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F. & A. B. CURTIS.

METAL SCREW MACHINE.

No. 280,296. Patented June 26, 1883.

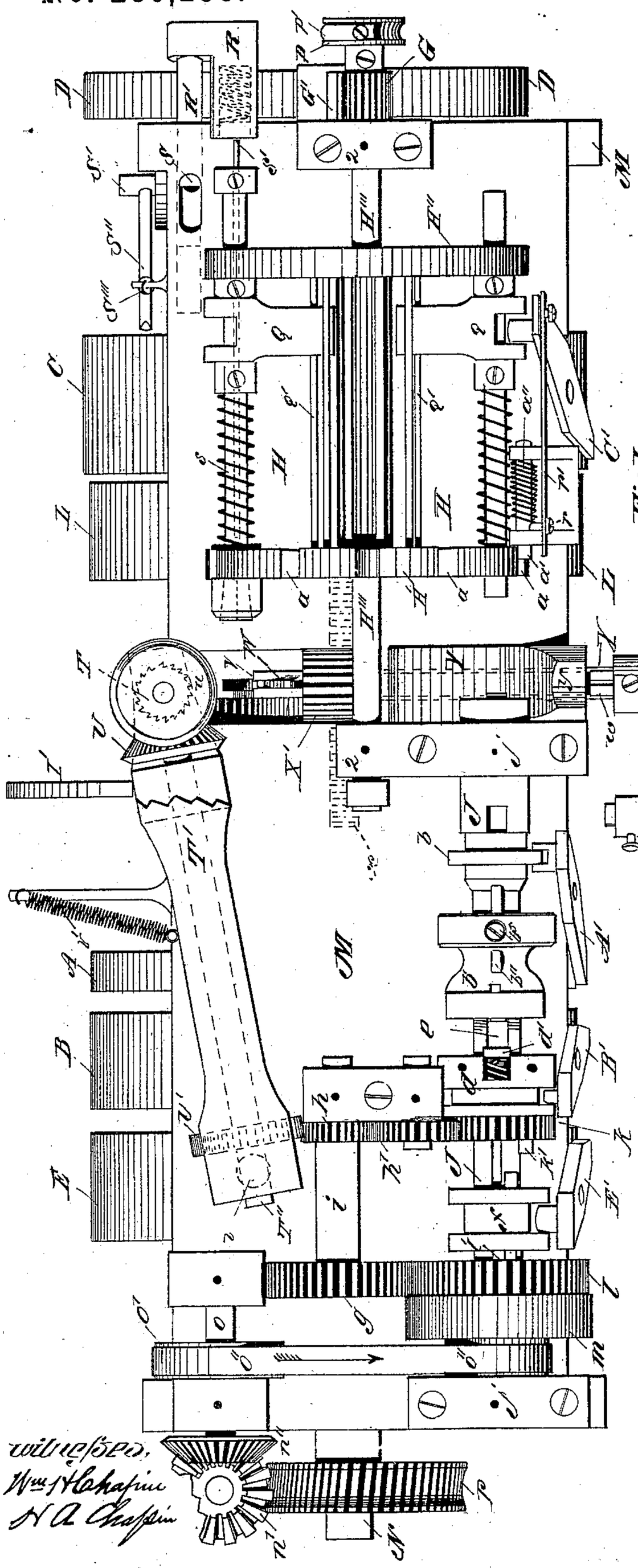

Fig. 1.

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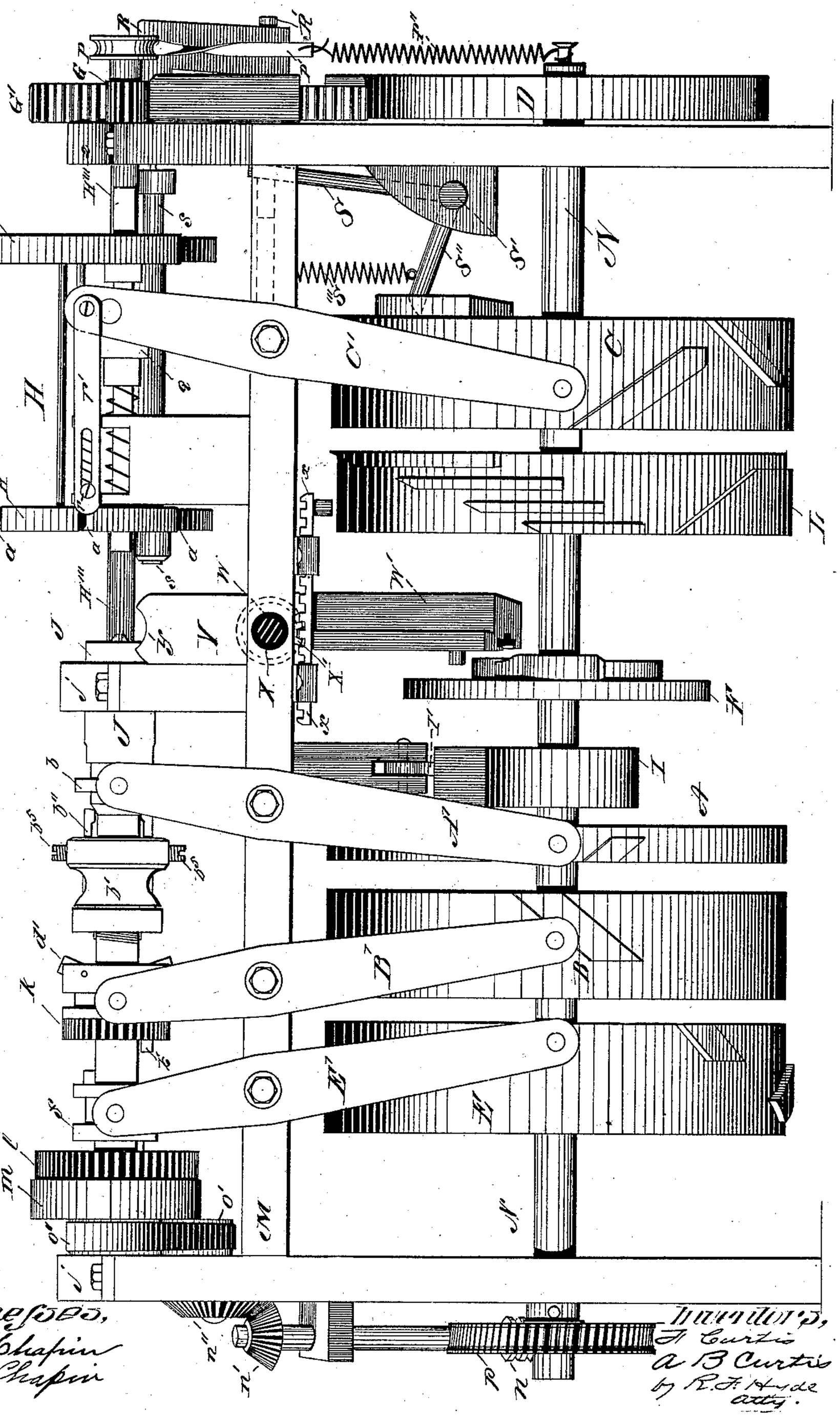

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F. & A. B. CURTIS.

METAL SCREW MACHINE.

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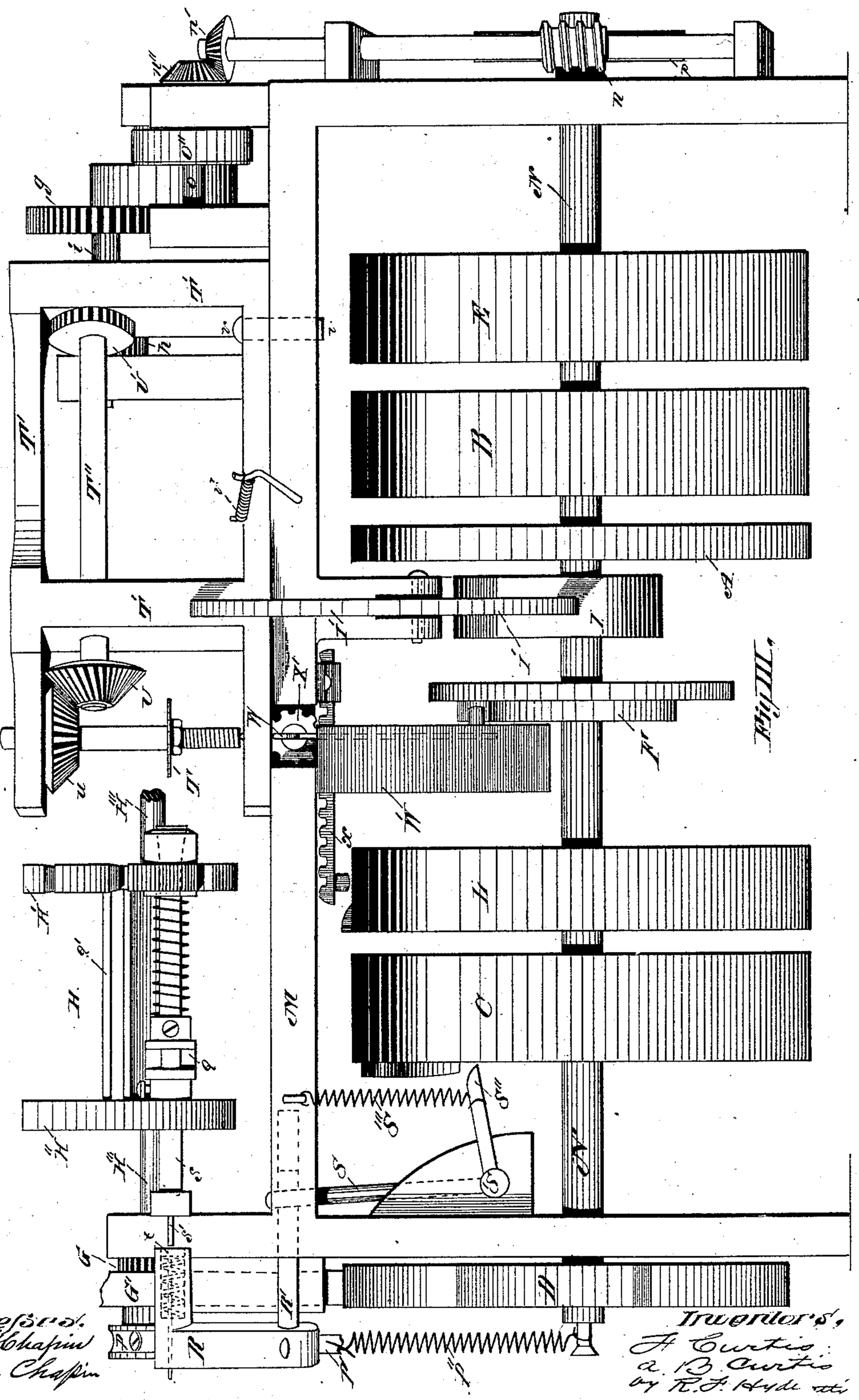

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F. & A. B. CURTIS.

METAL SCREW MACHINE.

No. 280,296. Patented June 26, 1883.

Fig III,

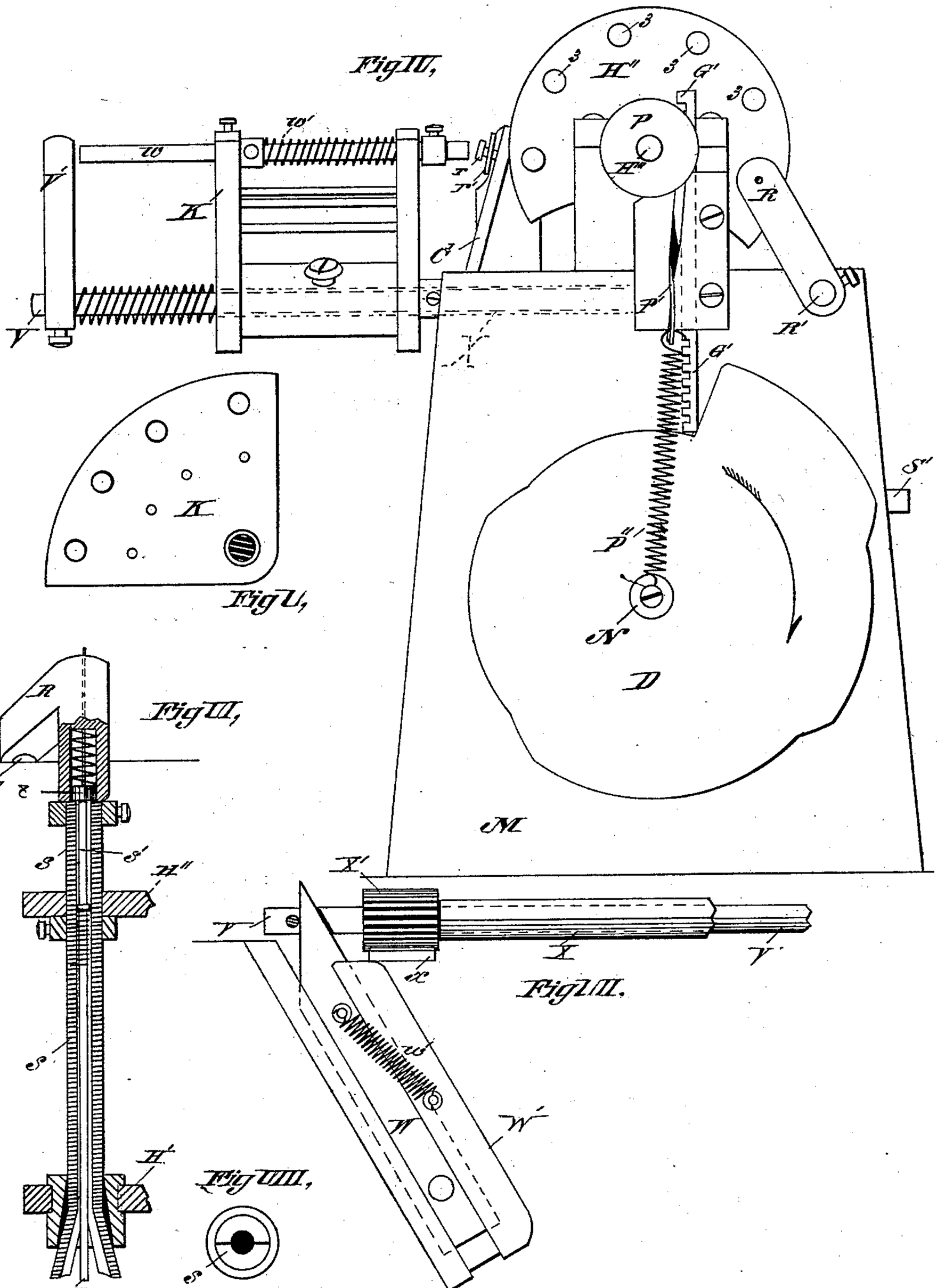

Fig V,

Fig VI,

Fig VIII,

Fig VII.

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F. & A. B. CURTIS.

METAL SCREW MACHINE.

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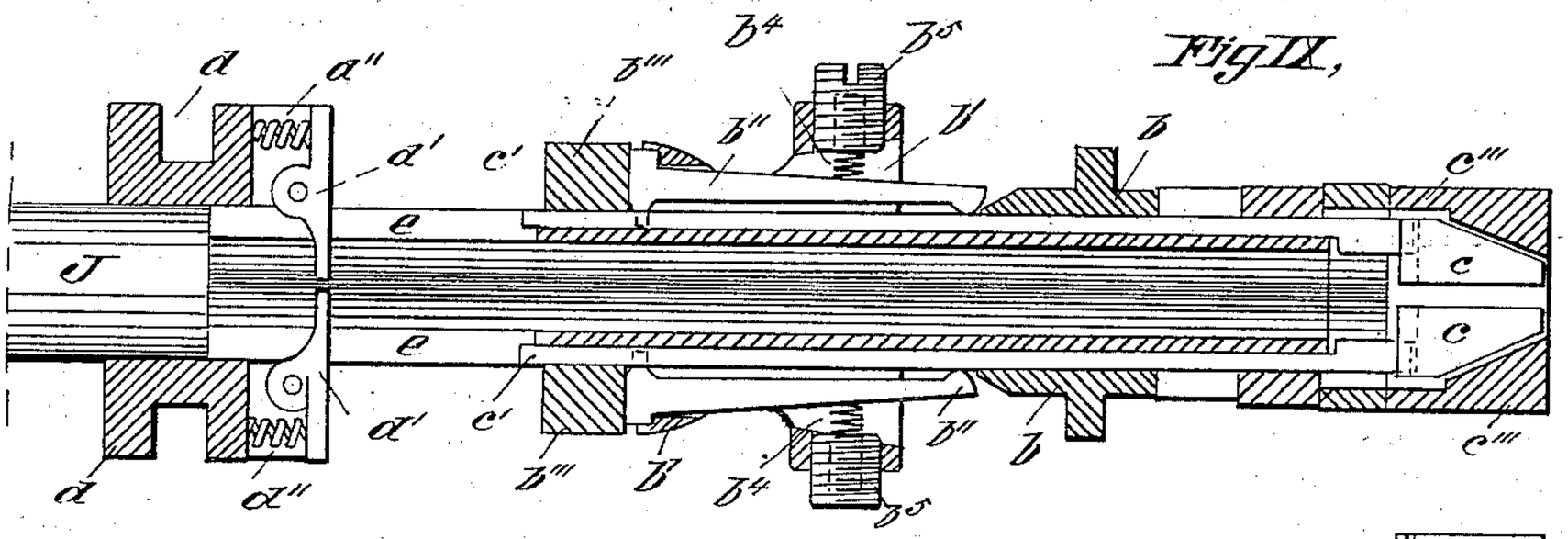

Fig IX,

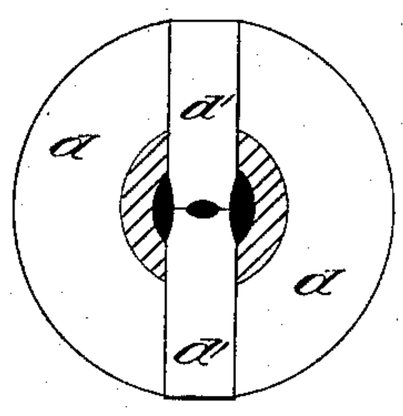

Fig X,

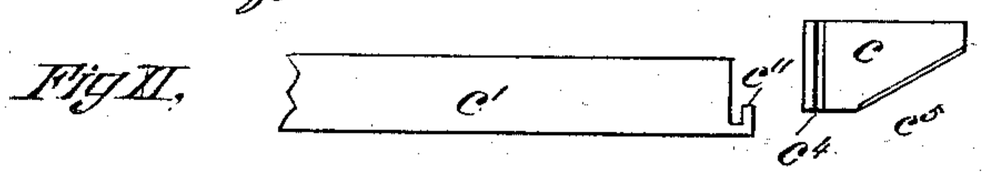

Fig XI,

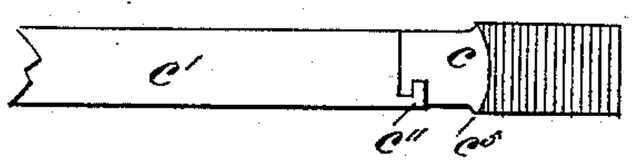

Fig XII,

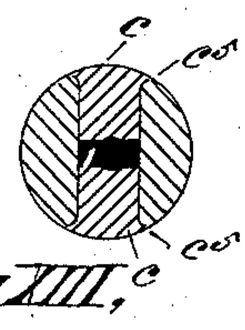

Fig XIII, c

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UNITED STATES PATENT OFFICE.

FRANCIS CURTIS AND ALBERT B. CURTIS, OF CHICOPEE, MASSACHUSETTS.

METAL-SCREW MACHINE.

SPECIFICATION forming part of Letters Patent No. 280,296, dated June 26, 1883.

Application filed January 9, 1883. (No model.)

To all whom it may concern:

Be it known that we, F. CURTIS and A. B. CURTIS, citizens of the United States, residing at Chicopee, in the county of Hampden and State of Massachusetts, have invented new and useful Improvements in Metal-Screw Machines, of which the following is a specification.

The nature of this invention consists in the construction and arrangement of a metal-screw machine, as will hereinafter be more fully set forth.

In the drawings, Figure I is a plan view of the top of the machine. Fig. II is an elevation of one side of the machine, showing a portion of the same. Fig. III is an elevation of the other side, showing a part thereof. Fig. IV is an elevation of one of the ends of the machine. Fig. V is a partial end view of one of the tool-holders. Figs. VI, VII, and VIII are detail views of parts of the mechanism. Fig. IX is an enlarged longitudinal section of the chuck-spindle, and Figs. X, XI, XII, and XIII are detail views of the same.

M is the frame of the machine, constructed in any suitable way to afford the required bearings for all of the movable portions of its mechanism.

Power is applied through a belt to the pulley *m* upon spindle J, and from the pulley *m* is, through belt *o''*, carried to shaft *o*, and from thence is, through the gear *n''*, transmitted, through worm *n* and gear *p*, to the cam-bearing shaft N. The pulley *m* forms part of or is intimately connected to a gear-wheel, *l*, and both are axially intersected by the spindle J. The spindle J, through which the wire is fed, and in which it is held to be operated upon by forming-tools, has journals above the bed of the machine at *j j*. The spindle J, besides bearing the hubbed gear *l*, bears also the gear *k*.

Between the shaft *o* and spindle J is a counter-shaft, *i*, supported in bearings from the bed of the machine, and this counter-shaft is provided with the gears *h* and *g*. The gear *g* is engaged with the constantly-revolving gear *l*, and the gear *h*, through the intermediate gear, *h'*, with the gear *k*. Both gears *l* and *k* are loose upon the spindle J, and are provided upon their inner and opposite faces with clutch-studs *l'* and *k'*.

Intermediate these gears, and splined to the spindle, is the clutch-wheel *f*, which is automatically moved to alternately fix one or the other of gears *l k* to the spindle, and it will be seen that the gear *l* either directly revolves the spindle, when fast to it, or indirectly, through the counter-shaft and in a reverse direction, when running loose upon it.

The spindle J is transversely slotted from side to side, and in this slot *e* move, with their holder, and also vibrate on their hinges radially to the axis of the holder, the jaws *d'* of feed-clamp *d*. This is more particularly illustrated in the enlarged views, Figs. IX and X, showing the jaw-holder *d* sleeved upon the spindle and adapted to be automatically reciprocated thereupon to have the feeding-jaws *d'* move therein. The feeding-jaws *d'* extend inward and meet upon opposite sides of the wire to be fed, and, being each hinged to the holder eccentrically to its longer axis, swing freely in one direction, while they firmly clamp an intermediate rod acting to move them in the opposite direction.

Interposed springs *d''*, as shown, cause the clamp ends to oppose each other with a force insufficient to offer an obstacle to the movement of the jaws over the wire when held by the chuck at the end of the spindle, but enough to cause the jaws to act instantly when the holder is moved in the direction to feed the wire to the chuck.

The chuck (shown more fully in the enlarged views, Figs. IX, XI, XII, and XIII,) is constructed as follows: In longitudinal grooves in the outer wall of the spindle, and upon opposite sides thereof, extend arms *c'* from the jaws *c*. The jaws are guided in their movement by the slotted end common to chucks, as seen in the section view, Fig. XIII, and which, with the conical cap *c'''*, also common, form upon their outside a journal-surface for the chuck in its bearings from the frame M. The jaw-arms *c'* in their grooves extend beneath a conical sleeve, *b*, a guide, *b'*, for jaw-moving levers *b''*, and an adjustable collar, *b'''*, which serves as a fulcrum for levers *b''*, and the arms *c'* receive the hook ends of the levers *b''*, which levers are arranged to have their heads above their hooks bear against the near wall of the collar *b'''*, so that when the free ends of levers *b''* in

a line with the outer surface of the spindle are raised by the insertion thereunder of the cone-sleeve *b* the bearing of the heads of the levers against the fixed collar *b'''* forces forward, through the arms *c'*, the jaws *c*, whose conical surfaces, coming against the corresponding inner surfaces of cap *c'''*, are brought together upon the stock or wire. The arms *c'* may be disconnected from the jaws *c* to only bear against their rear ends, or may be loosely connected therewith, though for the purpose of insuring the full bearing of their clamp-surfaces upon the wire, and at the same time providing a means of returning them to the proper position when the chuck is opened, the jaws *c* are provided with transverse grooves *c⁴*, into which hook ends *c''* of arms *c'*, by means of which both a longitudinal and transverse movement is permitted the jaws. The collar *b'''* is made to screw upon the outside of the spindle, so that its position may be adjusted relatively to the heads of the levers *b''*, to cause, by a greater or less interval between the two surfaces, more or less movement to the jaws. The levers *b''* are guided in their rise or fall by slots in part *b'*, and springs *b⁴* bear against them from the outside to bring their free ends against the spindle, and so return the arms *c'* to open the jaws *c*. The springs *b⁴* are received in a counterbore in the ends of screws *b⁵*, and by running in the screws the pressure upon the levers *b''* may be increased, while one may be quickly replaced by removing the screw holding it. The jaws *c* are provided with flanges *c⁵*, overlapping the slots in the head of the chuck in which they move, as seen in Fig. XIII, by means of which they are prevented from falling when not supported by the stock within the chuck.

The worm *n*, through worm-wheel *p*, rotates shaft N, extending from end to end of the frame M, and upon shaft N are all of the cams governing the automatic operations upon the wire from the moment of its introduction to the rotary spindle J until the finished screw is deposited. As seen in Figs. I and II, cam E, through hinged lever E', moves clutch-collar *f* to make either gear *l* or *k* fast with the spindle. Cam B, through lever B', moves the clamp *d* to feed the wire, and cam A, through lever A', moves the cone-sleeve *b* to close or release the chuck.

The main tool-holder H is constructed as follows: Two disks or segments of disks, H' H'', are secured to a shaft, H''', parallel to the spindle J, and supported in bearings 2 2 from the bed or frame of the machine. These disks are framed together and fixed to the shaft H''', and in corresponding holes therethrough, and parallel to the shaft H''', rest the stems of different tools to be brought to and from the spindle. These stem-supporting holes 3 are arranged concentrically to the axis H''', and at such distance from it that the stems therein may be brought in line with the axis of spindle J. Each stem is provided with a collar or other convenient means of engagement with a swinging lever, C', adapted to be caught by said lever only when opposite the spindle, and has a coil-spring to return it when released from said lever.

In practice the collars Q have an arm guided and supported between rods Q', extending from end to end of the holder, which serve not only to steady them, but to keep in one position forked ends adapted to move over a stud upon the end of lever C', as shown in Fig. I. The shaft H''' is prolonged outside of the frame M, and is provided with a pinion, G, and upon the extreme end has also a pulley, P. The pinion G engages with an upright rack, G', guided in the frame, and having its lower end resting upon the perimeter of cam-wheel D, so that, being lifted by said cam-wheel, it revolves the holder H, through the pinion G, to a degree determined by the cam.

Attached to and extending over the pulley P is a belt, P', connected at its lower end to a coil-spring, P'', attached in its turn at one end to a fixed point of the machine, so that when the rack and pinion are released by the cam D the pulley is revolved to lower the rack and return the holder H. The cam-wheel D is so formed, as shown in Fig. IV, as to successively bring each tool-stem into line with the axis of the spindle J, and afterward to permit the pulley P and its connections to quickly return the holder H to its starting-point.

Without a departure from the spirit of this invention the peculiarly constructed and arranged tool-holder H may be returned by a cam and rack acting upon a duplicate pinion, or in any equivalent manner. One of the ends or disks of the holder H is provided upon its perimeter with a series of notches, *a*, corresponding in number with the holes or bearings for the tool-stems, and a bolt, *a'*, connected to lever C', is actuated by said lever to pass into a notch, *a*, and lock the holder H when in the exact position, and is also operated by the lever to release the holder to permit its revolving movement.

In Fig. I the bolt *a'* is shown pressed forward by its spring *a''* in the direction of the notches *a* in the front disk, H', of the holder, and engaging, by means of a stud, *r*, with the link *r'*, secured to lever C'. The stud is received in an elongated slot in link, *r'*, adapted to permit the link to reciprocate with the stem-moving lever and retract the bolt *a'* to release the holder H only in time for its movement. At other times its spring bears the end of the bolt against the inner face of disk H' to instantly shoot it into a notch, *a*, when the corresponding tool-stem is in exact position relative to the spindle J.

In Figs. I and II are shown the cam C for moving the tool opposite the spindle, and the lever C', having means for engaging with the collars on the tool-stems.

In holder H is shown the last tool operating upon the screw, and the mechanism connected

therewith. This is shown more fully in the longitudinal section, Fig. VI.

A hollow stem, *s*, provided with means to return it from the spindle and to cause it to be engaged with lever C′, is formed into a spring-chuck at one end, and provided internally with a spring-plunger, *s′*. The front end of the plunger is pressed by its spring against the end of the screw within the spring-chuck, and the rear end projected beyond the stem *s*.

A head, R, moving in line with stem *s*, has a spring plunger-head, *t*, in a bore thereof, the surrounding wall of said bore being adapted to bear upon the end of stem *s*, while the plunger-head *t* comes against the projecting plunger *s′*. As the head R moves toward the stem *s* from the position seen in Fig. I, the head first brings the inner end of plunger *s′* against the screw carried by the spring-chuck, when, being rigidly held, the continued advancement of head R forces the projecting portion of stem *s′* into head R, compressing the spring supporting the plunger-head *t*. Finally, the head R moves the stem *s* to relax the grip of the spring-chuck, when the spring under head *t* causes the plunger *s′* to eject the screw. The spring of the plunger *s′* is only of strength enough to return the plunger *s′* to the position shown in Fig. I. The head R is secured to a rod, R′, splined or otherwise guided to move without rotation in the frame M, and is connected to an arm, S, from a rock-shaft, S′, hung in bearings in the frame, and moved by an arm, S″, acted upon by cam-wheel C in its revolution, and, as shown, a spring, S‴, effects the return of head R when the arm S″ is released by cam C.

The nicking-tool T is attached to a vertical shaft journaled in a swinging frame, T′, as shown in Figs. I and III. The frame T′ furnishes bearings for the horizontal shaft T″, having the gears U and U′, the gear U engaging with the gear *u* on the saw-shaft, and the gear U′ constantly or intermittently engaging with the constantly-revolving gear *h* upon the counter-shaft *i*. The frame T′ is hinged at or near one end, at *v*, to the bed of the machine, to move smoothly over the same when swung, and is swung by cam I, through lever I′, hinged centrally to frame M, to have its ends bear upon cam I and surface of frame T′. A spring, *v′*, from frame T′ to the body of the machine, returns the frame T′ when released by cam I. The gear U′ may be constantly engaged with gear *h*, or may mesh with it upon the swinging of the frame T′.

The cutting-off tool is supported from the frame M to reciprocate in a horizontal plane transversely to the axis of the spindle J, and its stem *w* has the spring *w′* to retract it in its bearings.

Beneath the stem *w*, and parallel thereto, is the stem V, held from rotating in the bed or frame M, provided upon its outer end with the arm V′, and surrounded by a coil-spring intermediate the arm and fixed frame. The inner end of stem V is longitudinally slotted to receive the end of a flat wedge, W, which moves in a vertical plane. The wedge W slides in a guide and support W′, rigid with and pendent from the frame M, and provision is made for its elevation to any desired degree through the bed of the machine. The free surface of the wedge, in its upward movement, coming against one end of the slot in stem V, slides the stem toward the spindle, and the arm V′, coming against the projecting end of stem *w*, carries its tool against the screw in the spindle-chuck. The wedge W has a stud upon its side in position to be acted upon by the cam F, and has also a coil-spring, *w′*, attached at one end to the guide-piece W′, which serves to withdraw the wedge and permit the springs of the stems *w* and V to retract them. This is more particularly shown in the detail, Fig. VII, where one end of the slot in stem V is formed of a round pin, (seen in this view in section,) which forms a non-friction surface for the wedge to bear against.

To perform operations upon the head of the screw in the spindle other than that of cutting it off, and of a successive character—such as rounding the head, milling, and otherwise shaping a thumb-screw by tools brought to operate at right angles to the spindle J—the stem V is inclosed by a sleeve, X, which, having upon the end within the frame the pinion X′, is continued outside of the frame M to be rigidly secured to the holder K, preferably continued through it. The pinion X′ rests upon a rack, *x*, supported by the bed of the machine, as clearly shown in Fig. II, which rack is acted upon by cams on wheel L, and positively revolves the holder K to bring successive tools in position to be brought by stem V against the stock in the spindle-chuck. The holder K, arranged as shown in Fig. IV, can be formed of two sides framed together to afford bearings for the different tool-stems, which sides may consist of a circle, or of any part required to seat the desired tools, and to insure sufficient stiffness to the tools thus borne in a holder outside of the frame-support a block, Y, from the machine-bed presents a surface, *y*, of configuration corresponding to that of the tool-holders of the stems in holder K, so that when the tool is operating it is rigidly supported and all jumping or chattering is avoided. This is shown in Figs. I and II.

In the elevation views, Figs, II, III, and IV, only so much of the machine is shown in each as is considered necessary to illustrate the invention as a whole.

The consecutive operations of the mechanism above described in the manufacture of metal screws is as follows: The stock being in the spindle and the chuck open, cam-wheel B causes a given length of the wire to be fed into position, and cam-wheel A closes the chuck to grip the wire. After the chuck is closed, cam-wheel C advances the sliding stem in holder

H, and a box-tool on said stem turns down the wire projecting from the chuck. The continued revolution of cam-wheel C returns the sliding tool-stem into position and simultaneously operates to release the tool-holder H. When holder H is released, cam-wheel D raises the vertical rack G′ to revolve the holder H to bring the next tool or die in position, the die being carried forward in turn to cut the thread.

When the thread is cut, cam-wheel E throws the clutch-slide *f* into the reversing-gear, and when the screw is run out of the die, cam-wheel E throws slide *f* back again to give a forward rotation to the spindle J. Meanwhile cam-wheel D turns the holder H to bring the removing-tool upon stem *s* into alignment with the threaded screw in the spindle. While holder H is taking above-mentioned position, the cam-wheel F throws the cutting-off tool into operation. During the advancement of the cutting-off tool the removing-tool is brought forward to loosely inclose the screw in its spring-chuck, and as soon as cut off, the action of cam-wheel C retracts stem *s*, taking the screw with it, tightens the chuck, and also, by withdrawing the locking-bolt, permits holder H to be returned to its primary position. At this time the first operation above enumerated recommences at the spindle, and while cam-wheel C is moving forward the first box-tool, cam-wheel I swings the nicking-saw past the screw in position to be nicked, and while the first box-tool is still moving forward, the plunger in stem *s* is brought into operation, as before described, to eject the completed screw.

To make a thumb-screw, when a box-tool and die may be sufficient in holder H, tool-holder K holding the head-shaping tools, and being in position to perform the first operation upon the head of the screw in the spindle, cam-wheel F moves forward the first tool. Then cam-wheel L revolves the holder K to bring the next tool in place. In turn this second tool, which may be a milling-tool, is advanced. The cam-wheel F, as in case of all of the other cam-wheels, may have adjustable cam-blocks to govern the movements of as many tools as required, and it requires no more than general skill to adjust these cam-blocks to the class of screw to be made.

Now, having described our invention, what we claim is—

1. A stock-feeding spindle having a transverse slot extending therethrough, and a sleeve, *d*, adapted to be automatically slid upon the spindle over said slot, and carry with it spring feeding-jaws *d′*, hinged thereto to bear upon opposite sides of the stock and vibrate in said slot, substantially as shown and described.

2. A spindle, J, having a conical cap, *c‴*, and slotted jaw-holder, jaws *c c*, and jaw-arms *c′ c′*, connected to permit the jaws to move radially as well as parallel to the axis of the spindle, levers *b″*, hooked to jaw-arms *c′ c′* to swing upon their rear ends or heads, a collar, *b‴*, adjustable upon the spindle, and having its vertical face form a fulcrum for the rear ends of levers *b″*, a guide, *b′*, arranged upon the spindle to guide the levers *b″* while vibrating from or toward the axis of the spindle, and provided with springs for depressing the ends of said levers, and a conical sleeve, *b*, arranged upon the spindle, and means to reciprocate it to vibrate the levers *b″*, as shown and described.

3. The combination of spindle J, cap *c‴*, and slotted jaw-holder with jaws *c* and arms *c′*, connected thereto, bearing *b‴*, adjustable upon the spindle, levers *b″*, arranged to have one end bear against collar *b‴*, their other in path of cone-sleeve *b*, and hooked to jaw-arms *c′* at a point intermediate their ends, lever-guide *b′*, springs *b⁴* and their adjustable holders *b⁵*, and cone-sleeve *b*, with means for reciprocating it, all arranged to operate as and for the purpose set forth.

4. The tool-holder H, consisting of the pieces H′ H″, framed together and to a journaled axis, H‴, two or more tool-stems seated in the ends H′ H″, provided with retracting-springs, and means, as Q, for engaging with a vibrating lever when in line with the spindle, and a spring-actuated locking-bolt, *a′*, adapted to lock the holder as each tool comes in position and release it after the tool has been withdrawn, substantially as shown and described.

5. The combination, with the oscillating holder H, having sockets *a*, arranged in the end H′, in number and position relative to the tool-stems, as shown, the spring-bolt *a′*, in bearings in the frame M, and the slotted link *r*, connected to the bolt *a′* and to the tool-driving arm or lever, and adapted to engage with the bolt during the backward movement of the lever.

6. The combination, with a spring-chuck adapted to reciprocate in a tool-holder, and having a spring-plunger with a rearward-projecting end, of a head, R, splined to the frame M, having an elastic surface opposite the plunger, inclosed by a rigid surface opposite the stem of the collet, and automatically reciprocated to come against both to release the screw from the spring-chuck and eject it, substantially as shown and described.

7. The combination of rock-shaft S′, having arm S″, with means for rocking it, and arm S, head R, having stem R′, engaged with arm S, and having in its face the elastic bearing *t*, and the spring-chuck having the projecting plunger-stem *s′*, all arranged to operate substantially as shown and described.

8. A frame, T′, resting on the bed of the machine, and hinged at one end thereto, two geared shafts hung in said frame at right angles to each other, one provided with a nicking-saw, T, and the other with a gear near the frame-hinge, engaged with a gear journaled to and revolving in the frame M, and means, substantially as shown, to automatically swing the frame T′ to and from the screw held in

track of the saw, all combined and arranged substantially as set forth.

9. The combination of frame T′, hinged at *v*, and having saw T and driving-shaft T″, and gears *u*, U, and U′, spring *v*′, lever I′, and cam I, all arranged to operate in the manner and for the purpose set forth.

10. A stem, V, arranged in the frame M to reciprocate therein without rotating, and to extend beyond the outside of the frame, and provided with an arm upon its outer end, and with a retracting-spring, a tool-stem supported without the frame M, and adapted to reciprocate at right angles to the spindle and have its outer end in contact with the arm, a wedge supported by and free to slide in the frame M, having one end passing through a vertical slot in stem V, and mechanism, substantially as shown, for automatically reciprocating the sliding wedge, combined and operating substantially as shown, and for the purpose described.

11. A pinion, X′, a pinion-shaft, X, in bearings in the frame M, at right angles to the axis of the spindle, a tool-stem support, K, secured to shaft X, and seating tool-stems at a radial distance from shaft X equal to the distance of the axis of the spindle therefrom, a rack, *x*, to engage with pinion X′, and means, substantially as shown, for automatically reciprocating the rack to bring different tool-stems in support K into the horizontal plane passing through the spindle.

12. Tool-support K, having two or more tool-stems provided with retracting-springs, shaft X, having pinion X′, and rack *x*, and mechanism for automatically reciprocating it, in combination with shaft V, sleeved within shaft X, provided with arm V′, and having means, substantially as shown and described, for automatically reciprocating a tool-stem in holder K.

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