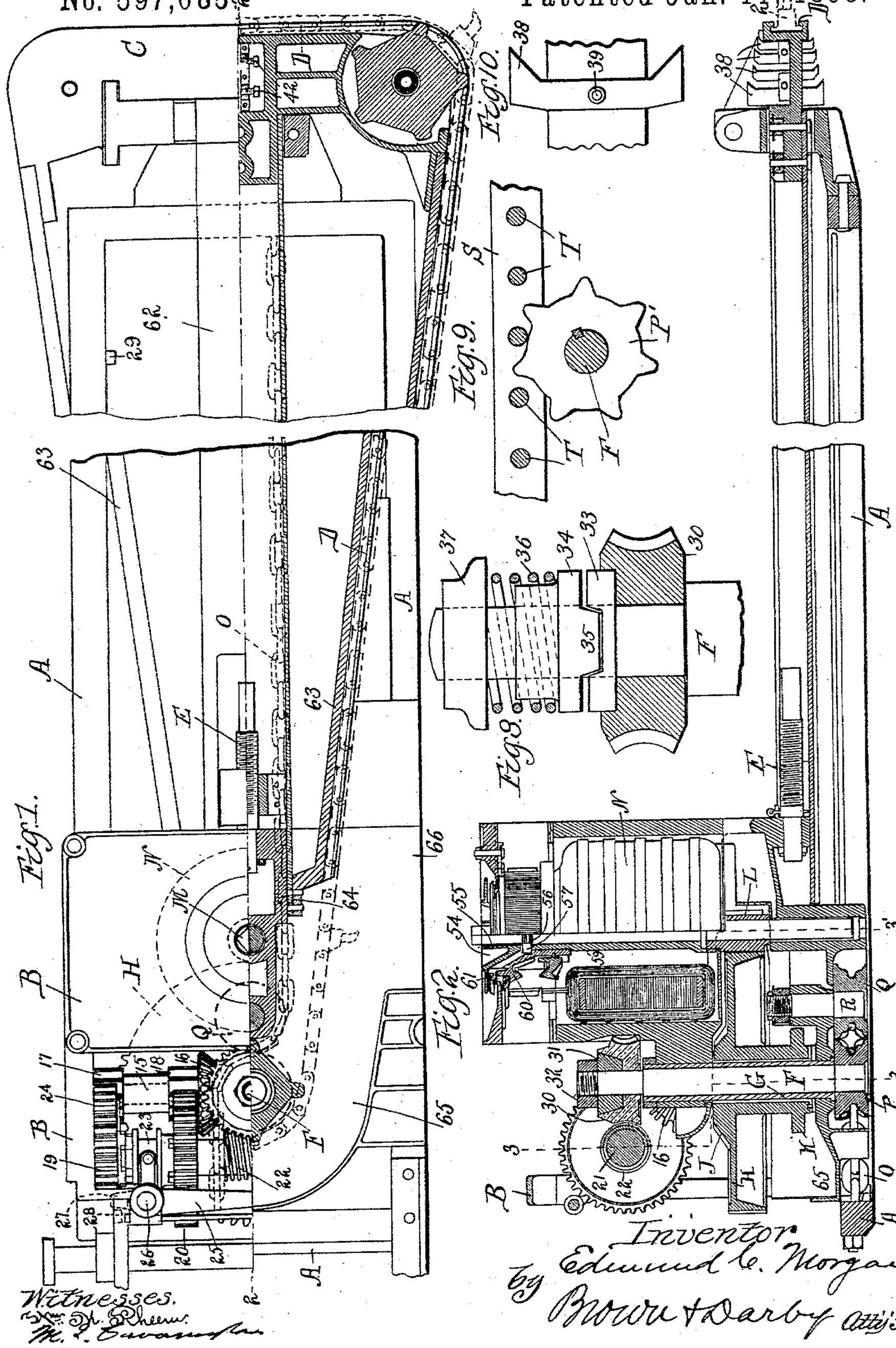
(No Model.) 2 Sheets—Sheet 1.

E. C. MORGAN.

MINING MACHINE.

No. 597,085. Patented Jan. 11, 1898.



(No Model.) 2 Sheets—Sheet 2.

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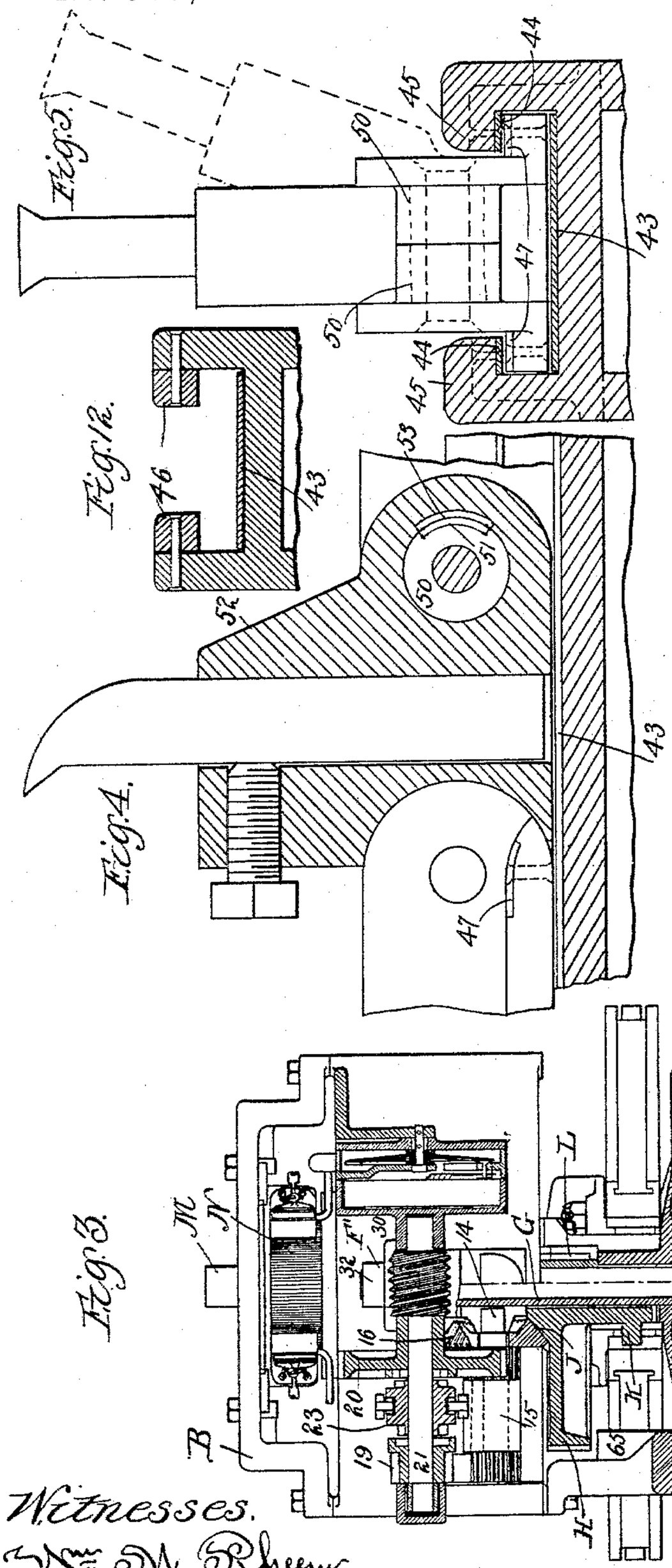

Fig. 12.

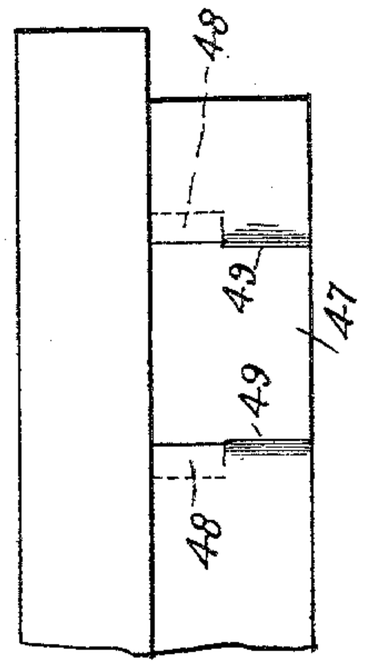

Fig. 7.

Fig. 4.

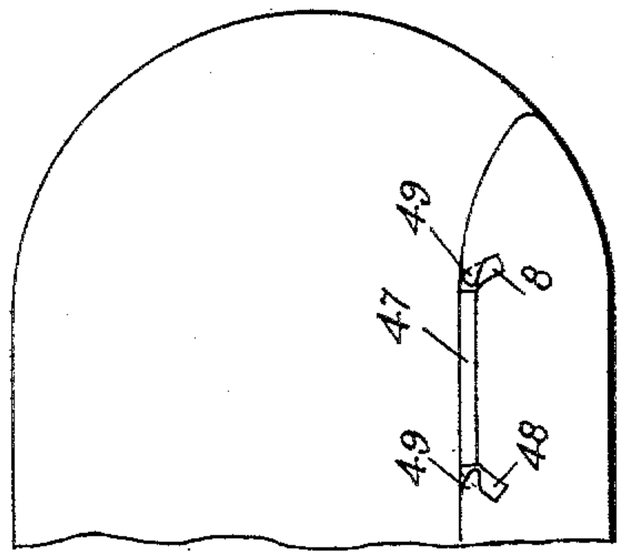

Fig. 6.

Fig. 3.

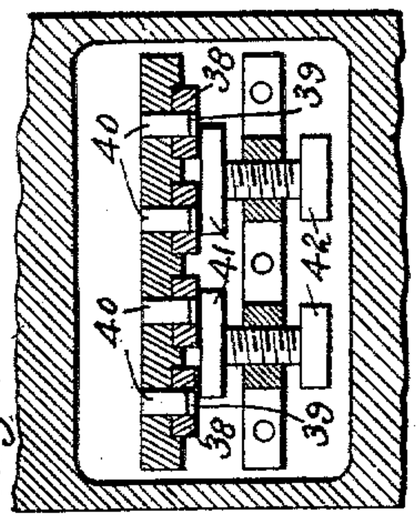

Fig. 11.

Witnesses.
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Atty's

UNITED STATES PATENT OFFICE.

EDMUND C. MORGAN, OF CHICAGO, ILLINOIS.

MINING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 597,085, dated January 11, 1898.

Application filed May 21, 1896. Serial No. 592,442. (No model.)

To all whom it may concern:

Be it known that I, EDMUND C. MORGAN, 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 Mining-Machines, of which the following is a specification.

This invention relates to mining-machines.

The object of the invention is to provide a mining-machine which is exceedingly simple in construction and operation, strong, durable, and efficient in action.

The invention consists, substantially, in the construction, combination, location, and relative arrangement of parts, all as will be more fully hereinafter set forth, as shown in the accompanying drawings, and finally specifically pointed out in the appended claims.

Referring to the accompanying drawings and to the various views and reference-signs appearing thereon, Figure 1 is a broken view, partly in plan and partly in horizontal section, of a mining-machine embodying the principles of my invention. Fig. 2 is a vertical central longitudinal sectional view of the same on the line 2 2, Fig. 1. Fig. 3 is a vertical transverse sectional view of the same, taken on the line 3 3, Fig. 2, part being on the line 3 3′, Fig. 2. Fig. 4 is a detached broken detail view, in longitudinal section, of the cutter-chain and its guide embodying features of my invention. Fig. 5 is a transverse sectional view of the same. Fig. 6 is a broken detached detail view, in side elevation, of a cutter link, illustrating a method of securing the wearing-plate therein. Fig. 7 is a plan view of the construction shown in Fig. 6. Fig. 8 is a broken detail view, in longitudinal section, showing a modified form of automatic safety-release for the cutter-frame-feeding mechanism. Fig. 9 is a broken detail view, parts being in plan and parts in horizontal section, of a modified form of cutter-frame-feeding mechanism. Fig. 10 is a detached detail view illustrating a form of guiding-cutter for preventing lateral vibration of the cutter-frame during the operation of the machine. Fig. 11 is a broken detail view, partly in plan and partly in horizontal section, illustrating the manner of supporting and clamping the guiding-cutters. Fig. 12 is a detached view in cross-section, showing a modified arrangement of guide for the chain cutter.

The same part is designated by the same reference-sign wherever it occurs throughout the several views.

In the drawings reference-sign A designates a suitable framework of convenient size and arrangement to support the working parts of the machine. Upon frame A is mounted a movable frame B, which I shall hereinafter designate the "motor-frame." Suitably bolted to the motor-frame B is the cutter-frame C, of suitable or any usual form, for supporting and guiding the cutter-chain D. Any suitable adjusting means may be employed for adjusting the motor-frame B and the cutter-frame C relative to each other in order to take up any slack in the chain cutter. I have shown a screw E for accomplishing this purpose.

Mounted upon the motor-frame is a vertical shaft F, which I shall designate "the main feed-shaft" and which is journaled to rotate in a sleeve G, which is suitably supported upon a convenient fixed part of the motor-frame B, as clearly shown in Fig. 2. Loosely mounted to revolve upon sleeve G is a large or master gear-wheel H, having peripheral or spur-gear teeth and having also formed thereon the bevel-gear teeth J and the sprocket-gear K. The spur-gear teeth of master-wheel H are arranged to be engaged by a spur-gear L upon the shaft M of a suitable motor N, which in the form shown (to which, however, I do not desire to be limited or restricted) comprises an electric motor, and whereby said master-wheel H is rotated continuously upon actuation of the motor. The chain cutter D is arranged to pass around and to be actuated by the sprocket-gear K, formed on the gear H.

The vertical shaft F constitutes the feed-shaft, by which the motor-frame and cutter-frame are moved upon the fixed or main frame A to advance the chain cutter to and from its work. This movement may be effected in a most simple and efficient manner by mounting a suitable sprocket-chain O in the main or stationary frame A to extend longitudinally thereof and arranged to pass around a suitable sprocket P upon feed-shaft F. In order to maintain an efficient engagement be-

tween feed-chain O and the sprocket P, I employ a guiding-sprocket Q and mount the same upon a pintle or stud R, adjacent to sprocket P, and arrange the feed-chain to pass partially around said sprocket Q and between the sprockets P and Q and then partially around the sprocket P in the opposite direction, as clearly shown in Fig. 1.

A simple and convenient manner of mounting the feed-chain O is to secure or anchor the ends thereof respectively in opposite ends of the main frame A, as shown. From this construction it will be seen that I provide an exceedingly simple and efficient feeding means for advancing the chain cutter to its work, and should a break occur in the feed-chain O it can be readily detached and a new one substituted therefor at comparatively small expense.

From the foregoing description it will be seen that when the feed-shaft F is actuated the sprocket P, mounted thereon to rotate therewith, will effect a feeding of the motor and cutter frames upon the stationary or main frame A by reason of its engagement with the feed-chain O.

Instead of employing a feeding-chain for the purpose of effecting a feeding of the motor and cutter frames I may, if desired, employ a rack. In Fig. 9 I have shown an embodiment of this idea, wherein I employ in place of the feed-chain O a rack-bar, as S, having pins T therein arranged to be engaged by sprocket P′ upon feed-shaft F.

I will now describe the means for rotating the feed-shaft F.

Reference-sign 14 designates a stud or pintle suitably and conveniently mounted in the motor-frame and upon which is mounted to revolve a sleeve 15, having cast therewith or formed thereon the bevel-gear 16 and the gears 18 17. The bevel-gear 16 is arranged to mesh with and to be driven by the bevel-gear J upon master-wheel H. The gears 17 18 are respectively arranged to mesh with and to drive gears 19 20, loosely mounted to revolve upon shaft 21, suitably journaled in the motor-frame B. Carried by and to rotate with shaft 21 is a worm or other form of gear 22, arranged to drive the shaft F, as will presently be more fully described.

Suitably splined to rotate with shaft 21 and arranged between the gears 19 20 is a sleeve 23, having clutch-teeth formed on the opposite faces thereof and arranged to engage similar teeth upon the adjacent faces of gears 19 20 when said sleeve 23 is shifted longitudinally upon shaft 21. By this construction either gear 19 or 20 may be clutched to shaft 21 to cause a rotation thereof. The engagement of gear 17 with gear 19 is through an intermediate idler 24 in a well-known manner in order to secure reverse rotations of shaft 21, according to whichever gear 19 or 20 is clutched therewith.

It will be observed that gear 20 is larger than the gear 19. The purpose of this is to secure a comparatively slow speed of rotation of feed-shaft F to feed the frame forward for the cutter to perform its work and a comparatively rapid feed when the cutter is fed away or is retracted from the cut. The sleeve 23 is shifted longitudinally upon shaft 21 in any suitable or convenient manner to clutch at will either gear 19 20 or to unclutch both said gears. I have shown a hand-lever 25 by which this movement of sleeve 23 may be effected at will. In order that when the cutter-frame has been moved to either limit of its travel the feed thereof may be automatically arrested or reversed, I provide the shaft 26, upon which lever 25 is mounted, with a projecting arm 27, arranged to engage lugs or shoulders 28 29 at the respective limits of travel of the motor-frame to effect an automatic unclutching or clutching of sleeve 23 with one or the other of the gears 19 20, whereby the feed is automatically arrested or reversed.

It will be observed that the sectional view, Fig. 3, is taken on different planes in order to more fully show the arrangement of the several parts.

I will now describe the arrangement of gearing whereby feed-shaft F is driven from shaft 21. The form of gearing shown for this purpose in Figs. 1, 2, and 3 comprises a gear-wheel 30, mounted to rotate loosely upon shaft F and arranged to mesh with and to be driven by gear 22 on shaft 21. The gear 30 is provided with preferably a conical seat in the upper surface thereof adapted to receive a similarly-shaped block 31, which may be of steel, wood, or other suitable material, and, if desired, covered or faced with rubber, leather, or the like to secure friction between the surface thereof and the inner wall of the socket or seat in gear 30. This block 31 is splined to rotate with but to move longitudinally upon shaft F, and a set-nut 32 may be employed to set said block 31 more or less tightly down into the seat in the face of gear 30. From this construction it will be seen that shaft F is driven through a friction-clutch, and hence, if the feed forward of the cutter-frame is opposed by an abnormal resistance, breakage of the parts is prevented by reason of the friction between block 31 and gear 30 yielding to such abnormal resistance; or, in other words, the friction between the contacting portions of the surfaces of block 31 and the seat in gear 30 is overcome, permitting said gear to rotate upon said shaft F, but without imparting rotation to said shaft until the impeding resistance is removed.

In Fig. 8 I have shown an arrangement for securing an automatic release of the feed, which, in many instances, I prefer to use. In this form of apparatus I suitably secure to or form with the gear 30 a block or plate 33, having a recessed upper surface, the walls of such recess being inclined, as shown, and I spline or feather up in shaft F a block 34, having a projection 35, shaped to correspond

with the recess in plate 33. By splining the block 34 to shaft F said block rotates with said shaft, but is capable of moving longitudinally thereon. A spring 36, interposed between said block 34 and an adjustable nut 37, serves to maintain said projection 35 seated in the recess in plate 33. By adjusting said nut 37 the tension of said spring is adjusted. The normal tendency of said spring 36 is to maintain the projection 35 in the seat or recess in plate 33, and hence to effect a coupling of gear 30 to shaft F. If, however, undue resistance to the advancement of the cutter-frame is encountered, the friction between the inclined surfaces of projection 35 and the walls of the seat or recess in plate 33 is overcome, and said block 34 is caused to move longitudinally upon shaft F against the action of spring 36 until the projection 35 is disengaged from the seat in plate 33, thereby effecting an unclutching of gear 30 from shaft F. The gear 30 will continue to revolve until the undue resistance is overcome or removed, and then when the projection 35 again registers with the recess or seat in plate 33 the spring 36 causes said projection to snap into said recess to cause a coupling up of gear 30 with shaft F.

In the practical operation of a chain-cutter coal-mining machine it is of importance to brace the cutter-frame against the lateral strains to which it is subjected during the cutting operation. I will now describe a construction and arrangement whereby this desirable object may be attained in a most efficient, simple, and economical manner.

In the extreme forward end of the cutter-frame and, preferably, midway the width thereof I mount a series of progressively-lengthening cutters 38, having cutting-edges formed on each of the forwardly-presented ends of each cutter. The extreme forward cutter of the series is arranged to have its cutting ends extend, respectively, slightly above and slightly below the top and bottom walls of the cut made by the chain cutter in order to cut a channel of shallow depth in both of said upper and lower walls as the cutter-frame is advanced longitudinally to its work, and the body of said cutter following the cutting edge thereof, entering the channel thus made, serves as a guide to relieve the cutter-frame of the lateral strains due to the operation of the chain cutter. The next succeeding cutter of the series projecting slightly beyond the path of the ends of the immediately preceding cutter deepens the channels made by such preceding cutter, and so on, until finally the channels are of sufficient depth to afford a firm bearing for the guiding-cutters to efficiently resist the lateral strains of the machine. In order to quickly adjust the guiding-cutters, I form in each cutter and centrally the length thereof, a perforation 39, adapted to receive a projection 40, formed on the cutter-frame, and the guiding-cutters are supported by the clamping-plates 41 and bolts 42, as clearly shown.

During the operation of the chain cutter the resistance of the coal to the passage of the cutters therethrough imposes severe friction upon the base and flanges of the guide or channel of the cutter-frame, it being understood that it is common to provide the cutter-frame with a channel-guide to receive the flanges of the links of the chain cutter. This continued friction rapidly wears out the base and flanges of the guide-channel, necessitating frequent stoppages for repairs. In order to avoid this trouble, and in an exceedingly simple, economical, and efficient manner, I provide in the base of the channel a strip or plate of hardened steel, as shown at 43, and arrange the same in the channel to extend around the forward end of the cutter-frame. In the same manner and for a similar purpose I also suitably secure a wearing-plate 44 upon the under surface of the flanges 45, forming the channel or guide in which the flanges of the chain cutter operate, as clearly shown in the drawings.

Instead of lining the under surface of the flanges 45 I may, and in some cases prefer, to form the entire flanges of strips of bearing material, as indicated at 46, thereby not only securing the objects sought—namely, of reducing the wear—but also facilitating the manufacture of the guide-frame.

During the operation of the cutters in the coal the links of the cutter-chain are tilted, owing to the resistance offered by the coal to the cutters, so that there is a tendency of the flanges of the links wearing away at the corners thereof by reason of the friction thereof against the flanges of the guide in which the chain moves, thereby speedily making the parts work loose and impairing the efficiency of the machine. In order to overcome and avoid this objection, I insert in the corners of the flanges of the links of the chain upon which this increased friction is imposed by the tendency of such links to tilt a bearing-plate 47 of suitable material, such as hardened steel. In Figs. 6 and 7 I have shown a simple and inexpensive method of inserting these plates, wherein I cast with or otherwise form in the links recesses having their ends curved down into the body of the flange of the link. The plates 47 are then slipped edgewise into these recesses. Each plate 47 is provided on the ends thereof adjacent to its inner edge with the flanges 48, suitably bent to receive the curved end portions of the seats. After these bearing-plates are inserted in the seats or recesses the outer portion of the overhanging wall of the recesses in which the end flanges or wings 48 are received are hammered or otherwise forced down, as indicated at 49, Figs. 6 and 7, thereby efficiently retaining the plates 47 in the recesses in the flanges of the link. In like manner it is the purpose of my invention to make provision against undue

wear and friction in the joints of the chain cutter. It will be understood that the friction in these joints effects a rapid wearing of the chain and speedily causes the chain to become loose and weakened. In order to obviate this difficulty, I provide the boss 50 of each link of the chain with a seat at that point thereof where the greatest friction occurs, and I arrange in such seat a friction-plate 51 of, say, hardened steel. In the same way and in order to coöperate with the friction-plate 51 I arrange on the adjacent wall of the cutter block or link 52 a similar steel plate 53. The friction of the meeting surfaces of the joints is thus imposed on the wearing-plates 51 and 53, thereby relieving the parts of the joints of undue wear. When the plates 51 53 are worn out, they may be readily removed and new ones substituted therefor.

I have specified that feed-shaft F is driven by any suitable form of motor N. I have also referred to the particular form of motor shown as an "electric" motor. When an electric motor is employed, it is important to supply lubricant to the bearings of the motor-shaft in such a manner that the lubricant will not get into and injure the insulation of the motor-windings. In order to accomplish this result, I provide an oil-receptacle 54, surrounding the motor-shaft bearing and communicating therewith through a perforated bushing 55. Upon the motor-shaft and arranged immediately below its bearings I form screw-threads 56, adapted to receive an annular ring or collar 57, which serves as a stop to prevent the lubricant from entering the windings of the motor. The ring or collar 57 is arranged at the base of an annular recess 58, which extends to the outer surface of the end of the motor and is formed between the armature-spider 59 and the commutator-spider 60. An annular threaded ring or collar 61, arranged at the end of the commutator-spider 60, serves to prevent the lubricant from entering and injuring the insulation of the parts at that point. The lubricant after lubricating the bearing for the motor-shaft encounters the ring 57 and is forced by centrifugal action out through passage 58 without entering the space occupied by any of the insulation of the motor.

In the construction of chain mining-machines as heretofore carried out it was customary for the center bar 62 of the cutter-frame to be connected to the movable motor-frame B through the adjusting-screw E in substantially the same manner as illustrated herein; but the side bars 63 as heretofore arranged have been without support, but merely extend rearwardly from the corners of the front end of the cutter-frame. The effect of such construction was to impose on the corners of the forward end of the cutter-frame undue strains by reason of the fact that the entire pressure by which the forward feed of the cutter-frame is effected to advance the cutter to its work, is in a line longitudinal with respect to the cutter-bar 62 of such frame, and hence in a line centrally the width of the cutter-frame, thereby having the corners of the forward end of the cutter-frame to withstand the severe strains imposed during the cutting operation without any bracing. In order to avoid this serious difficulty and thereby render the machine stronger, more durable, and less liable to be injured by the excessive strains to which it is subjected while in use, I rivet or bolt the rear ends of the side bars 63 of the cutter-frame to the center bar 62 of such frame, as at 64, thereby not only bracing the corners of the forward end of the cutter-frame, but also distributing the force applied to advance the frame longitudinally with the cut.

In order to prevent any dust or dirt being carried by the cutter-chain upon its return travel and deposited thereby in the path of the motor-frame during its withdrawal movement, thereby preventing said frame from being fully withdrawn or moved to the extreme rear end of the main or stationary frame, I provide a shield 65, over or upon which the chain cutter travels and which receives such dirt or dust until it is ejected from the machine at the side thereof, as at the point 66.

While I have shown and described a specific construction and arrangement of parts as illustrative embodiments of my invention, it will be understood that many changes and alterations would readily suggest themselves to persons skilled in the art and still fall within the spirit and scope of my invention. I do not desire, therefore, to be limited or restricted to the exact details of construction and arrangement shown and described; but,

Having now explained the object and nature of my invention and a form of apparatus embodying the same, and having explained the construction, function, and mode of operation thereof, what I claim as new and useful and of my own invention, and desire to secure by Letters Patent, is—

1. In a mining-machine, a main frame, a frame movably mounted on said main frame and carrying a cutter, a shaft mounted on said movable frame, a gear mounted on said shaft to rotate therewith, means engaged by said gear for moving said movable frame upon said main frame, a master-wheel mounted concentrically with but adapted to rotate independently of said shaft, means for rotating said master-wheel, and gearing engaged and driven by said master-wheel, and intermediate said wheel and shaft, for rotating said shaft, as and for the purpose set forth.

2. In a mining-machine, a main frame, a cutter-frame movably mounted thereon, a feed-shaft mounted on said cutter-frame, a gear mounted thereon to rotate therewith, means arranged to be engaged by said gear for moving said cutter-frame upon said main frame, a master-wheel loosely sleeved concentric with but adapted to rotate independently

of said shaft, gearing carried by said movable frame for rotating said master-wheel, means carried by said movable frame for actuating said gearing and gearing arranged to be engaged and driven by said master-wheel, and intermediate said wheel and shaft, for rotating said shaft, as and for the purpose set forth.

3. In a mining-machine, a main frame, a frame movably mounted on said main frame and carrying a cutter, a shaft mounted on said movable frame, a gear-wheel loosely mounted to revolve on said shaft, means carried by said movable frame for rotating said loosely-mounted gear, gearing intermediate said loosely-mounted gear and the shaft upon which said gear is mounted, and adapted to be actuated by said loosely-mounted gear, for driving said shaft, a sprocket-gear mounted on to rotate with said shaft, a guide-sprocket arranged in said movable frame in proximity to the sprocket-gear on said shaft, a chain fixed at one end in said main frame and arranged to be passed around said sprockets, whereby, when said shaft is actuated, said movable frame is moved upon said main frame, as and for the purpose set forth.

4. In a mining-machine, a main frame, a frame movably mounted thereon and carrying a cutter, a sleeve rigidly supported on said movable frame, a shaft journaled to rotate in said sleeve, gearing actuated by said shaft for moving said movable frame upon said main frame, a gear loosely mounted to rotate upon said sleeve, means carried by said movable frame for rotating said gear, and gearing engaged and driven by said loosely-mounted gear and arranged intermediate said gear and said shaft for rotating said shaft, as and for the purpose set forth.

5. In a mining-machine, a main frame, a frame movably mounted thereon and carrying a cutter, a sleeve rigidly supported on said movable frame, a shaft journaled to rotate in said sleeve, gearing actuated by said shaft for moving said movable frame upon said main frame, a gear-wheel loosely mounted to rotate upon said sleeve, means carried by said movable frame for rotating said gear-wheel and gearing including a frictional engagement, interposed between said gear-wheel and said shaft, and engaged and driven by said gear-wheel for rotating said shaft, as and for the purpose set forth.

6. In a mining-machine, a main frame, a frame movably mounted thereon and carrying a cutter, a shaft mounted on said movable frame and carrying a gear-wheel, means arranged to be engaged by said gear-wheel for moving said movable frame upon said main frame, a drive-gear loosely mounted to rotate upon said shaft and provided with a recess or seat, a sleeve mounted on to rotate with said shaft and adapted to be received in the recess or seat in said drive-gear, whereby said shaft is rotated through frictional engagement when said driving-gear is rotated, a master-wheel loosely mounted to rotate on said shaft, means carried by said movable frame for rotating said master-wheel, and gearing actuated by said master-wheel and intermediate said master-wheel and said drive-gear for rotating the latter, as and for the purpose set forth.

7. In a mining-machine, a main frame, a movable frame mounted thereon and carrying a cutter, a shaft journaled in said movable frame, a gear mounted on to rotate with said shaft, gearing arranged to be engaged and driven by said gear for moving said movable frame upon said main frame, a driving-gear loosely mounted upon said shaft and provided with a seat or recess, a sleeve mounted on to rotate with said shaft, but capable of movement longitudinally thereon, said sleeve adapted to be received in the seat or recess in said driving-gear, means for yieldingly maintaining the engagement of said sleeve with said seat or recess, a master-wheel loosely mounted to rotate upon said shaft, means carried by said movable frame for rotating said master-wheel and gearing actuated by said master-wheel, and intermediate said master-wheel and drive-gear for rotating the latter, as and for the purpose set forth.

8. In a mining-machine, a main frame, a movable frame mounted thereon and carrying a cutter, a shaft journaled in said movable frame, a feed-gear mounted thereon to rotate therewith, means arranged to be engaged by said feed-gear for moving said movable frame upon said main drive-gear loosely mounted upon said shaft and provided with a recess or seat having inclined walls, a sleeve loosely mounted on to rotate with said shaft, but capable of movement longitudinally thereon and provided with a lug or projection having inclined sides arranged to be received in the seat or recess in said drive-gear, means for yieldingly maintaining said lug or projection in said seat or recess, a master-wheel loosely mounted to rotate on said shaft, means carried by said movable frame for rotating said master-wheel and gearing arranged to be actuated by said master-wheel, and intermediate said master-wheel and driving-gear for rotating the latter, as and for the purpose set forth.

9. In a mining-machine, a main frame, a cutter-frame movably mounted thereon, a shaft journaled in said cutter-frame, a gear mounted on said shaft to rotate therewith, means arranged to be engaged by said gear for moving said cutter-frame upon said main frame, a master-wheel loosely sleeved upon said shaft, means for driving said master-wheel, sprocket-gears formed on said master-wheel, a chain carried by said cutter-frame and arranged to be engaged and driven by said sprocket-gears, and means actuated by said master-wheel for driving said shaft, as and for the purpose set forth.

10. In a mining-machine, a main frame, a cutter-frame movably mounted thereon, a shaft journaled in said cutter-frame, a gear

mounted thereon, means arranged to be engaged by said gear for moving said cutter-frame upon said main frame, a master-gear loosely sleeved to rotate upon said shaft, means for rotating said master-gear, a stud or pintle, mounted in said cutter-frame, a sleeve mounted to rotate upon said pintle and provided with gears at each end thereof, a counter-shaft having gears loosely sleeved thereon and arranged to be engaged by the gears on said sleeve, means for rotating said sleeve from said master-wheel, a movable clutch arranged to lock either of said gears to said counter-shaft at will, and means actuated by said counter-shaft for driving said first-mentioned shaft, as and for the purpose set forth.

11. In a mining-machine, a main frame, a cutter-frame movably mounted thereon, a feed-shaft mounted in said cutter-frame, means actuated thereby for moving said cutter-frame upon said main frame, a master-wheel loosely sleeved on said feed-shaft and having sprocket-gear mounted thereon, a chain cutter arranged to be engaged and driven by said sprocket, gearing actuated by said master-wheel for rotating said feed-shaft, including a clutch, and means for automatically shifting said clutch at the extreme limits of travel of said cutter-frame, as and for the purpose set forth.

12. In a mining-machine, a main frame, a movable frame mounted thereon and comprising a central bar and an end portion and oppositely-inclined side bars secured to said central bar at one end and to said end portion at the opposite end, a chain cutter arranged to operate upon said movable frame, a shaft also mounted on said movable frame and having a feed-gear thereon to rotate therewith, gearing arranged to be engaged by said feed-gear for moving said movable frame upon said main frame, a master-wheel loosely mounted to rotate upon said shaft, means carried by said movable frame for actuating said master-gear, and gearing actuated by said master-gear, and intermediate said master-gear and shaft for rotating the latter, as and for the purpose set forth.

13. In a mining-machine, a cutter-carrying frame, means for advancing the same to its work, in combination with stationarily-held guiding-cutters of progressively-increasing length, each cutter provided with cutting edges at each end thereof, arranged to cut a channel in the top and bottom walls of the cut made by the cutter; as and for the purpose set forth.

14. In a mining-machine, a cutter-carrying frame, means for moving said frame to advance said cutter to its work, a series of guiding-cutters of progressively-increasing length arranged with their ends projecting above the plane of the cut made by the cutters, and means for stationarily holding said guiding-cutters in said frame, as and for the purpose set forth.

15. In a mining-machine, a cutter, means for actuating the same, means for advancing and retracting said cutter toward and from its work, a stationarily-mounted guiding-cutter of a length greater than the width of the cut made by the cutter, and having the opposite ends thereof projecting above and below the path or plane of operation of the cutter, said guiding-cutter having a perforation arranged therein and centrally with respect to the length thereof, as and for the purpose set forth.

16. In a mining-machine, a cutter-frame, having lugs or projections formed thereon in the forward end thereof, means for moving said frame to advance the cutter to its work, a guiding-cutter having a perforation centrally the length thereof, adapted to receive said lug or projection and arranged to project above and below the path of the cut made by the cutter, as and for the purpose set forth.

17. In a mining-machine, the combination of an endless-chain cutter, means for actuating the same, means for advancing the cutter to its work, and a shield arranged at the rear of the cutter as a housing and within which said cutter operates, said shield adapted to receive the dust and dirt withdrawn by the cutter upon its return movement, whereby the actuating-gearing for said cutter is protected and the dust and dirt are ejected from the machine, as and for the purpose set forth.

18. In a mining-machine, a chain cutter provided with flanges and bearing-plates mounted in the corners of said flanges to receive the wear thereof, as and for the purposes set forth.

19. In a mining-machine, a flanged chain cutter having a recess in the corner of the flange thereof, and removable wearing-plates arranged in said recesses, as and for the purpose set forth.

20. In a mining-machine, a cutter-carrying chain having guiding-flanges, seats or recesses formed in such flanges and having the ends thereof curved into the body of such flanges, a bearing-strip provided with flanges adapted to be received in said recesses, said flanges arranged to be received in the curved ends of such recesses, as and for the purpose set forth.

In witness whereof I have hereunto set my hand this 18th day of May, 1896, in the presence of the subscribing witnesses.

EDMUND C. MORGAN.

Witnesses:
S. E. DARBY,
M. I. CAVANAGH.