(No Model.) 2 Sheets—Sheet 1.

F. K. COPELAND & W. VIELHABER.

AUTOMATIC FEEDING DEVICE FOR TUNNELING MACHINES.

No. 540,299. Patented June 4, 1895.

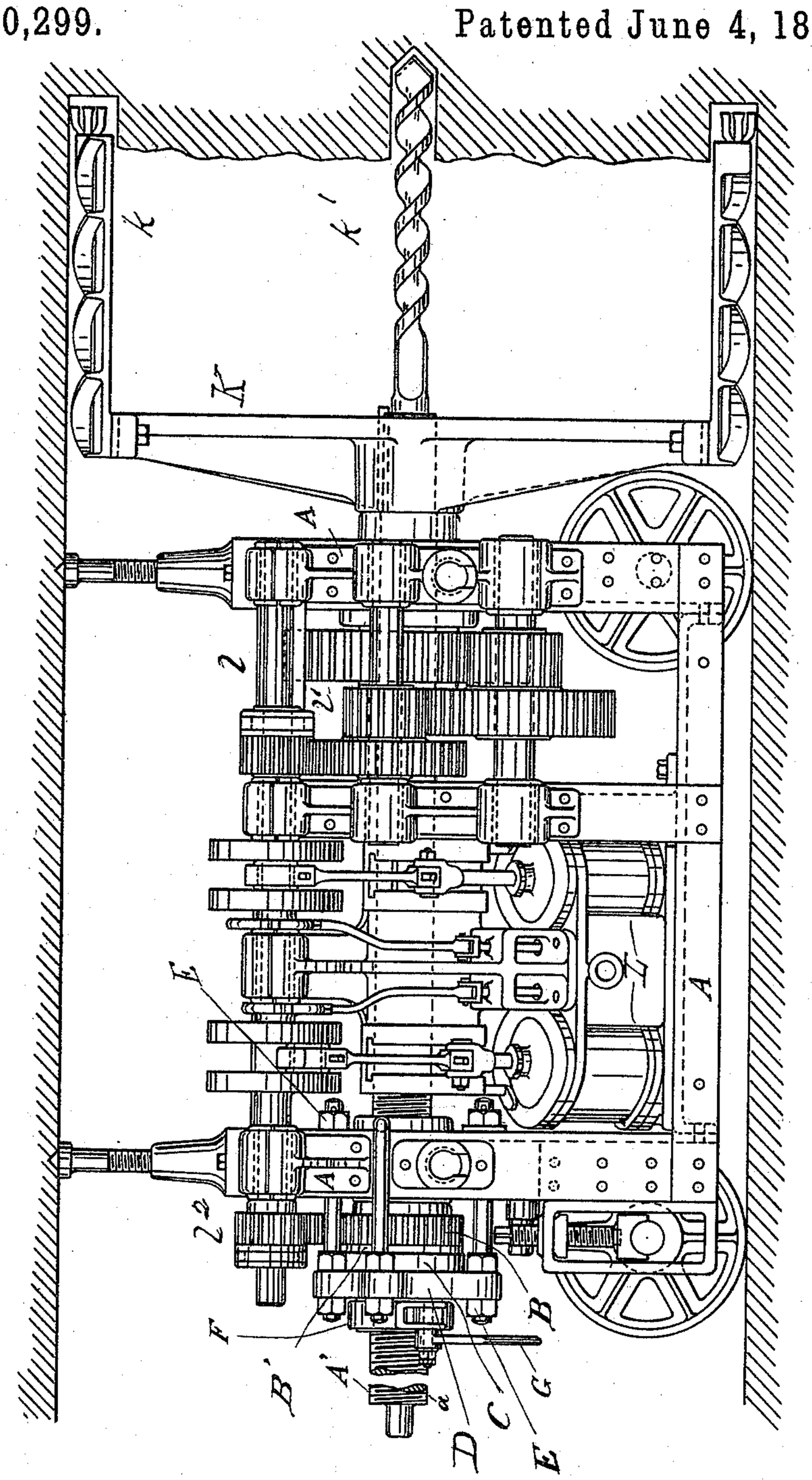

Fig. 1.

Witnesses
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John W. Brown

Inventors
Frederick K. Copeland
Walter Vielhaber,
By their Attorney
Charles H. Roberts.

(No Model.) 2 Sheets—Sheet 2.

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Fig. 2.

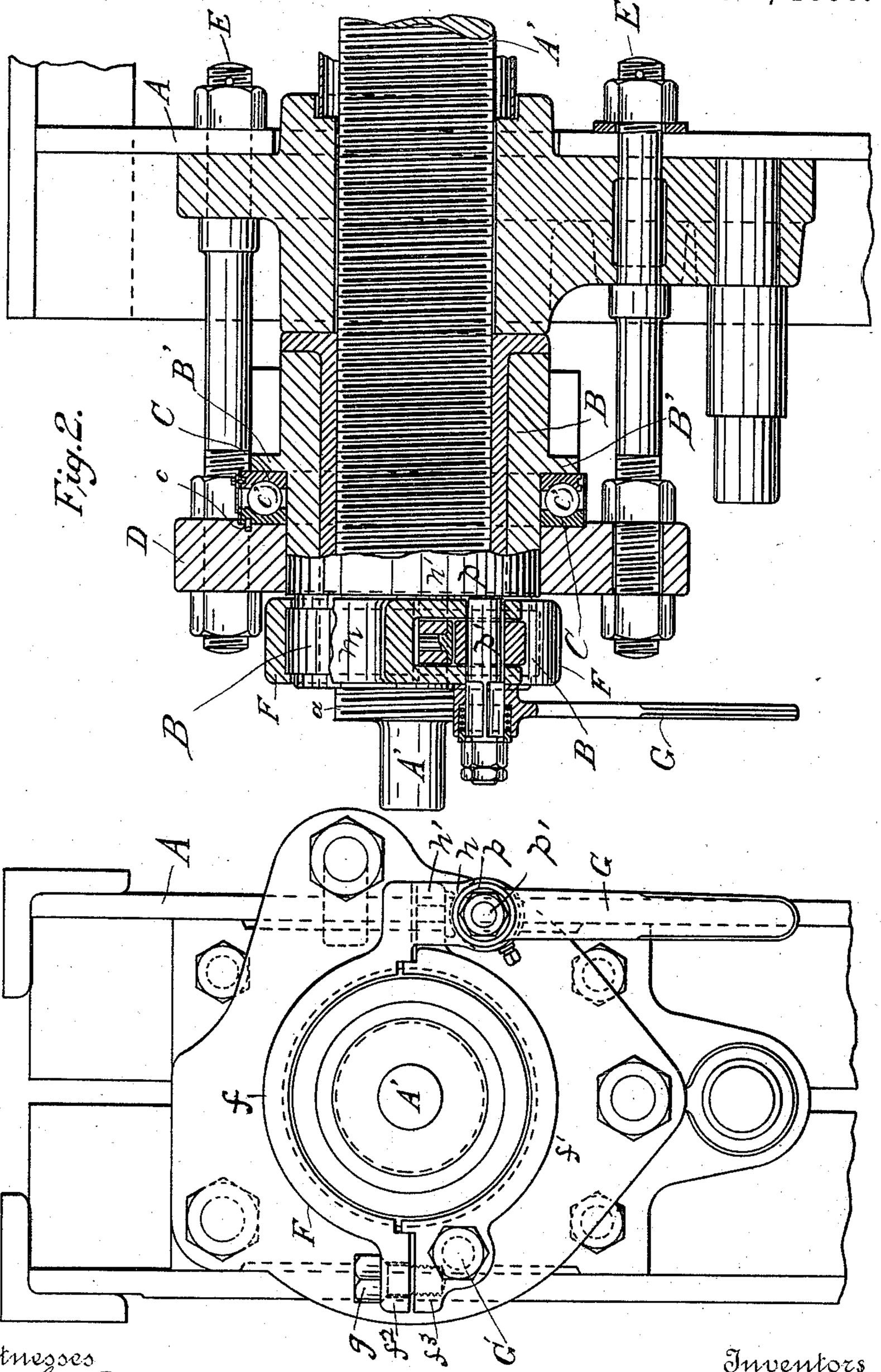

Fig. 3.

Witnesses
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UNITED STATES PATENT OFFICE.

FREDERICK K. COPELAND, OF WINNETKA, AND WALTER VIELHABER, OF CHICAGO, ASSIGNORS TO THE DIAMOND PROSPECTING COMPANY, OF CHICAGO, ILLINOIS.

AUTOMATIC FEEDING DEVICE FOR TUNNELING-MACHINES.

SPECIFICATION forming part of Letters Patent No. 540,299, dated June 4, 1895.

Application filed October 5, 1891. Serial No. 407,765. (No model.)

To all whom it may concern:

Be it known that we, FREDERICK K. COPELAND, a citizen of the United States, residing at Winnetka, and WALTER VIELHABER, a subject of the Emperor of Germany, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Automatic Feeding Devices for Tunneling-Machines, of which the following is a specification.

Our invention relates to the feeding forward of the cutter frame of tunneling machines of the type illustrated in Reissue Letters Patent, granted to Reginald Stanley, No. 11,333, dated May 9, 1893, in which there were employed a main frame held stationary during the cutting operation, and a cutter frame having a central threaded shaft mounted in the main frame and with which engines on the main frame engage by suitable gearing connections so as to rotate the shaft; and a nut supported on the main frame engaged with the threaded shaft so as to cause the forward feeding of said shaft and cutter frame through the rotation of the same. The ordinary coal in which these tunneling machines are most generally employed varies in density or hardness, arising from foreign matters contained in the coal, such as sulphur balls, which are extremely hard and liable to break the cutter, offering great resistance thereto, as well as other foreign substances. These are of course found at irregular intervals in the body of coal, and while for the cutting of ordinary coal the machine may be advanced rapidly without fear of injury to the cutters or mechanism, it is practically impossible for the operator to know when the machine first strikes any such hard body, and the result is that if the nut sustaining the strain on the cutter frame and transferring it to the main frame were held rigidly, a very heavy strain would suddenly be brought upon the machine, which would lead to the breaking either of the cutters, the gearing, or some other part thereof. It is therefore extremely desirable in this class of machinery that some means be employed providing for the rapid feeding of the cutter frame when encountering the ordinary resistance but permitting of the slow feeding or the cessation of feeding where the cutter frame encounters such hard objects; and the present invention has for its object the provision of such mechanism as specially applied to this class of tunneling machines.

It consists in certain improvements, in the braking mechanism employed in these tunneling machines to overcome the difficulties above referred to, as will be hereinafter more particularly set forth and claimed.

To enable others skilled in the art to make and use our invention, we will describe the same more fully, referring to the accompanying drawings, in which—

Figure 1 is a side view of an entry-driving or tunneling machine to which our improvements are applied. Fig. 2 is an enlarged sectional view through the threaded shaft and resistance-plate at the rear of the machine, illustrating the invention. Fig. 3 is an end view of the resistance-plate and brake supported thereon further illustrating the invention.

Like letters of reference indicate like parts in each.

In the drawings A is the main frame of the machine in which is mounted the rotary cutter frame K having the central threaded shaft A′ having the threaded surface *a*, the forward end of the cutter frame K being illustrated with the same cutter arms *k* and central auger *k′* as usually employed with said Stanley machine, the machine cutting a kerf for the full diameter of said cutter frame, and the main frame being anchored during the cutting operation and being drawn into the cut made by the cutter frame so as to prepare for a fresh cut thereof. It will be noticed that the engines L are mounted on the main frame and turn the engine shaft *l*, which, by a train of gearing not necessary to refer to separately, drives the gear wheel *l′* engaging with the threaded shaft A′ by a feather fitting within a groove. (Not shown.) At the rear end of the main frame is the resistance plate D which is supported from the main frame by the heavy bolts E, and mounted within this resistance plate is the nut B which engages with the threaded shaft A′ and acts to feed the same forward as said shaft is turned.

For certain purposes in such Stanley machines, as for instance the drawing forward of the main frame when the cutter is anchored, this nut B is provided with a geared face *b* and is rotated around the cutter shaft thereby, gear connections from the pinion l^2 on the engine shaft *l* being made when desired with such gear face *b* upon the nut B.

The nut B has an annular collar or shoulder B′ in front of the resistance plate D and between such shoulder and the resistance plate is the ball-bearing C, such bearing being employed to overcome the friction between the nut and resistance plate, so providing for the easy turning of the nut when desired, and for the entire control of the nut in feeding forward the cutter frame through the braking mechanism hereinafter described. The rear plate of this ball-bearing is attached to the resistance plate by a dowel pin *c*. By the employment of this ball-bearing in this position it will be seen that where the nut is left free to turn, as the friction between the nut and resistance plate is overcome by the ball-bearing and considerable friction is created between the threaded shaft and nut, the nut will normally turn with the threaded shaft so that there is no forward feed of the cutter frame through its shaft.

As above stated, the nut B has its main bearing in the resistance plate, and it extends through the same to the rear of such plate, and in the rear of such plate has the braking or friction surface *m*, and supported on said resistance plate D is the strap brake F which fits around the friction surface of the nut and holds the same from turning the result being that the feed of the cutter frame is regulated according to the friction applied through such brake to the nut. By means of such friction brake the nut is held from turning unless the friction of the threaded shaft upon the inner surface of the nut is so great as to overcome the friction of the strap brake thereon, in which case the nut turns within the brake, permitting the rotation of the cutter shaft, by the engines, but providing for a reduced forward feed, or if the obstruction is very great, the entire cessation of such forward feed.

The form of strap brake preferred by us is illustrated in the drawings, the brake being formed in two semi-circular sections *f*, *f′*, said sections being cast to shape, and therefore made of great strength and sufficient rigidity, and one section being mounted on the resistance plate D by the bolt G′ while the other section is loosely secured thereon by the bolt *g* passing loosely through a hole in one flange f^2 in one strap section and screwing into a flange f^3 on the other strap section. This bolt *g* provides for the adjustment of the two strap sections according to the desired friction between the brake and nut, and provides for the taking up of wear.

At the opposite end of one strap section *f* is the yoke *n* within which the lug *n′* on the other strap section enters, and mounted on the yoke *n* is the cam shaft *p′* carrying the cam *p*, said cam shaft being turned by the hand lever G. It will be seen that by the turning of said cam shaft and the cam thereon through the hand lever the two strap sections *f f′* of the brake may be caused to bear with varying pressures upon the annular friction surface *m* of the nut, and in that way the nut may be held by a strong frictional bearing to the resistance plate through the strap brake and enabled to resist the frictional action brought thereon through the pressure of the threaded shaft A′, with the result that the machine will be fed forward for the full length of the threads of the central cutter shaft A′ so long as the nut is held stationary by the strap brake.

The operation of the improvement may be briefly described as follows: Through the gearing connecting the engine and the central cutter shaft A′ that shaft is turned continuously. When it is desired to feed the cutter frame forward, the operator, through the hand lever G and the cam *p* turned thereby, causes the strap brake to bear with the desired frictional force upon the friction surface *m* of the nut, in which case, as the nut is held stationary against all ordinary force brought by the cutter shaft upon it, the cutter shaft and its frame are fed forward for the full thread of the shaft. If, however, the cutter frame strikes any sulphur balls or other substances offering extraordinary resistance this resistance is transmitted through the cutter frame and its shaft to the nut and sufficient friction created between the shaft and nut to overcome partially or entirely the frictional action of the strap brake upon the nut, so that the feeding action is either diminished while that shaft is turned, so enabling the machine to cut through such harder substance with a slower feed and less strain upon the cutters and cutter frame, or, if the resistance is too great, the feeding ceases and injury to the cutters and cutter frame or the gearing is prevented, so that the operator can stop the machine, and, if necessary, remove the sulphur balls or other hard substance by hand.

During this operation of the machine, as the natural frictional action between the nut and main frame is overcome through the ball-bearing C entire frictional control of the nut is obtained by means of the strap brake, and the operator can regulate such frictional control and the feed of the machine by the simple means of the hand lever, the machine according to the class of coal to be cut, whether soft or hard, being thus within the control of the operator.

In this class of massive and heavy machinery, by the employment of the sectional strap brake held from turning upon the resistance plate a sufficiently strong braking mechanism for sustaining all strains may be obtained, as the parts of the brake may be formed of strong castings, and the wear on such parts through the braking action may be provided for, if de-

sired, in the bodies of the two strap sections, this being of importance in providing for the durability of this part of the machine.

What we claim as our invention, and desire to secure by Letters Patent, is—

1. The combination of a main frame having a driving engine thereon, a rotating cutter frame having a horizontal axial threaded shaft mounted in the main frame and gearing between the engine and said shaft, a resistance plate supported on the main frame, a nut engaging with the threaded shaft and supported against and extending through the resistance plate and having an annular friction surface back of the same, a strap brake mounted on the resistance plate back of the same and fitting around the friction surface of the nut, and a hand lever controlling the strap brake, substantially as set forth.

2. The combination of a main frame having a driving engine thereon, a cutter frame having a horizontal axial threaded shaft mounted in the main frame and gear connections between the same and the engine, a resistance plate supported in the main frame a nut engaging with the threaded shaft and mounted on and extending through and bearing against the resistance plate the main frame, and a friction brake formed of two semi-circular sections, one section being mounted on the resistance plate and the other section supported loosely thereby, said strap sections fitting around the friction surface on the nut, and a hand lever controlling the friction of said strap sections on the nut, substantially as set forth.

3. The combination with a main frame, of a cutter frame having a horizontal axial threaded shaft mounted in the main frame and gear connections between the engine on the main frame and said shaft, the resistance plate D supported on the main frame, the nut B engaging with the threaded shaft and mounted in and bearing against the resistance plate, the strap brake F formed of two strap sections f, f', one section being mounted on the resistance plate by the bolt G', and the other section secured thereto by the bolt g, one section having a yoke n having a cam p mounted therein and the other section having a lug n' with which such cam engages, and a hand lever operating said cam, substantially as set forth.

In testimony whereof we affix our signatures in presence of two witnesses.

FREDERICK K. COPELAND.
WALTER VIELHABER.

Witnesses:
EDWIN H. KNIGHT,
THOS. L. DEE.