No. 625,486. Patented May 23, 1899.

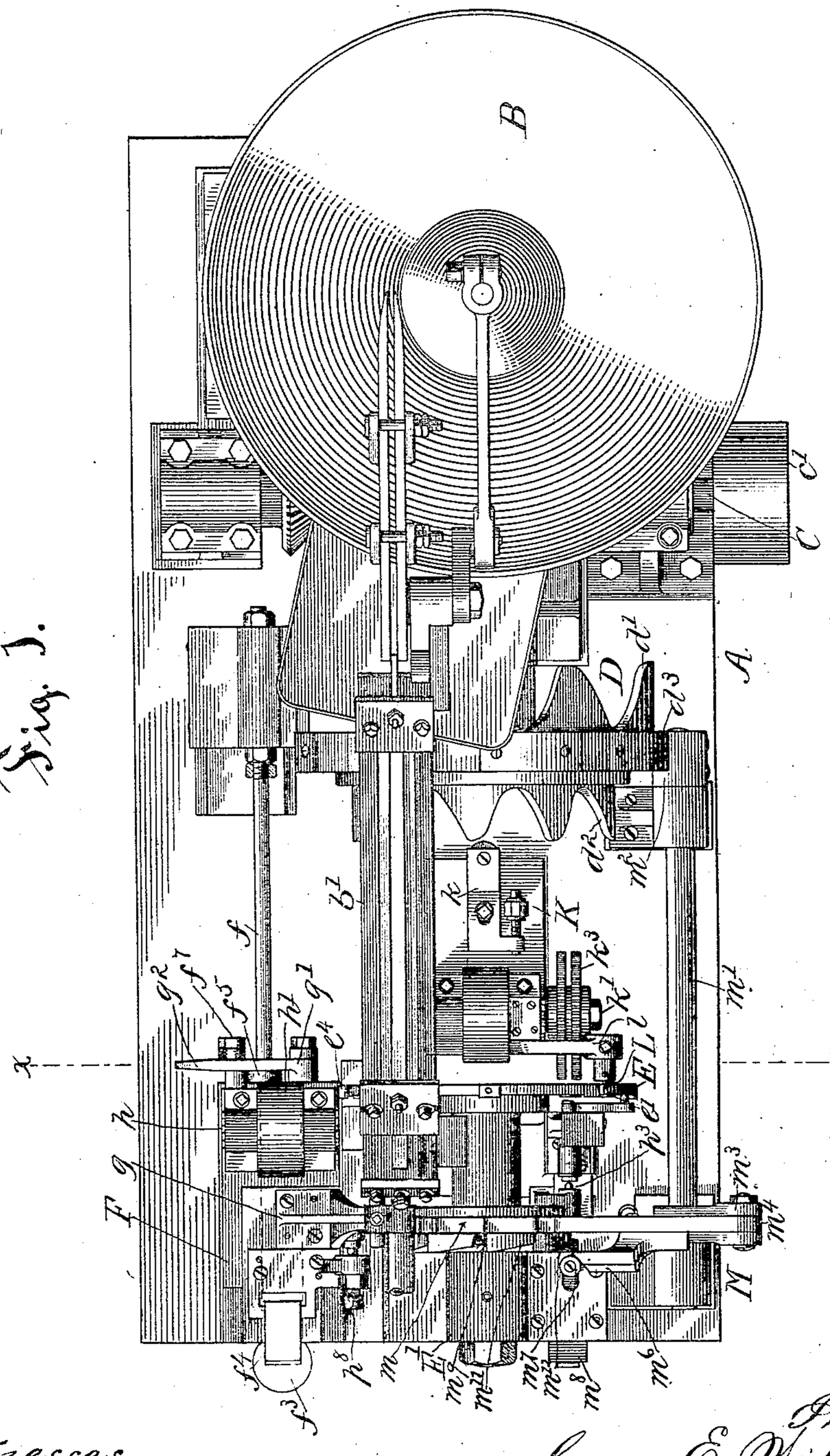
G. E. WITHERELL.

METAL WORKING MACHINE.

(Application filed Feb. 26, 1896.)

(No Model.) 7 Sheets—Sheet 1.

Fig. 1.



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(No Model.) 7 Sheets—Sheet 2.

Fig. 2.

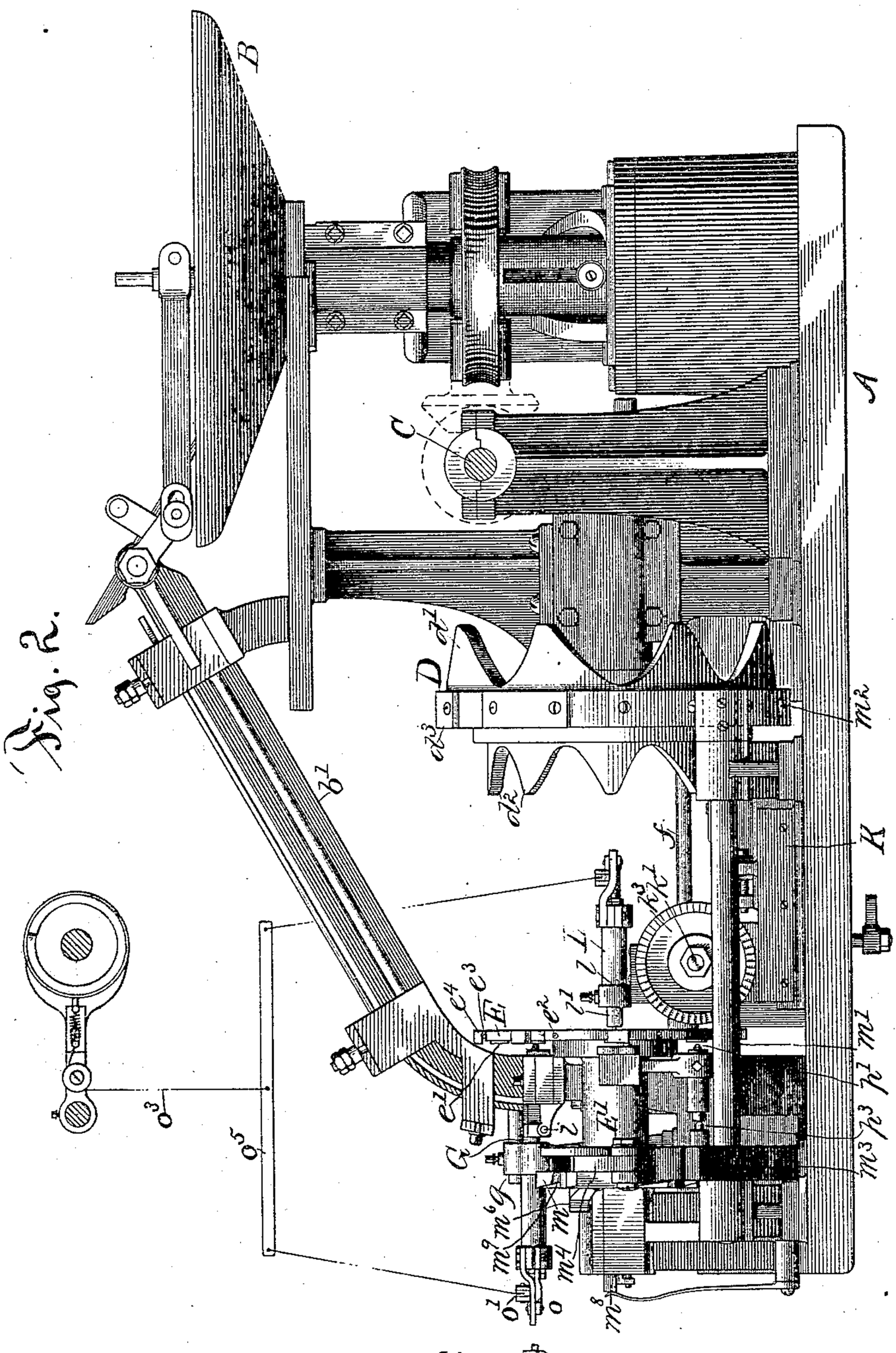
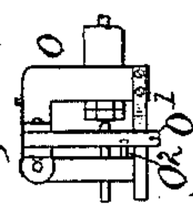


Fig. 14.



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(No Model.) 7 Sheets—Sheet 3.

Fig. 8.

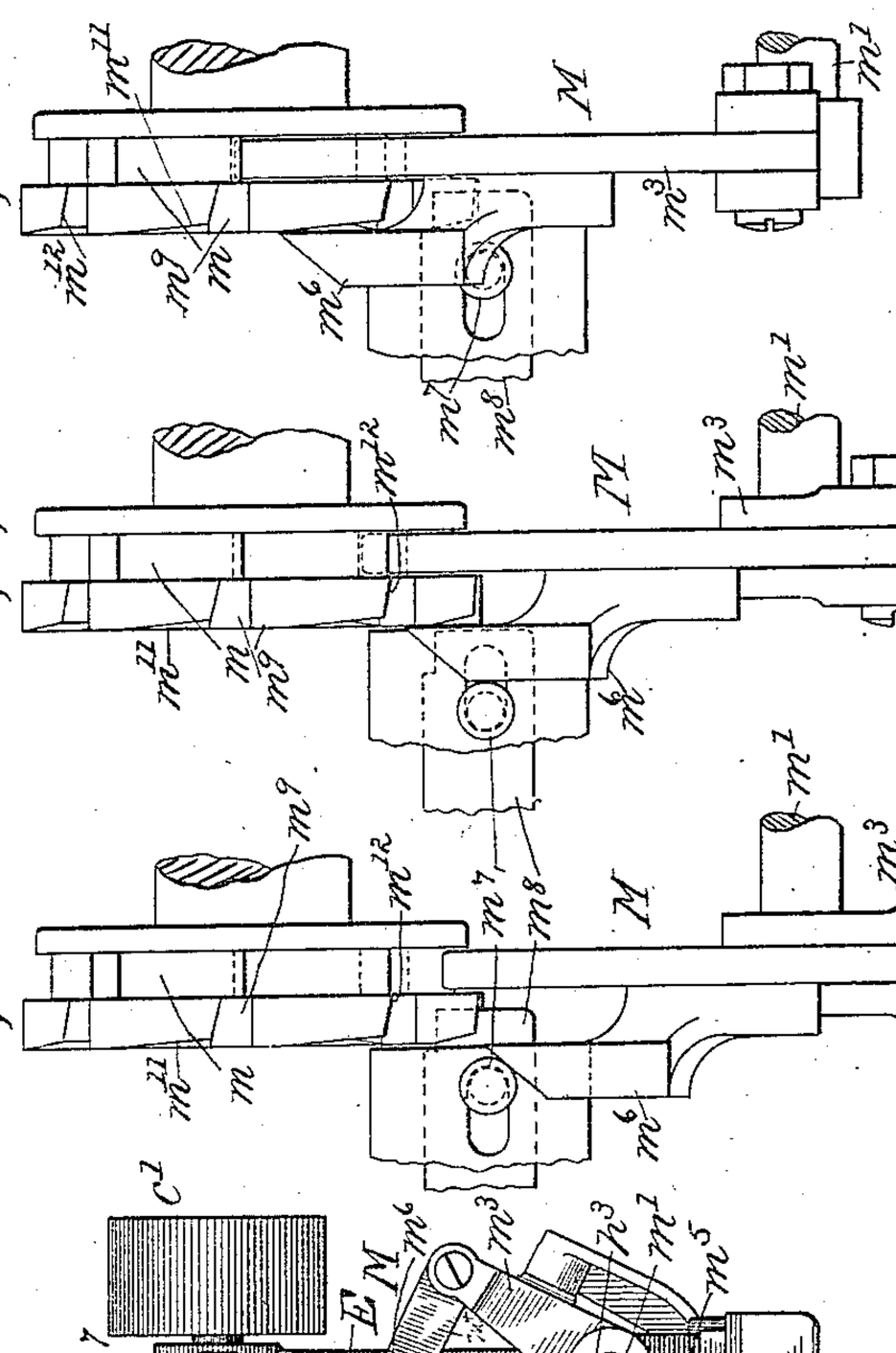
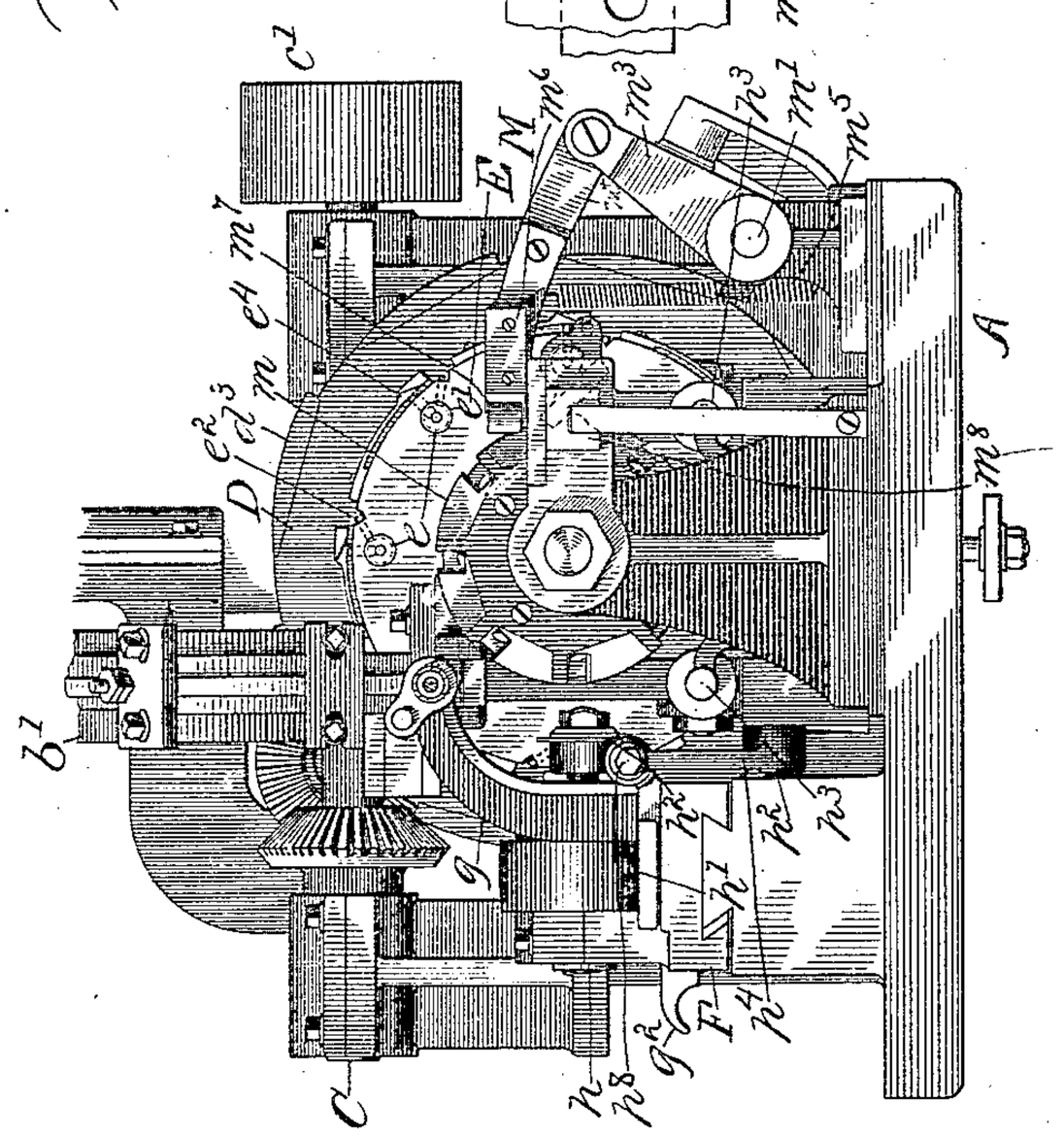


Fig. 7.

Fig. 6.

Fig. 3.



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(No Model.) 7 Sheets—Sheet 4.

Fig. 4.

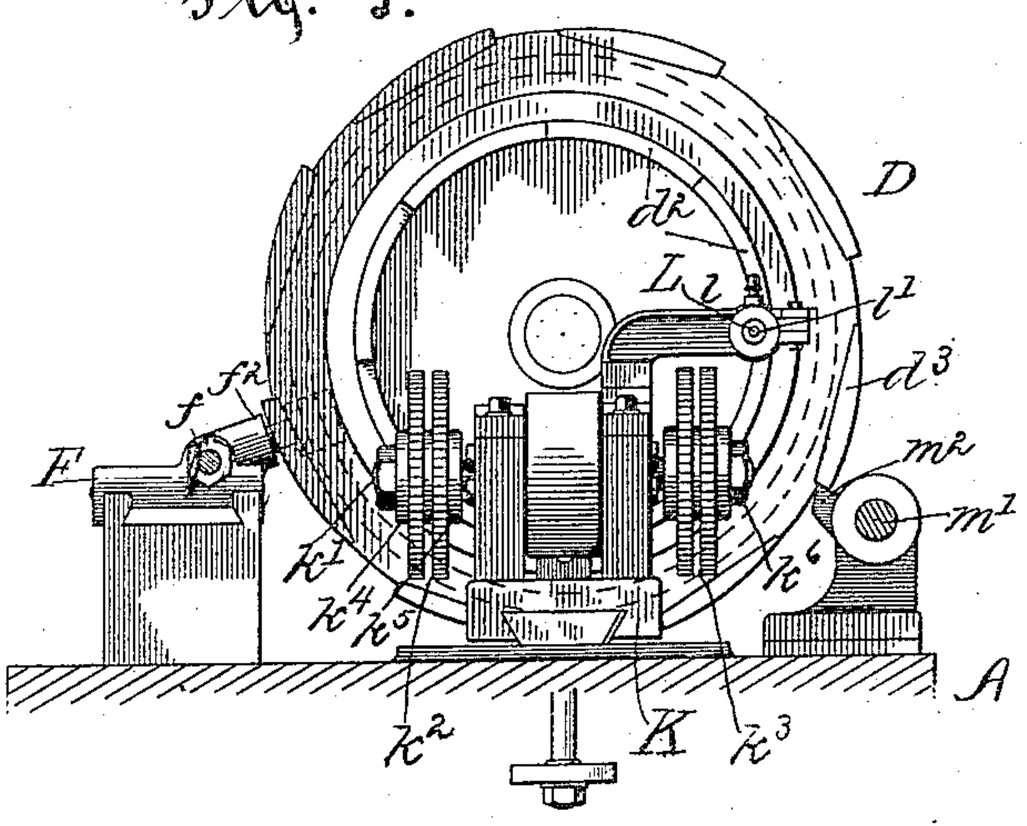
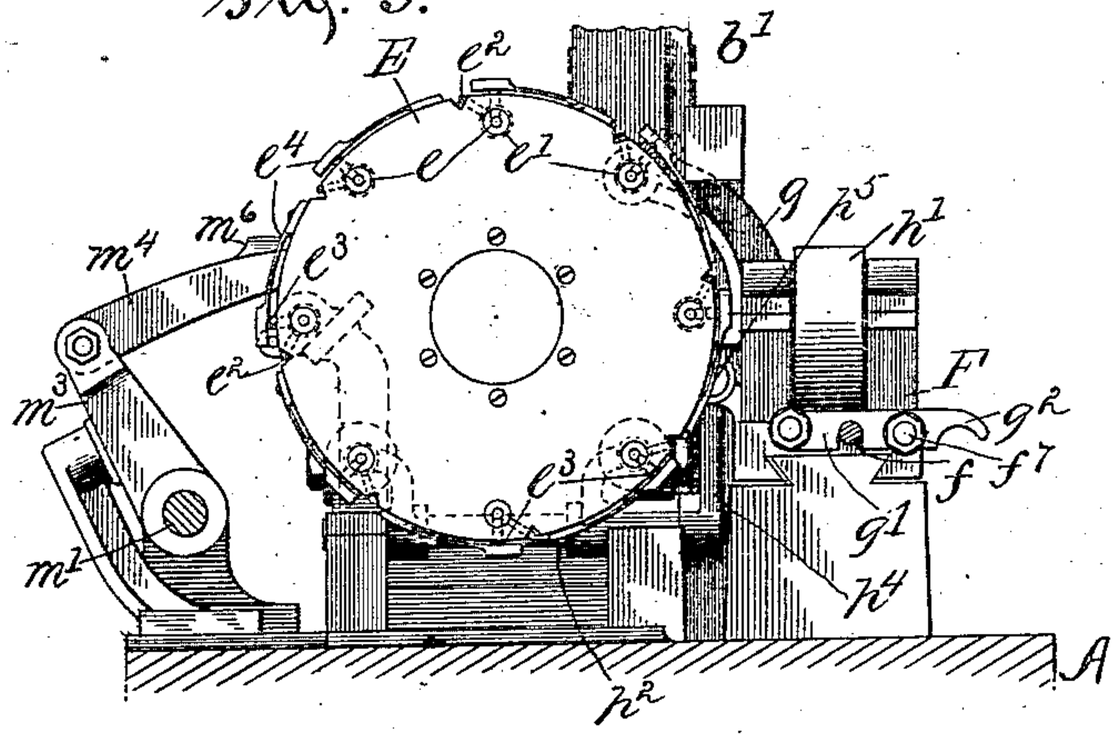


Fig. 5.



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(No Model.) 7 Sheets—Sheet 5.

Fig. 9.

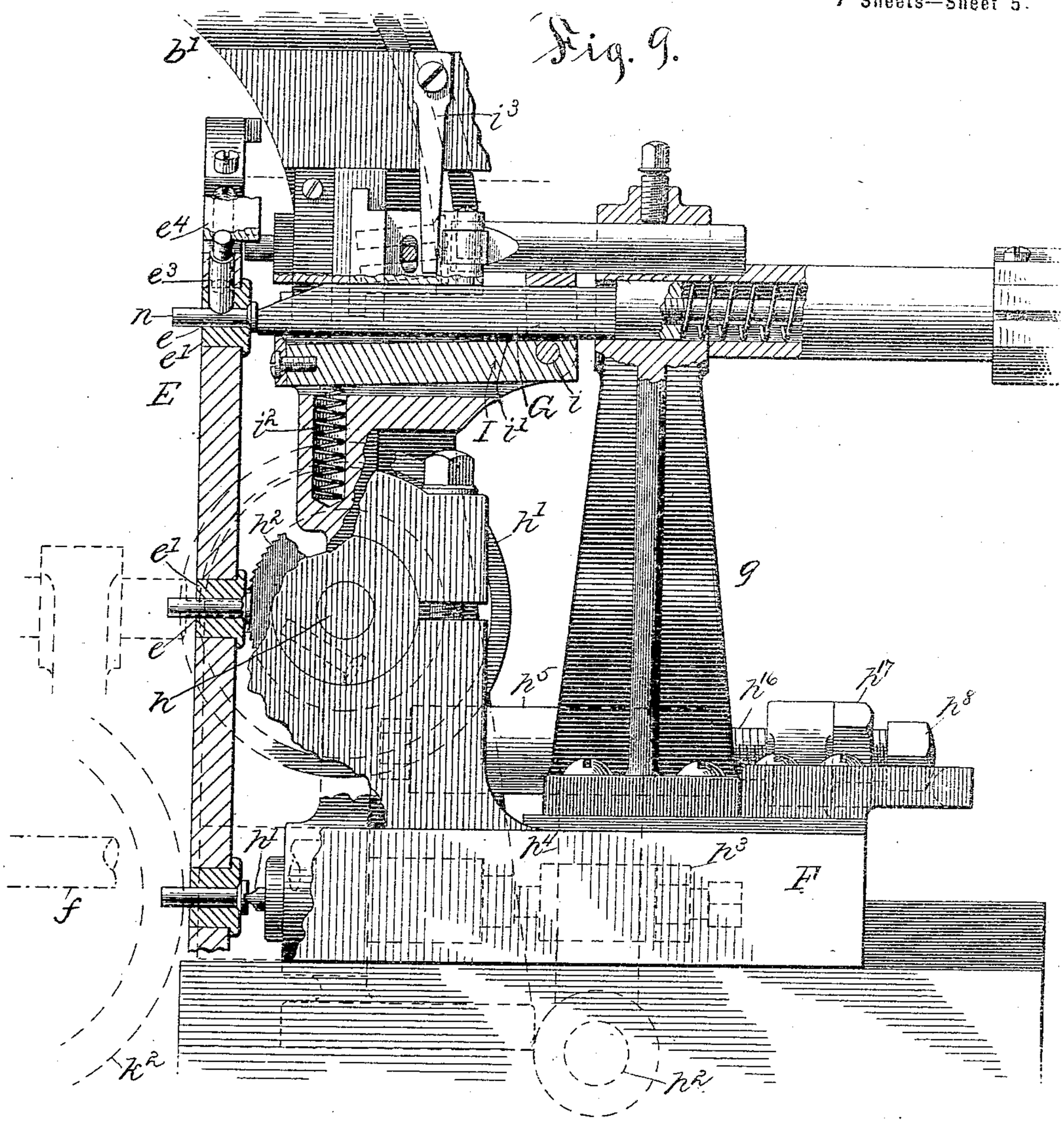
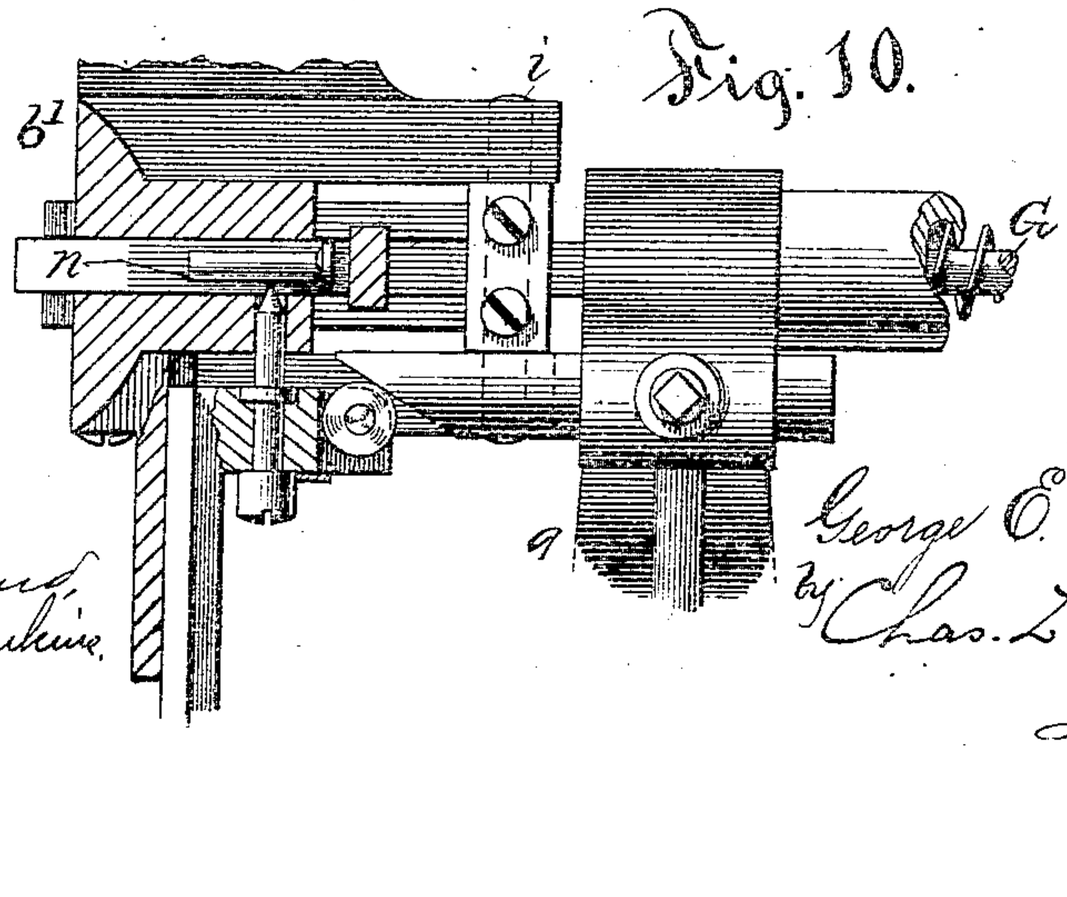


Fig. 10.



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METAL WORKING MACHINE.

(Application filed Feb. 26, 1896.)

(No Model.) 7 Sheets—Sheet 6.

Fig. 11

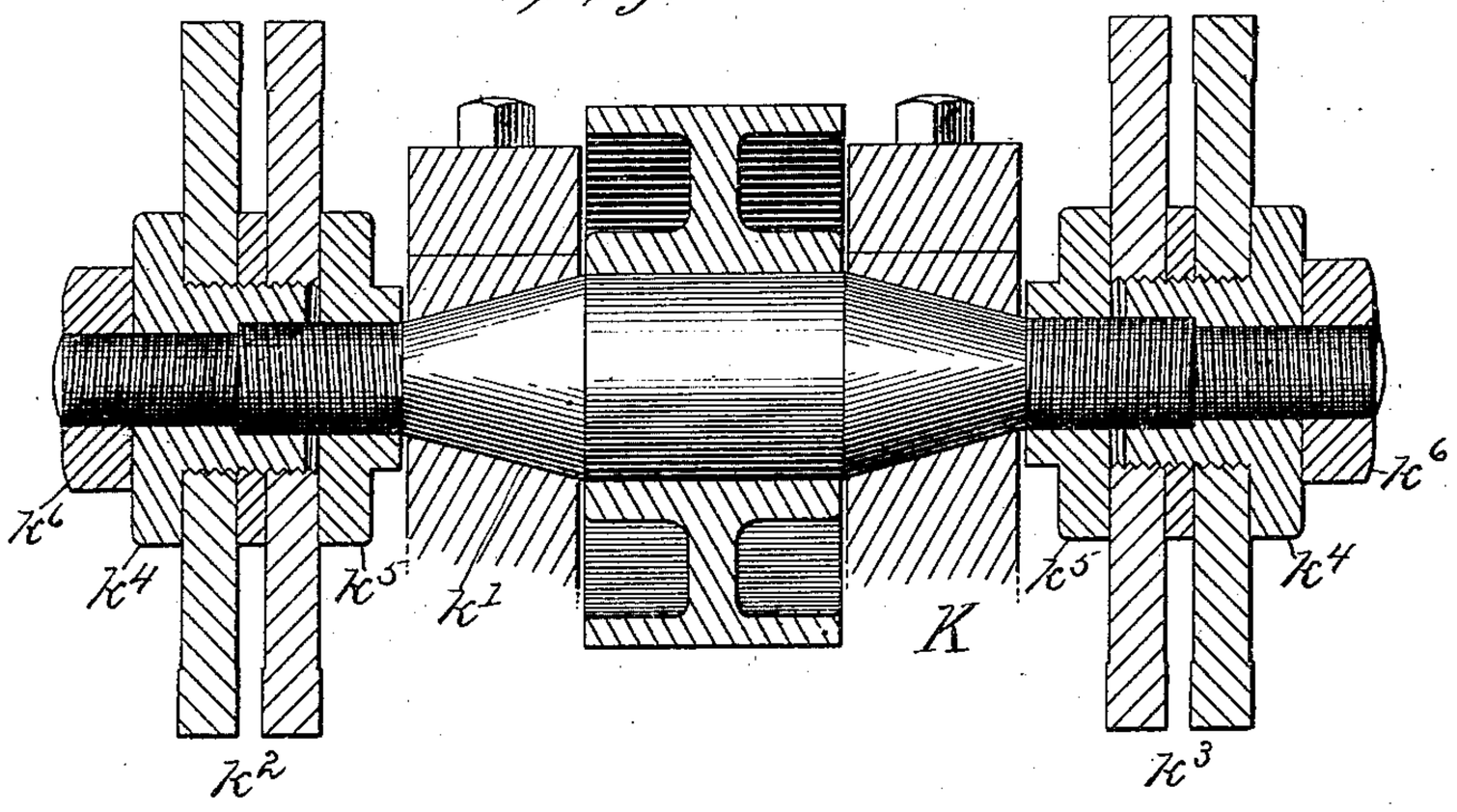

Fig. 12

Fig. 13

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METAL WORKING MACHINE.

(Application filed Feb. 26, 1896.)

(No Model.) 7 Sheets—Sheet 7.

Fig 15.

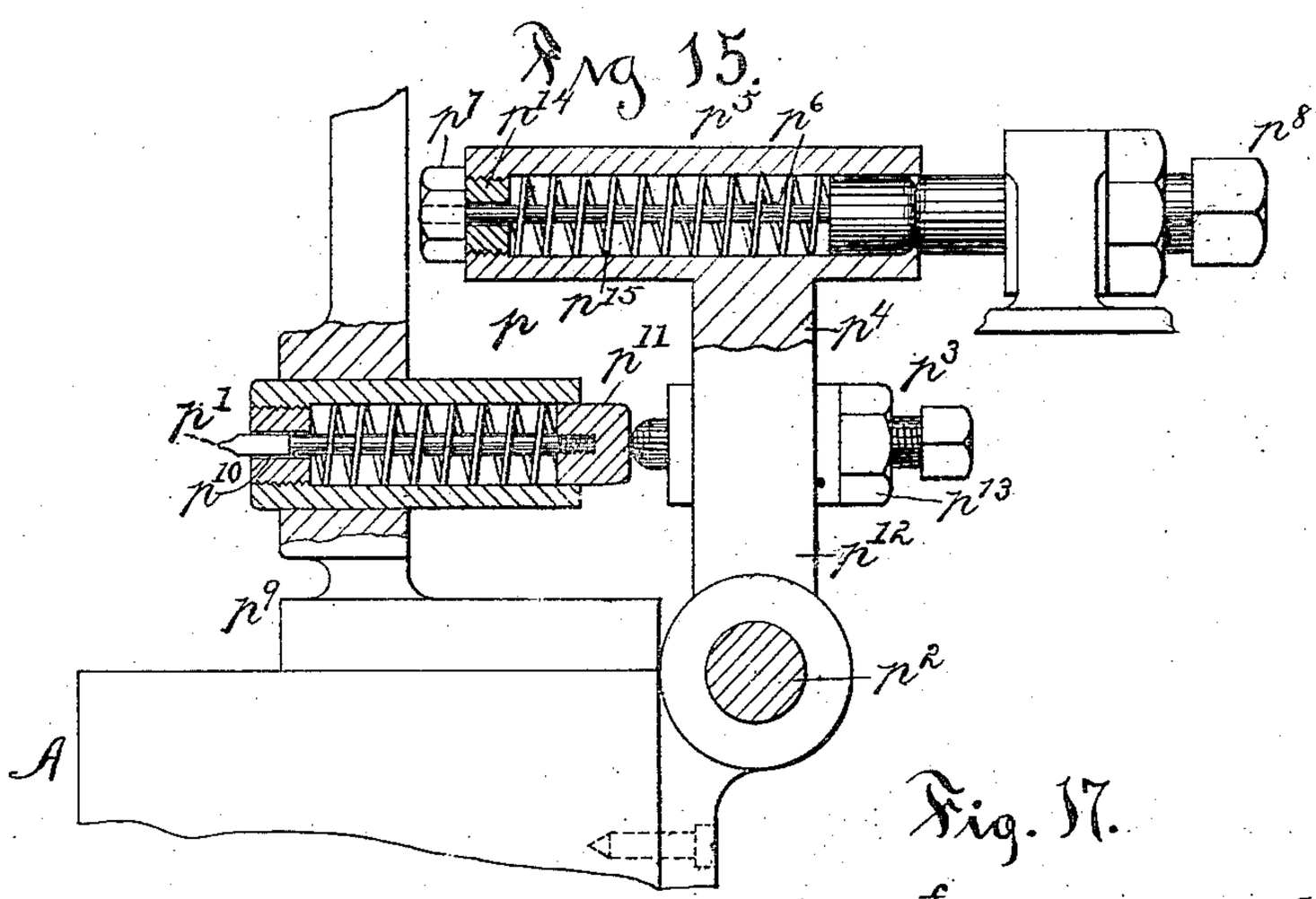


Fig. 17.

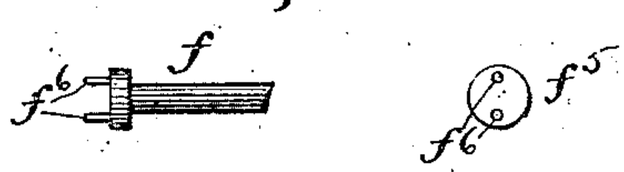
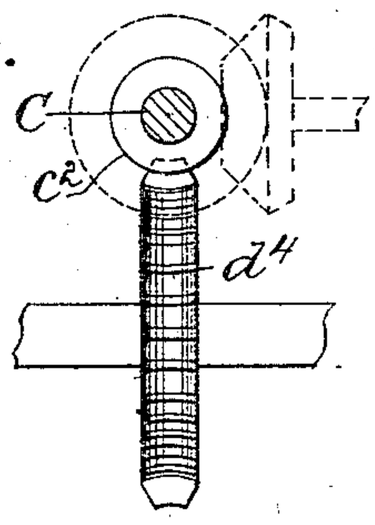


Fig. 16.



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UNITED STATES PATENT OFFICE.

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METAL-WORKING MACHINE.

SPECIFICATION forming part of Letters Patent No. 625,486, dated May 23, 1899.

Application filed February 26, 1896. Serial No. 580,870. (No model.)

To all whom it may concern:

Be it known that I, GEORGE E. WITHERELL, a citizen of the United States, and a resident of Hartford, in the county of Hartford and State of Connecticut, have invented certain new and useful Improvements in Metal-Working Machines, of which the following is a full, clear, and exact description, whereby any one skilled in the art can make and use the same.

My invention relates to the class of machines that are adapted to receive and automatically subject to one or more operations blanks which are fed into the machine at more or less regular intervals; and the object of the invention is the production of a machine of this class that will receive and hold a blank (usually for making a small article) while the several operations needed to change its shape are automatically performed.

My invention consists in the details of the several parts making up the combined mechanisms and in the combination of the parts, as hereinafter described, and more particularly pointed out in the claims.

There is hereinafter described a machine embodying my invention which is particularly constructed for automatically slotting and slabbing a nipple such as is used in the construction of a wheel for a bicycle or like vehicle, although the machine is not limited to the making of a single article, but is capable of adaptation to various uses.

Referring to the drawings, Figure 1 is a plan view of a machine embodying my invention with that portion of the mechanism bearing the stop-motion device broken off and removed. Fig. 2 is a view in side elevation of the machine. Fig. 3 is a view in end elevation of the machine with a portion of one of the stop-motion mechanisms broken off. Fig. 4 is a detail view, in transverse section, across the machine looking toward the mills and on plane denoted by dotted line x x, of Fig. 1. Fig. 5 is a detail view in section on the same plane, but looking toward the carrier-disk. Fig. 6 is a detail diagram view illustrating the ratchet-and-pawl mechanism in one position of the parts. Fig. 7 is a like view showing a succeeding position of the parts. Fig. 8 is a like detail view showing still another succeeding position of the parts. Fig. 9 is a detail view, on enlarged scale, in side elevation, of the feed-plunger and its support and in section through the blank-sockets in the carrier-disk, the line of section being parallel with the periphery of the disk, a portion of the positive blank-holding means being shown in dotted outline. Fig. 10 is a detail sectional view, on enlarged scale, of a portion of the feed-plunger mechanism, looking downward. Fig. 11 is a detail view, in central section, through the straddle-mill shafts, showing means for adjusting the relative position of the mills in each set with reference to each other and to the different pairs of mills. Fig. 12 is a detail view of a nipple-blank, showing it in side and end view. Fig. 13 is a detail view of the nipple after it has been slotted as to the head and squared as to the shank in side and in end view. Fig. 14 is a detail view showing the stop-motion mechanism. Fig. 15 is a detail side view of the positive blank-holding mechanism on enlarged scale, and with parts broken away to show construction. Fig. 16 is a detail view showing the connection between the driving and cam shafts. Fig. 17 is a detail view showing in side and end view that end of the connecting-shaft attached to the feed-carriage.

The object of my invention and the manner of its use are clearly brought out in connection with the within description of the embodiment of the several features of the invention in a machine for shaping a nipple, the particular operations being in this case the slotting of the head and the squaring of the shank. The nipple is a cylindrical article having an enlarged head and a central perforation, which is threaded to receive the threaded end of a spoke. The head is slotted for convenience in securing the nipple to the spoke in fastening a rim to the outer ends of the spoke; but in order to enable the proper tension to be put upon the spokes means are provided for turning the nipple after a tire is in place in the rim and without requiring the latter to be removed. For this purpose the inner or shank end of the nipple is squared or otherwise made of irregular shape, so that it may be grasped by a wrench, spanner, or like tool and rotated.

In the accompanying drawings the letter

A denotes the bed or frame of the machine, which is properly supported on a standard or legs, and B a hopper which may be of any convenient construction, but in this case is of the construction shown and described in United States Letters Patent previously granted to me, dated January 2, 1894, numbered 511,830.

A driving-shaft C is mounted in bearings on the machine, provided with a pulley c', driven from a counter-shaft, to which it is connected by belting in the usual manner. From this shaft the several mechanisms are driven.

A cam-wheel D is mounted in bearings on the bed, and its shaft bears a worm-wheel d^4, in mesh with a worm c^2 on the driving-shaft C. This cam-wheel is provided on one face with projecting cams d' and on the opposite face with a like series of cams d^2, both series being arranged to operate slides which support various parts of the mechanism. The periphery of the wheel bears also a set of cam projections d^3, that by contact with the rock-shaft of the ratchet mechanism serve to operate the latter at certain predetermined intervals of time.

E denotes a carrier-disk mounted in bearings E′ on the bed of the machine, the disk in this instance being adapted to rotate in a plane parallel to the plane of the cam-wheel and arranged at such distance from the latter as to afford space for the location between them of the mill-carriage and the ejector mechanism. The carrier-disk is provided with a number of blank sockets e, in this instance formed in bushings e', located in holes through the disk parallel to its axis and near the periphery, so that a binding-screw e^2, located in a socket in the edge of the disk, can be used to clamp the bushing in place.

A radial socket through the wall of the bushing and in line with one in the periphery of the disk is provided in which a clutch part e^3 is located, a spring e^4, secured to the edge of the disk at one end, thrusting with the other onto the outer end of the clutch part e^3 and tending to force the inner end into contact with the blank held in the socket. A lateral pin on the clutch part or a projection on the spring is arranged so that in the rotary movement of the carrier-disk it will encounter a cam on a fixed part of the machine, over which the spring rides and by means of which it is lifted, so as to open the clutch. The hold of the clutch is thus released at those times when a blank is being fed into or ejected from the socket; but at all other times the blank is held by the clutch with a grasp firm enough to prevent movement while being subjected to the several cutting operations. The carrier-disk is given a step-by-step rotary movement, provision being made for locking the disk at each pause to enable the several operations of feeding, slotting, slabbing, and ejecting to be simultaneously performed by the several mechanisms.

A feed-carriage F is mounted on slideways on the bed in such manner and by such ordinary means as to enable it to be given a reciprocating movement across the plane of the carrier-disk, and it is moved by means of a connecting-rod f, the end of which bears an arm f^2, held in yielding contact with the cams d' on the cam-disk by means of a counterpoise device, preferably consisting of a weight f^8, secured by means of a strap f^4 to the carriage F. The end of the rod f, connected with the carriage F, has a shoulder f^5, on which are pins f^6, fitting sockets in the carriage. A retaining-lever g' is pivoted at one end on the carriage, the opposite end having a handle g^2. This retaining-lever is located in position to swing downward, so that the shoulder f shall lie between the lever and the carriage, and thus form, in connection with the pins f^6, a means of securing the connecting-rod f to said carriage. Sockets are preferably formed in the under side of the lever, overlying the rod f and a post f^7 on the carriage, the latter bearing suitable means, as nuts, forming shoulders, for clamping the lever in its lowermost position. In the use of the machine it is found necessary to frequently disconnect the rod f from the carriage F, and the object of this construction between the parts is to afford means whereby said parts may be disconnected without disturbing the adjustment of the rod f, obtained by means of the nuts on its outer end.

In each instance in this machine where parts are held together with a yielding pressure a counterpoise-weight is preferred, for the reason that in such a device the pull is constant and can readily be adjusted by varying the weight; but of course the equivalent device of a tension-spring may be used.

On a bracket g on the feed-carriage a feed-plunger G is supported, the front end of the plunger being adapted to enter a receiver located in the path of movement of the plunger and to push out from the receiver a blank which has been fed into it from the delivery end of the feed-slide b', which extends from the hopper B. The feed-carriage also supports a cutter-spindle h, mounted in suitable bearings, the spindle being driven by means of a belt from a counter-shaft passing around a pulley h' on the cutter-spindle, and on the outer end of the cutter-spindle a thin cutter or saw h^2 is located, with its plane in line with or parallel to the axis of a blank held in a socket in the carrier-disk, so that when the cutter moves forward toward the disk it will cut a slot transversely of the head of the nipple, (or of the other part held in the carrier-disk.)

At each pause in the rotary movement of the carrier-disk an empty socket is located directly opposite the chamber in the receiver I and in line with the feed-plunger G, so that a blank n may be thrust into the socket by the forward movement of the plunger. The receiver I is a block mounted on a bracket

fixed to the frame, the block being supported by means of a pivot *i* at its outer end, a chamber *i'* in the upper side of the receiver being open on top and ends, so as to receive the blank, the plunger, and to allow the delivery of the blank. When the blank, as in the present instance, has a head portion larger in diameter than the shank portion, the blank will naturally rest in the chamber in the receiver, with its axis out of alinement with the axis of the socket in the carrier-disk, and to obviate this a lip is secured to the forward end of the receiver, extending above the bottom of the chamber *i'* a distance equal to the extent of projection of the head of the blank beyond the shank. To enable the blank to be thrust into the socket in the cam-disk without obstruction by contact of the head of the blank with the lip on the receiver, the latter is pivoted so that its inner end will be thrust downward by contact of the head with the beveled inner surface of the lip and allow the passage of the blank into the socket in the cam-disk. The spring i^2, underlying the forward end of the receiver, returns it to proper position, with its upper edge resting against an adjustable stop i^3, that determines the position of the receiver to insure the delivery of the blank into the socket in the cam-disk. In order to further aid the fitting of the blank into it, the socket is countersunk and is also beveled off on one side transversely. The forward-feeding movement of the plunger carries the blank into place in the socket and at the next pause in the rotary movement of the disk it stops in the plane of the cutter h^2, so that when the feed-slide F next moves toward the plane of the disk another blank is fed into the socket next in rear, while the saw or cutter h^2 forms the slot in the head of the first blank, the clutch at that time being in operation to hold the blank firmly in place in the socket.

The mill-carriage K is mounted on the bed of the machine and has a reciprocating movement in line with or parallel to the axis of the carrier-disk. It has a projecting arm *k* in contact with the cams d^2 on the cam-wheel, and it supports a mill-spindle *k'*, on the outer ends of which are supported the straddle-mills k^2 k^3, arranged in pairs. The mills in each pair are arranged at the proper distance apart to slab the sides of the shank and leave it of the proper diameter, and the distance between lines located centrally in the space between the mills of each pair corresponds precisely to the distance between the axes of two of the blanks held in alternate sockets in the carrier-disk. When so arranged, the mills when moved forward toward the disk operate to slab two different blanks simultaneously. The blank which is in one position slabbed by the mills k^2 in a subsequent position of the carrier-disk is slabbed on other faces by the mills k^3.

The mill-spindle *k'* is shouldered at its outer ends, each reduced end having a screw-thread running in opposite direction to the screw-thread located on the larger part of the spindle at each end. A flanged support k^4 is secured upon the smaller end of the spindle, and on this support are secured the straddle-mills by means of interengaging screw-threaded parts. An adjusting-nut k^5 is borne upon the larger threaded end of the spindle and a lock-nut k^6 upon the smaller threaded end of the spindle. By means of this construction the mills upon each end of the spindle may be adjusted to any desired degree with reference to each other and so secured in place that in the operation of the mills none of the screw-threaded interengaging parts will become loose.

In the particular embodiment of my invention in the machine described the sockets are so arranged in the disk that radial lines drawn through alternate sockets are located at right angles to each other, so that the flat surfaces formed in slabbing off a nipple in its first position, where it is operated upon by the mills k^2, are located at right angles to the plane of the surfaces which are formed by the slabbing operation of the next set of mills k^3, this change in the plane of the surfaces being accomplished by the rotary movement of the carrier-disk. It is obvious that this same idea may be embodied in a disk having sockets so located that the surfaces formed by the slabbing operation of the cutters may bear a different relation to each other, and instead of cutting the shank to surfaces at right angles with each other a hexagonal, octagonal, or other polygonal form of figure may be formed, the same idea, however, of the angular relation of sockets located on radial lines on the disk being carried out in each form of the device. The mill-carriage K also supports an ejector L on a bracket *l*. The ejector is a pin or rod borne in a plunger *l'* and held at the outward limit of its play in a socket and by spring-pressure. When the blank is so tightly held that the ejector cannot thrust it out of the socket, the latter is thrust backward and its outer end encounters the trip of a stop device, by the operation of which the power is thrown off and the machine stopped. This trip device is similar in construction to the trip device used in connection with the plunger-feed, and both will be hereinafter described as to details.

The rotary movement of the carrier-disk is imparted by a ratchet mechanism M, which includes a series of ratchet-teeth *m*, formed on the edge of the carrier-disk or on a disk secured thereto. A rock-shaft *m'* is mounted in bearings on the frame and has an arm m^2 arranged to project into the path of movement of the cam projections d^3 on the cam-wheel D, so that in the rotation of the cam-disk a rocking movement is at suitable intervals imparted to the rock-shaft. On the rock-shaft is secured an arm m^3, to the upper end of which the pawl m^4 is pivoted. The pawl is normally located at about right angles

to the arm m^3, and a spring m^5, connected at one end to the pawl and at the other to the bed of the machine, is located diagonally to the pawl in such manner that it operates not only to hold the pawl downward in position to engage the ratchet-teeth by a forward swinging movement of the pawl, but to also retract the arm and withdraw the pawl after each forward feeding movement of the disk under the thrust of the pawl. This pawl is provided on one side with a trip-cam m^6, that is arranged to thrust against an arm m^7 on a sliding bolt m^8 at a certain time.

It is essential to the proper operation of the machine that the carrier-disk should be locked at each pause in its intermittent forward motion, and the locking is effected by means of the sliding bolt m^8, borne in a socket in a fixed block on the machine, the front end of the bolt engaging the locking-sockets m^9 in the face of the ratchet-disk. This ratchet-disk has lateral or face ratchet-teeth as well as the peripheral teeth. The lateral teeth have the backward-sloping surfaces m^{11}, extending from the highest point on the tooth to the edge of each locking-socket m^9, but the angle is relieved by a surface m^{12}, which is at an angle of about thirty degrees (30°) with the back of the locking-socket, as shown in the drawings. In the forward movement of the pawl the trip-cam m^6, striking the arm m^7 on the bolt, withdraws it from the locking-socket just before the forward end of the pawl strikes the ratchet-tooth, and as the pawl continues its forward movement to rotate the disk it lifts the trip-cam m^6 over the arm and permits the bolt to be thrust forward by a spring, so that its forward end strikes against the sloping side of the tooth m^{12}, the arm m^7 in this movement passing under the trip-cam m^6. As the disk continues its rotary movement under the thrust of the pawl the bolt sliding down the rear surface of the tooth is quickly snapped into the next socket, aided in its locking movement by the relieving-surface m^{12}. The cam on the cam-disk having passed the arm on the rock-shaft the latter is permitted to swing backward under the pull of the spring m^5, and the pawl is then located in proper position for a succeeding forward movement to effect, in a manner similar to that described, the rotation of the carrier-disk.

The mill-carriage K is held with the arm k in contact with the cams d^2 by the pull of a counterpoise-weight or its equivalent, a spring.

The stop device in each instance consists of a latch o', pivoted to the frame o, fast to the bracket on the carriage, in such manner as to swing in a plane transversely of the axis of the ejector or plunger. This latch is held in a closed position by a bolt o^2, projecting into a socket in the latch, the bolt being arranged in the path of movement of the plunger, the backward motion of which by contact with the bolt releases the latch. The latch is connected, as by means of a cord o^3, with a stop-motion of any convenient form, which is arranged usually on the counter-shaft over the machine. In the within case the cord from the shifter or stop-motion supports an equalizer o^5, from each end of which cords extend to respective latches appurtenant to the stop-motions on the feed-plunger and on the ejector.

After a blank has been slotted and while it is being slabbed off it is held against rotation in the socket by a positive clamping device p, consisting of a blade p', with its end shaped like the end of a screw-driver and of a dimension to enable it to enter the slot previously formed by the cutter in the end of the blank and in which it is held until the mills are withdrawn sufficiently to allow the disk to make the next movement in its step-by-step rotation. In the form of positive clamp shown the blade p' is borne in a standard p^9, fixed to the frame, this standard having a socket the forward end of which is closed by a screw-plug. A slot p^{10} is formed in this screw-plug, extending diametrically across it and into which the broadened end of the blade is forced under the force of the spiral spring thrusting with one end against the screw-plug and the other end against the shouldered headed end p^{11} of the blade. A rock-shaft p^2 is mounted in bearings on the bed, and to an upward-extending arm p^{12}, secured to said shaft, is a blade-plunger p^3. This blade-plunger is adjustably borne in the socket in the arm by means of interengaging threaded parts and is secured in any desired position by means of a lock-nut p^{13}, the inner end of the plunger being adapted to strike against the headed end of the blade to force it inward. Two of these blades are provided, working in opposition to each of the pair of straddle mills, blade-plungers being located on the rock-shaft p^2 appurtenant to each blade. An arm p^4 is also secured to the rock-shaft and bears in its upper end a socket-piece p^5. In this socket-piece is located the rock-shaft plunger p^6, having on its end the nut p^7. A threaded plug p^{14} closes one end of the socket-piece, and a spiral spring p^{15} is located between the threaded plug and the outer headed end of the rock-shaft plunger, that is adapted to be forced inward by a screw p^8, adjustably located on the feed-carriage F. By this construction it will be seen that in each forward movement of the feed-carriage and of the saw borne thereon the blades p' will be forced into the slots previously cut by the slotting-saw, and the spring connection between the feed-carriage and the rock-shaft plunger allows the carriage to move forward after the blade p' has encountered the bottom of the slot in the blank.

The operation of the machine is as follows: The blank is fed from the hopper into the receiver, is thrust by a plunger out of the receiver into a socket in the carrier-disk, and in the disk is carried by a series of step-by-

step movements to a final position opposite the ejector. At the first stop after the blank has been inserted in a socket it is while clamped by the clutch appurtenant to each socket slotted as to the head and then in a successive movement of the carrier-disk slabbed as to the shank. At a succeeding point in the intermittent movement of the disk the blank is again subjected to the action of straddle-mills and further slabbed. At a succeeding position of the carrier-disk the ejector pushes the blank out of the socket into a runway, through which it is discharged into any convenient receptacle. While the nipples were being slabbed they were held by the positive clamp, as above described.

It is obvious that many of the features of improvement in the mechanisms above described are capable of use in different connections and in different combinations, and I do not limit myself to the specific use in the combination of parts and of mechanisms above described.

I claim as my invention—

1. In combination with a rotary carrier-disk, transverse blank-sockets arranged at intervals about the disk, a friction-clamp located on the disk appurtenant to the blank-socket, tools for operating on the blanks held in the socket, means for imparting an intermittent step-by-step motion to the carrier-disk, and a positive blank-holding clamp located off the disk adapted to engage the projecting end of the blank and hold the latter against rotation, all substantially as described.

2. In combination with a rotary carrier-disk, blank-holding sockets arranged at equal intervals in the disk and on radial lines, a bushing having a blank-socket secured within each socket in the disk, a friction-clamp on the disk appurtenant to each blank-socket, means for imparting an intermittent step-by-step movement to the carrier-disk, means for locking the disk at each pause in its intermittent movement, a positive blank-holding clamp adapted to engage the projecting end of the blank, a tilting receiver, a reciprocating plunger, an automatic feed device, automatic tools for operating on the device held in the carrier-disk, and an automatic extractor, all substantially as described.

3. In combination with a part having ratchet-teeth, a tilting arm, a pawl borne on the tilting arm, a cam appurtenant to the pawl, and a locking mechanism having a bolt with a projecting part arranged in the path of movement of the cam on the pawl, all substantially as described.

4. In combination with a carrier-disk having blank-holding sockets, a disk-holding bolt having a projecting arm, and a ratchet feed mechanism including a pawl having a rigid bolt-operating cam, all substantially as described.

5. In combination with a blank-holding carrier, a carrier feed mechanism, a locking-bolt for holding the carrier at intervals in its progressive movement, a rock-shaft having an arm secured thereto, a spring-retracted pawl pivoted on the arm and having an appurtenant bolt-operating cam integral therewith and means for rocking the shaft to operate the pawl, all substantially as described.

6. In combination with a movable carriage constructed and arranged to receive a blank, tools for operating successively on the blank while held in such carriage, and a positive blank-holding clamp fixed with reference to the forward-feeding movement of the carriage, and constructed and arranged to engage a surface on the blank formed by a preceding tool and to prevent rotation of the blank during such engagement.

7. In combination with a movable carriage constructed and arranged to receive a blank, tools for operating successively on the blank while held in such carriage, a positive blank-holding clamp fixed with reference to the forward-feeding movement of the carriage and constructed and arranged to engage a surface on the blank formed by a preceding tool and prevent rotation of the blank during such engagement, and a friction-clamp for holding the blank when a tool is not in operation thereon.

8. In combination with a rotary carrier-disk with means for rotating it, blank-holding sockets in the disk, tools for operating successively on blanks while held in such disk, a positive blank-holding clamp fixed with reference to the forward-feeding movement of the disk and constructed and arranged to engage a surface on the blank formed by a preceding tool and prevent rotation of the blank during such engagement.

9. In combination with a rotary carrier-disk with means for rotating it, blank-holding sockets in the disk, tools for operating successively on blanks while held in such sockets, a positive blank-holding clamp fixed with reference to the forward-feeding movement of the disk and constructed and arranged to engage a surface on the blank formed by a preceding tool and prevent rotation of the blank during such engagement, and a friction-clamp for holding the blank when a tool is not in operation thereon.

10. In combination with a movable carriage constructed and arranged to receive a blank, tools for operating successively on the blank while held in such carriage, and a positive blank-holding clamp fixed with reference to the forward-feeding movement of the carriage and constructed and arranged to engage a surface on the blank formed by a preceding tool and prevent rotation of the blank during such engagement, said clamp being located off the carriage.

11. In combination with a movable carriage adapted to receive a blank, tools for operating successively on the blank while held in such carriage, a positive blank-holding clamp located off the carriage and fixed with reference to the forward-feeding movement of the carriage and constructed and arranged to engage

a surface on the blank formed by a preceding tool and prevent rotation of the blank during such engagement, and a friction-clamp located on the carriage and constructed and arranged to engage the blank during the movements of the carriage.

12. In combination with a rotary carrier-disk with means for rotating it, blank-holding sockets in the disk, tools for operating successively on a blank while held in a socket in the disk, and a positive blank-holding clamp located off the disk and fixed with reference to the forward-feeding movement of the disk and constructed and arranged to engage a surface on the blank formed by a preceding tool and prevent rotation of the blank during such engagement.

13. In combination with a rotary carrier-disk with means for rotating it, blank-holding sockets in the disk, tools for operating successively on a blank while held in a socket in the disk, a positive blank-holding clamp located off the disk and fixed with reference to the forward-feeding movement of the disk and constructed and arranged to engage a surface on the blank formed by a preceding tool and prevent rotation of the blank during such engagement, and a friction-clamp located on the disk and constructed and arranged to hold the blank during the movements of the disk.

14. In combination with a rotary carrier-disk having a blank-socket, a tool constructed and arranged to operate upon a blank while held in such socket, a positive blank-holding clamp located off the carrier and fixed with reference to the forward-feeding movement of the disk and constructed and arranged to engage a surface formed by said tool on the blank to hold it against rotation.

15. In combination with an intermittently-rotated carrier-disk having a blank-socket, a tool constructed and arranged to operate upon a blank while held in such socket, and a positive blank-holding clamp located off the disk and fixed with reference to the forward-feeding movement of the disk and constructed and arranged to engage a surface formed by said tool on the blank and hold it against rotation during a dwell in the rotation of the carrier.

16. In combination with an intermittently-rotated carrier-disk having a blank-holding socket, a tool for slotting the end of a blank held in the socket, and a reciprocating blade adapted to engage, during a dwell of the carrier-disk, the slot formed in the blank, all substantially as described.

17. In combination with an intermittently-rotated carrier-disk having a blank-holding socket, a tool for slotting the end of a blank held in the socket, a blade having a reciprocating movement transversely of the plane of the carrier-disk and adapted to engage the slot in the end of the blank, all substantially as described.

18. In combination with an intermittently-rotated carrier-disk having a blank-holding socket, a reciprocating carriage supporting a slotting-tool and movable toward and from the carrier-disk, a reciprocating blade adapted to engage the slot formed in the blank by the slotting-tool, and means for causing a reciprocation of the blade by the movement of the carriage supporting the slotting-tool, all substantially as described.

19. In combination with an intermittently-rotated carrier-disk having a blank-holding socket, a tool for slotting a blank held in the socket, a reciprocating blade supported on a standard movable transversely of the plane of the carrier-disk and adapted to engage the slot formed in the blank, and means for reciprocating the blade, all substantially as described.

20. In combination with an intermittently-rotated carrier-disk having a blank-holding socket, a tool for slotting a blank held in the socket, a spring-retained plunger supported on a fixed standard and movable transversely of the plane of the carrier-disk, a blade secured to the plunger and adapted to engage the slot formed in said blank held in the socket, and means for moving the plunger toward the carrier-disk, all substantially as described.

21. In combination with a rotary carrier-disk, a bolt to lock the disk against rotation, and a pawl having a cam-surface adapted to move the bolt to unlock the disk the pawl moving the latter forward, all substantially as described.

22. In combination with a rotary carrier-disk, a bolt to lock the disk against rotation, a pawl to rotate the disk, and a cam rigidly borne on the pawl engaging the bolt to unlock the disk, the cam riding over and freeing the bolt as the pawl moves forward, all substantially as described.

23. In combination with a rotary carrier-disk, a vibrating arm, a pawl pivoted to the arm, and a spring normally pulling the pawl backward and holding it in engagement with the carrier-disk, all substantially as described.

24. In combination with an intermittently-rotated carrier-disk having faced ratchet-teeth with backward-sloping surfaces, peripheral ratchet-teeth located on the carrier-disk, a locking-bolt in engagement with the face ratchet-teeth, a trip-arm located on the bolt, a pivoted pawl adapted to engage the teeth on the carrier-disk, a trip-cam borne on the pawl and adapted to engage the trip-arm on the locking-bolt, but to ride over the end of said arm in the forward movement of the pawl, an arm supporting the pawl and secured to a rock-shaft, the rock-shaft, and means for rocking said shaft, all substantially as described.

25. In combination with an intermittently-rotated carrier-disk having blank-holding sockets, a reciprocating plunger for delivering the blanks to the disk, means for delivering the blanks to the plunger, means for intermittently rotating the disk, tools for operating upon the blanks held in the disk during

a dwell in its rotation, and means located off the carrier and for positively holding the blank during said dwell in the rotation of the disk, all substantially as described.

26. In combination with an intermittently-rotated carrier-disk having blank-holding sockets, a reciprocating plunger for delivering the blanks to the disk, means for delivering blanks to the plunger, means for intermittently rotating the disk, a tool for slotting, during a pause in its rotation, the end of a blank held in the disk, a reciprocating blade adapted to engage, during a succeeding pause in the rotation of the carrier-disk, a slot made by the slotting-tool, and tools for operating upon the blank while held by the blade, all substantially as described.

27. In combination with an intermittently-rotated carrier-disk having blank-holding sockets, a reciprocating plunger for delivering the blanks to the disk, means for delivering the blanks to the plunger, means for intermittently rotating the disk, a tool for slotting, during a pause in its rotation, the end of a blank held in the disk, a reciprocating blade adapted to engage, in a succeeding pause in the rotation of the carrier-disk, the slot made by the slotting-tool, and mills adapted to operate upon opposite sides of the blank while held by the reciprocating blade, all substantially as described.

28. In combination with an intermittently-rotated carrier-disk having blank-holding sockets arranged in pairs on radial lines at angles to each other, a reciprocating plunger for delivering the blanks to the disk, means for delivering the blanks to the plunger, means for intermittently rotating the disk, a tool for slotting during a pause in its rotation, the blanks held in the disk, a reciprocating blade adapted to engage, during said pauses in the rotation of the disk, the slot made by the slotting-tool, and mills adapted to operate simultaneously upon blanks located in the pairs of sockets, all substantially as described.

29. In combination with an intermittently-rotated carrier-disk having blank-holding sockets, arranged in pairs on radial lines at angles to each other, a tool for slotting the end of a blank held in a socket, a reciprocating mill-carriage appurtenant to the carrier-disk and at the opposite end of a blank to that operated upon by the slotting-tool, a plural number of pairs of mills each pair located appurtenant to each socket of a pair in the carrier-disk, and operating upon opposing surfaces of said blank, and reciprocating blades located opposite each pair of mills and adapted to engage the slots in the ends of the blank while the mills are in operation, all substantially as described.

30. In combination with a movable carriage, a slide and means for operating the same, a connecting-rod adjustably secured to the slide, a shoulder on the connecting-rod, a lever secured to the carriage and adapted to engage the shoulder on the rod, and centering pins and sockets on the rod and carriage, all substantially as described.

31. In combination with a movable carriage, a rock-shaft appurtenant to the carriage and operated thereby, a positive clamp operated in the movement of the rock-shaft, and a yielding connection between the carriage and positive clamp whereby permissive movement is given to the carriage independent of the positive clamp, all substantially as described.

32. In combination with a movable carriage, a rock-shaft adapted to be operated thereby, a positive clamp located in the path of movement of an arm on the rock-shaft, a casing on the shaft supporting a spring-actuated plunger, and a projection on the carriage adapted to engage said plunger, all substantially as described.

33. In combination with a movable carriage, a positive spring-retained clamp, a rock-shaft, a plunger located on the shaft to engage the positive clamp, an arm also secured to the rock-shaft and bearing a spring-retained plunger, and a projection on the carriage adapted to engage said spring-retained plunger, all substantially as described.

34. In combination with a bed, a movable carriage supported thereon, a positive clamp supported on a standard secured to the bed and in the path of movement of an arm on a rock-shaft, the rock-shaft pivoted on the bed, and a reciprocating carriage adapted to operate the rock-shaft.

35. In combination with a movable carrier having a blank-holding socket, a tool for slotting the end of the blank held in the socket, a blade having a reciprocating movement transversely of the plane of the carrier and adapted to engage the slot in the end of the blank, and means for preventing the rotation of the blade.

36. In combination in a movable carriage, a bed supporting the carriage, a support mounted on the bed, a spring-retained positive clamp mounted in the support, a rock-shaft mounted on the bed and having a block-plunger adjustably supported thereby and adapted to engage the positive clamp, a spring-retained rock-shaft plunger mounted on the rock-shaft, and a screw adjustably mounted on the carriage and adapted to engage the rock-shaft plunger.

37. In combination with a movable carrier having a blank-holding socket, a tool for slotting the end of the blank held in the socket, a reciprocating blade adapted to engage the slot in the blank, a spring-case inclosing the blade, a spring interposed between a shoulder on the blade and a shoulder in the case, and a plug secured in one end of the casing and having a slot engaging the end of the blade to prevent its rotation.

38. In combination a bed, a carrier-disk mounted on the bed, a feed device for delivering blanks to a feed-plunger, the feed-plunger for delivering the blanks to the car-

rier-disk, a reciprocating carriage supporting the feed-plunger, a slotting-tool mounted on said carriage movable transversely of the plane of the carrier-disk, a mill-carriage located on the opposite side of the disk from the feed-plunger, an ejector mechanism located on the mill-carriage, means for reciprocating said carriages, and means for rotating the carrier-disk.

39. In combination with a bed, a carrier-disk mounted on the bed, means for rotating the carrier-disk, a mill-carriage movable toward and from the disk transversely of the plane thereof, an ejector mechanism mounted on the mill-carriage, and means for reciprocating the carriage.

40. In combination with a base a carrier-disk mounted on the base, means for rotating the carrier-disk, a reciprocating carriage movable in a path transversely of the plane of the carrier-disk, a feed-plunger mounted on the carriage, and a slotting device also mounted on the carriage.

41. In combination with a bed, a carrier-disk mounted on the bed, means for rotating the carrier-disk, a reciprocating carriage movable in a path transversely of the plane of the carrier-disk, a feed-plunger mounted on the carriage, a slotting-tool mounted on the carriage, and a reciprocating blade mounted on the bed of the machine and adapted to engage a slot formed in a blank by the slotting-tool, said blade being operated by the movement of the carriage.

42. In combination with a bed, means for rotating the carrier-disk, a carriage movable toward and from the disk transversely to the plane thereof, a feed-plunger mounted on the carriage, a slotting-tool mounted on the carriage, a spring-retained blade mounted on the base and adapted to engage a slot formed in a blank by the slotting-tool, a rock-shaft mounted on the bed and adapted to operate the blade, and a spring-retained plunger borne on the rock-shaft in the path of movement of the feed-plunger carriage whereby permissive movement of said carriage is obtained independent of the movement of the blade.

43. In combination with a bed, a carrier-disk mounted on the bed, a mill-carriage mounted on the bed, a slotting-tool carriage mounted on the bed, feed and ejecting devices mounted on the bed, a cam-wheel having cams on opposite faces and on its periphery adapted to operate mechanisms for rotating the carrier-disk and for operating the carriages.

44. In combination a bed, a carrier-disk mounted on the bed, a cam-wheel having cams on opposite faces and on its periphery, connecting means for operating the carrier-disk by the peripheral cams, a mill-carriage supporting an ejector device, and connecting means for operating said carriage by the face-cams on the cam-wheel a carriage supporting the feed device and slotting device, and connecting means for operating said carriage by the cams on the opposite side of the cam-wheel.

45. In combination with a spring-operated clutch, an equalizer, a connection between the equalizer and clutch device, and connections between the equalizer and a plural number of stop-motion devices.

46. In combination with a spring-operated clutch device, an equalizer, a flexible connection between the ends of the equalizer and a plural number of latches each appurtenant to a stop-motion device, a reciprocating plunger for holding the latch in a closed position, and means for releasing the hold of the plunger when its reciprocating movement is retarded.

47. In combination with a movable carriage constructed and arranged to receive a blank, tools for operating successively on the blank while held in said carriage, and a positive blank-holding clamp constructed and arranged to engage a surface on the blank formed while it is held in said carriage and by a preceding tool said clamp being arranged to prevent rotation of the blank in said carriage during the operation of the tools.

48. In a slabbing-machine, in combination, a carrier-disk, blank-sockets arranged in said disk, means for intermittently rotating the disk, a reciprocating carriage carrying a spindle on one end with its axis arranged parallel with the face of the disk, pairs of cutters substantially alike borne on the spindle to operate upon two articles, and means for driving the spindle, substantially as described.

49. In a slabbing-machine, in combination, a carrier-disk, blank-sockets arranged in the disk, means for intermittently rotating the disk, a reciprocating carriage carrying a spindle with its axis arranged parallel with the face of the disk, pairs of cutters substantially alike mounted on the spindle and adapted to operate simultaneously upon a pair of articles, means for reciprocating the carriage, and means for driving the spindle, substantially as described.

50. In a slabbing-machine, in combination, a carrier-disk, blank-sockets located in the disk, means for intermittently rotating the disk, a reciprocating carriage, a spindle mounted on the carriage with its axis arranged parallel with the face of the disk, pairs of cutters substantially alike mounted on the spindle and adapted to operate simultaneously on a pair of articles, a second reciprocating carriage, a cutter mounted on a spindle on said carriage and adapted to slot the heads of said articles, and means for reciprocating said carriage and for rotating said spindles, substantially as described.

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