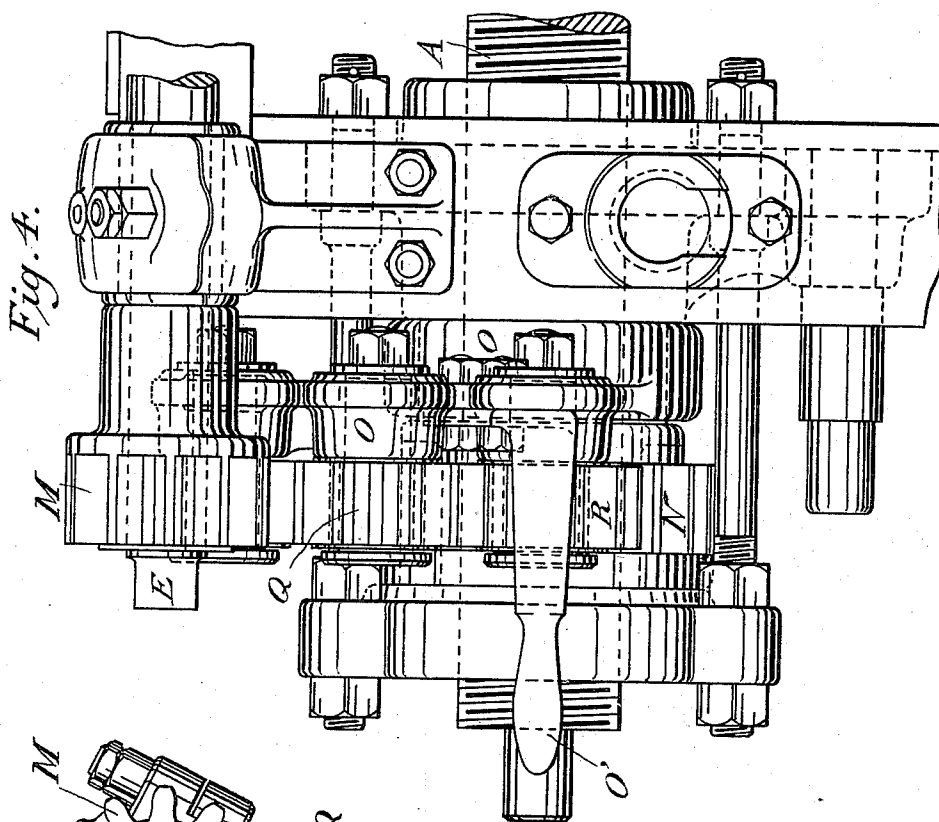
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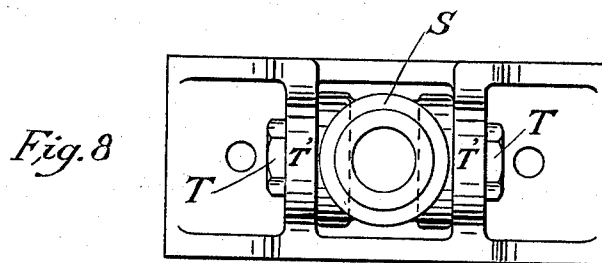
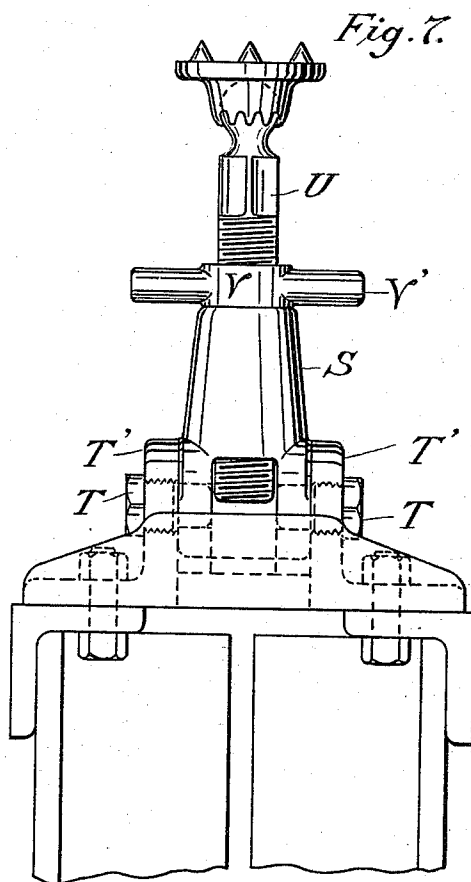
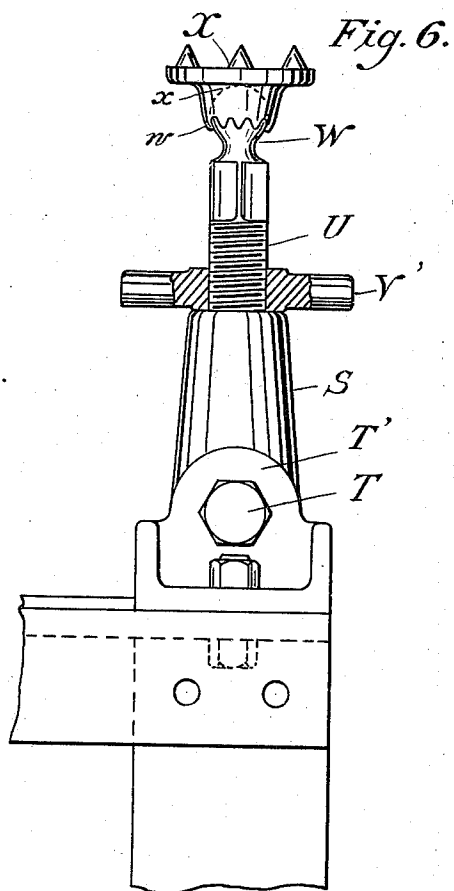
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# UNITED STATES PATENT OFFICE.

THOMAS W. FRY, OF CHICAGO, ILLINOIS, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE SULLIVAN MACHINERY COMPANY, OF SAME PLACE AND CLAREMONT, NEW HAMPSHIRE.

## TUNNELING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 540,306, dated June 4, 1895.

Application filed December 12, 1891. Serial No. 414,839. (No model.)

*To all whom it may concern:*

Be it known that I, THOMAS W. FRY, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Tunneling-Machines, of which the following is a specification.

My invention relates to entry driving or tunneling machines of the general character of what is known as the Stanley machine, such as shown in the Stanley patent, No. 418,893, dated November 12, 1889, and the reissue thereof, No. 11,333, dated May 9, 1893, its objects being to provide such machines with a novel speed gearing attachment, by means of which the speed of revolution of the cutter frame carrying the cutters which operate upon the rock may be reduced and the power thereof increased without the slackening of the speed of the engines driving the machinery; to improve the mechanism for turning the nut with which the threaded shaft of the cutter frame or cutting mechanism engages, in order to provide for the movement of the main frame and the cutter frame in either direction with relation to each other while driving the engine shaft in the same direction; and to provide an improved jacking device for use in connection with the machine.

The particular improvements desired to be covered by this application will be hereinafter set forth and claimed.

In the drawings, Figure 1 is a side elevation of the tunneling-machine having my improvements added thereto. Fig. 2 is an enlarged view of the speed-reduction gearing, and Fig. 3 an end view of the same on the line *xx*, Fig. 2. Fig. 4 is a side view of the gearing for moving the nut upon the threaded shaft. Fig. 5 is an end view of the same, partly in section; and Figs. 6, 7, and 8 are views of the stay jack or brace above referred to.

Like letters of reference indicate like parts in each figure.

As the general form of the machine is fully described in said Stanley patent, I will not extend the present description further than is necessary to clearly illustrate the improvements to be applied to that machine.

In the drawings A is the main frame of the

machine in which is mounted what has generally been termed the cutter frame, consisting of a threaded shaft A' mounted on the main frame and carrying the arms or cutter head B having the arm extensions C which carry the cutters at their forward ends. The shaft A' is mounted in suitable bearings in the main frame, and has both a rotating and an advance or retrograde movement imparted thereto, the rotating movement being imparted to the threaded shaft by means of the large gear D having a feather and key-way connection with the shaft, while the longitudinal movement is imparted to the shaft by the nut N mounted on the main frame, which may be held from turning in any suitable way while the cutting operation is being carried on, but which is a geared nut, so that it itself can be turned, as hereinafter described.

On the main frame are mounted the engines, from the engine shaft E of which power is taken to rotate the cutter frame itself through the gear wheel D and to rotate the nut N, as hereinafter described.

The first part of the invention relates to the means for controlling the speed of the cutter frame, which in the Stanley machine is always rotated at a particular speed with relation to the speed of the engines, so that whether cutting in soft or hard rock its speed and its power could not be varied. By the mechanism hereinafter described such speed can be varied to increase the power and reduce the speed of the cutter frame.

The engine shaft E has secured thereto the pinion F, which is keyed to the engine shaft and has on one side thereof a clutch face, while mounted loosely on said engine shaft are the pinions G H, the pinion H having a clutch face and running loosely on said shaft, but having no longitudinal movement thereon, while the pinion G both runs loosely on the shaft and has a longitudinal movement, said pinion G having clutch faces at each end, so that it may be thrown into engagement with either the pinion F or the pinion H. The pinion G is what might be termed a long pinion, the gears on its face being of such length that it always remains in mesh with the gear wheel I' mounted on a counter-shaft J which

carries the power to the gear wheel D on the shaft A' of the cutter frame through the gears 1<sup>2</sup> 1<sup>3</sup> 1<sup>4</sup>.

Above or to one side of the engine shaft is the speed reduction gearing, which I will now describe, said speed reduction gearing being supported in the bearing 7<sup>3</sup> and being so supported that it is capable of movement from or toward the engine shaft so as to bring this speed reduction gearing into or withdraw it from operative position. For that purpose I prefer to employ the mechanism shown in the drawings, an eccentric sleeve 7<sup>2</sup> being mounted in the bearing 7<sup>3</sup> and the shaft 7<sup>1</sup> being mounted in such eccentric sleeve and extending on each side thereof, and carrying the pinion K in position to mesh with the pinion F on the engine shaft, and the pinion L in position to mesh with the pinion H running loosely on the engine shaft, so that when these several pinions are in mesh power is carried from the pinion F to the pinion K, thence through the shaft 7<sup>1</sup> to the pinion L, and thence to the pinion H. In order to bring the shaft 7<sup>1</sup> and its pinions K L into mesh or withdraw them from mesh with the pinions F and H, the eccentric sleeve 7<sup>2</sup> is turned within its bearings 7<sup>3</sup>, and for that purpose I employ the handle 7<sup>4</sup> engaging directly with the eccentric sleeve, which handle, as shown, fits within a transverse slot in the bearing 7<sup>3</sup>, resting in one end of the slot when the gearing is in mesh, and resting in the other end of the slot when the speed reduction gearing is drawn out of mesh, such gearing being shown in mesh in Figs. 2 and 3.

When this mechanism is employed it is to be understood that in cutting soft coal, or rock which does not require very heavy power and which does not vary so that the operator must be ready to apply more power if necessary, the speed reduction gearing is drawn out of mesh by the handle 7<sup>4</sup>, the eccentric sleeve 7<sup>2</sup> being thrown into such position that the pinions K L do not mesh with the pinions F H. Through the clutch lever engaging with the pinion G that pinion is thrown into mesh with the driving pinion F, and power is transmitted through the train of gears to the cutter frame. In case, however, the machine is being operated in hard rock or rock of irregular hardness so that increased power may be desired, the apparatus may be operated in either of two ways. The operator may, when the machine strikes a hard rock and a heavier strain is thrown upon it, first bring the speed reduction gearing into mesh and then throw the clutch pinion G into mesh with the pinion H, performing the two operations at one time, or, as is preferred, he moves the speed reduction gearing to mesh through the handle 7<sup>4</sup>, and continues to drive the machine with the clutch pinion G in mesh with the driving pinion F, power meanwhile being transmitted at the same time through the speed reduction gearing so as to turn the pinion H in the same direction, but at a slower

speed than the driving pinion F. When the operator desires to increase the power and reduce the speed he simply moves the clutch pinion G into mesh with the pinion H. The power is then transmitted from the driving pinion F to the pinion K, thence through the shaft 7<sup>1</sup> to the pinion L, to the pinion H and the clutch pinion G, and thence through the same train of gearing to the cutter frame, the amount of speed reduction and the amount of increased power in such operation being regulated by the sizes of the gearing employed. In this way the operator can control at will the speed and power of the machine, giving greater power when necessary, and at the same time reducing the wear and breakage of the cutters when hard material is encountered. The Stanley machine above referred to was constructed to either hold the feed nut N stationary or to so turn it that the cutter frame would be drawn back toward the main frame, or the main frame toward the cutter frame, but when it was desired to advance the cutter frame back to its position for work this could only be done by the slow process of holding the nut stationary and rotating the shaft through the train of gearing turning the gear wheel D.

Another object of the present invention is to provide mechanism by which, without changing the direction of movement of the engine shaft, the feed nut can be turned in either direction around the threaded shaft of the cutter frame so as to rapidly withdraw or feed forward the cutter frame or draw the main frame toward or force it away from the cutter frame, as desired. For that purpose I employ what might be termed two lines of gears between the engine shaft and the geared feed nut, or laterally adjustable gearing between the same, and will now proceed to describe the same. On the engine shaft E is the pinion M, and on the geared nut N engaging with the threaded shaft A' is the swivel arm O, which carries intermediate gears P Q R, said swivel arm being adapted to swing upon the shaft or nut N so as to form the desired line of gears between the engine shaft and the geared nut, the swivel arm being provided with a suitable handle O' to move the same into the desired position. It will be noticed that the loose pinion R is always in mesh with the geared nut N, the loose pinion Q in mesh with the pinion R, and the loose pinion P in mesh with the pinion Q. The swivel arm O is of such form and these pinions are mounted on it in such way that by the movement of the arm either the pinion P or the pinion Q can be brought into mesh with the pinion M. To so rotate the geared nut N to draw back the cutter frame the swivel arm O is moved so as to bring the pinion Q in mesh with the pinion M, and power is transmitted from the pinion M through the pinions Q and R to the nut gear, which is rotated with the effect of drawing back the cutter frame without turning it, or

to draw the main frame up to the cutter frame, where this operation is desired. To advance the cutter frame from the main frame the pinion P is swung into mesh with the pinion M, and the power then passes from the pinion M through the pinions P, Q and R to the geared nut, driving it in the opposite direction, and therefore acting to force the cutter frame forward from the main frame, or force the main frame back from the cutter frame if that movement is desired.

In Figs. 6, 7 and 8 are shown the improvement in stay-jack or brace, which forms part of the subject matter of this application. It will be noticed that this stay brace is hinged directly to the machine frame, its sleeve S being hinged by bolts T T seated in lugs T' T' on the main frame and engaging directly with the sleeve S. U is the screw bar of the jack which fits within the sleeve S and is adapted to be adjusted by the nut V having handles V' or other means of turning, or, if desired, the sleeve S may be threaded to receive the screw bar. The screw bar U is provided at its upper end with a ball W, which is surrounded by a cap piece X having spikes thereon to engage with the tunnel wall. This cap piece has a spherical bearing  $\alpha$  to receive the ball W, and has downwardly projecting fingers  $\alpha$  which close around and grasp the neck of the ball, so permitting the cap X to swivel around the ball in either direction. When the screw bar is advanced out of the sleeve this cap piece readily adapts itself to any uneven surface in the tunnel wall, and therefore obtains a stronger hold upon the same. When the jack itself is used, on account of the employment of the hinged joint at the base of the jack and at the point of connection with the frame, it is evident that in certain positions, such as those desired to resist the strain, for example, the twisting strain, in the operation of the machine, on account of the hinged joint the jack will be able to sustain all such strains rigidly. Where, however, a movement in another direction is imparted to the jack and the jack is left free in such movement to swing on its hinged bearing formed by the bolts T T, the jack will swing down out of the way, and injury to the jack which might occur where the operator forgot to release the same is therefore prevented.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The combination of a main frame, a cutter frame mounted therein, a power shaft, three pinions on said power shaft having clutch faces and connections therefrom to the

cutting mechanism, and an auxiliary shaft at the side of and movable toward and from the power shaft and carrying pinions adapted to mesh with the pinions on the power shaft to change the speed of the cutting mechanism, substantially as set forth.

2. The combination of a main frame, a cutter frame mounted therein, a power shaft carrying a pinion rigid therewith and two pinions running loosely thereon, said pinions having clutch faces and connections from one of said pinions to the cutting mechanism, and an auxiliary shaft at the side of and movable toward and from the power shaft and carrying pinions adapted to mesh with the pinions on the power shaft to change the speed of the cutting mechanism, substantially as set forth.

3. The combination of a main frame, a cutter frame mounted thereon, a power shaft carrying a pinion rigid therewith, a pinion running loosely thereon and a pinion running loosely and slidable thereon, said pinions having clutch faces, gear connections from the slidable pinion to the cutter frame for driving the same, and an auxiliary shaft at the side of and movable toward and from the power shaft and carrying pinions adapted to mesh with the pinions on the power shaft to change the speed of the cutting mechanism, substantially as set forth.

4. The combination of a main frame, a cutter frame mounted therein, a power shaft, three pinions on said shaft having clutch faces and connections therefrom to the cutting mechanism, an eccentric sleeve mounted at the side of the power shaft, and an auxiliary shaft mounted in the sleeve and carrying pinions adapted to mesh with two of the pinions on the power shaft, substantially as set forth.

5. The combination of a main frame, a cutter frame mounted therein, a power shaft, three pinions on said shaft having clutch faces and connections therefrom to the cutting mechanism, an eccentric sleeve mounted at the side of the power shaft, said eccentric sleeve being mounted in a bearing in the main frame having a transverse slot therein and carrying a handle moving in said slot, and an auxiliary shaft mounted in the sleeve and carrying pinions adapted to mesh with two of the pinions on the power shaft, substantially as set forth.

In testimony whereof I affix my signature in presence of two witnesses.

THOS. W. FRY.

Witnesses:

M. J. READY,  
T. L. DEE.