(No Model.) 5 Sheets—Sheet 1.

# J. B. CLYNE.

## MACHINE FOR MAKING SCREWS, NIPPLES, &c.

No. 554,814. Patented Feb. 18, 1896.

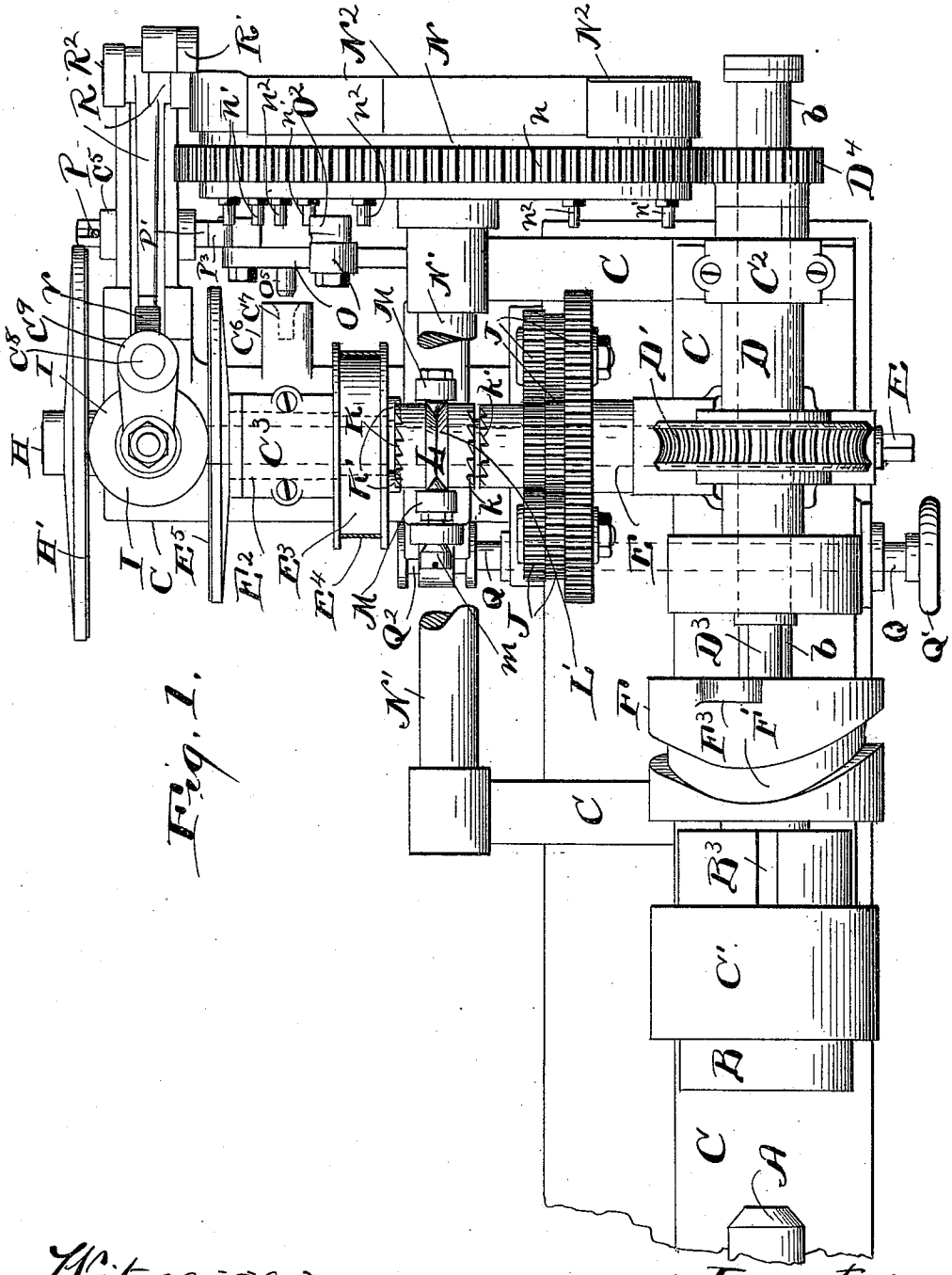

Fig. 1.

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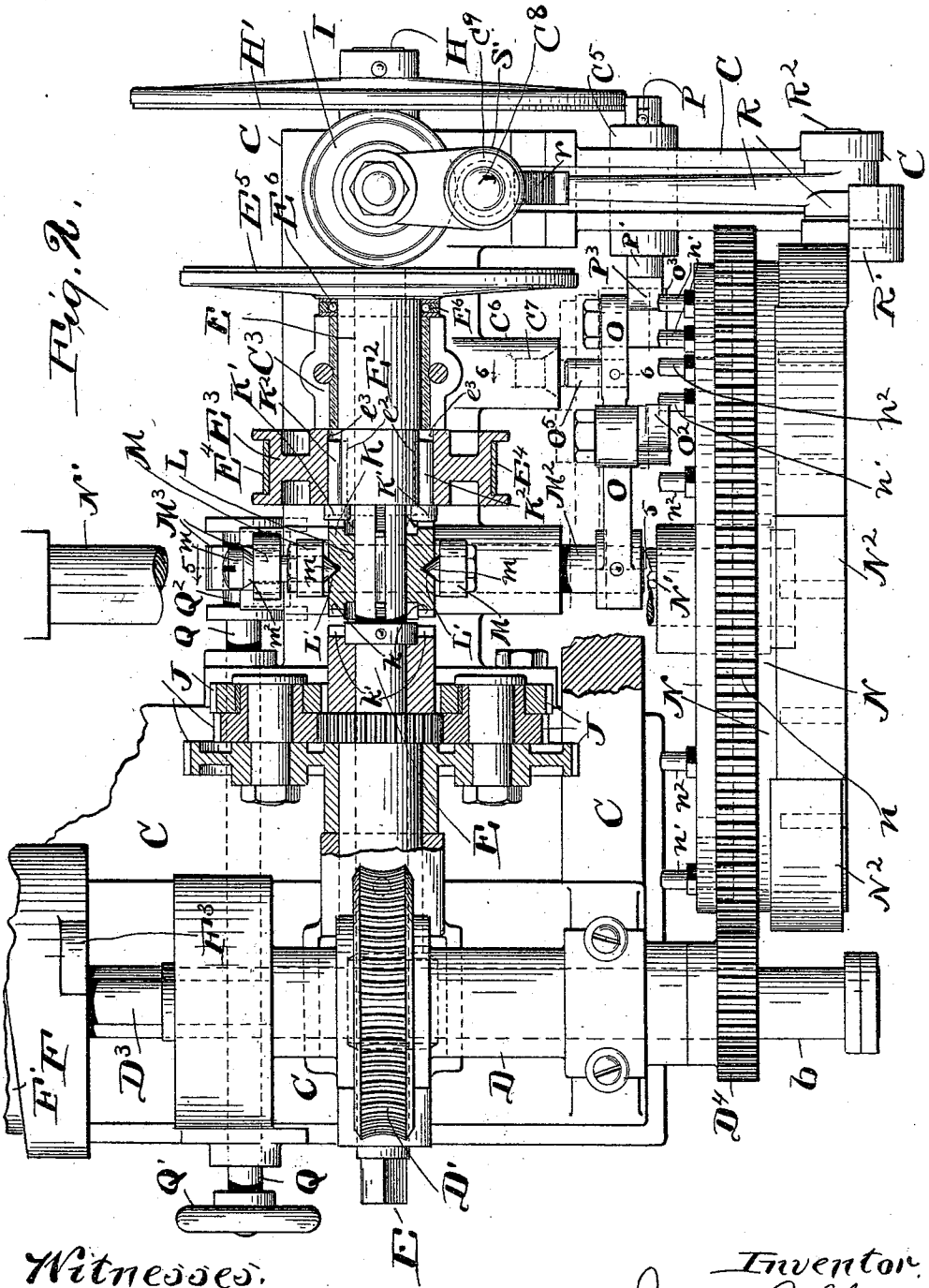
(No Model.) 5 Sheets—Sheet 2.

# J. B. CLYNE.

## MACHINE FOR MAKING SCREWS, NIPPLES, &c.

No. 554,814. Patented Feb. 18, 1896.

Fig. 2.



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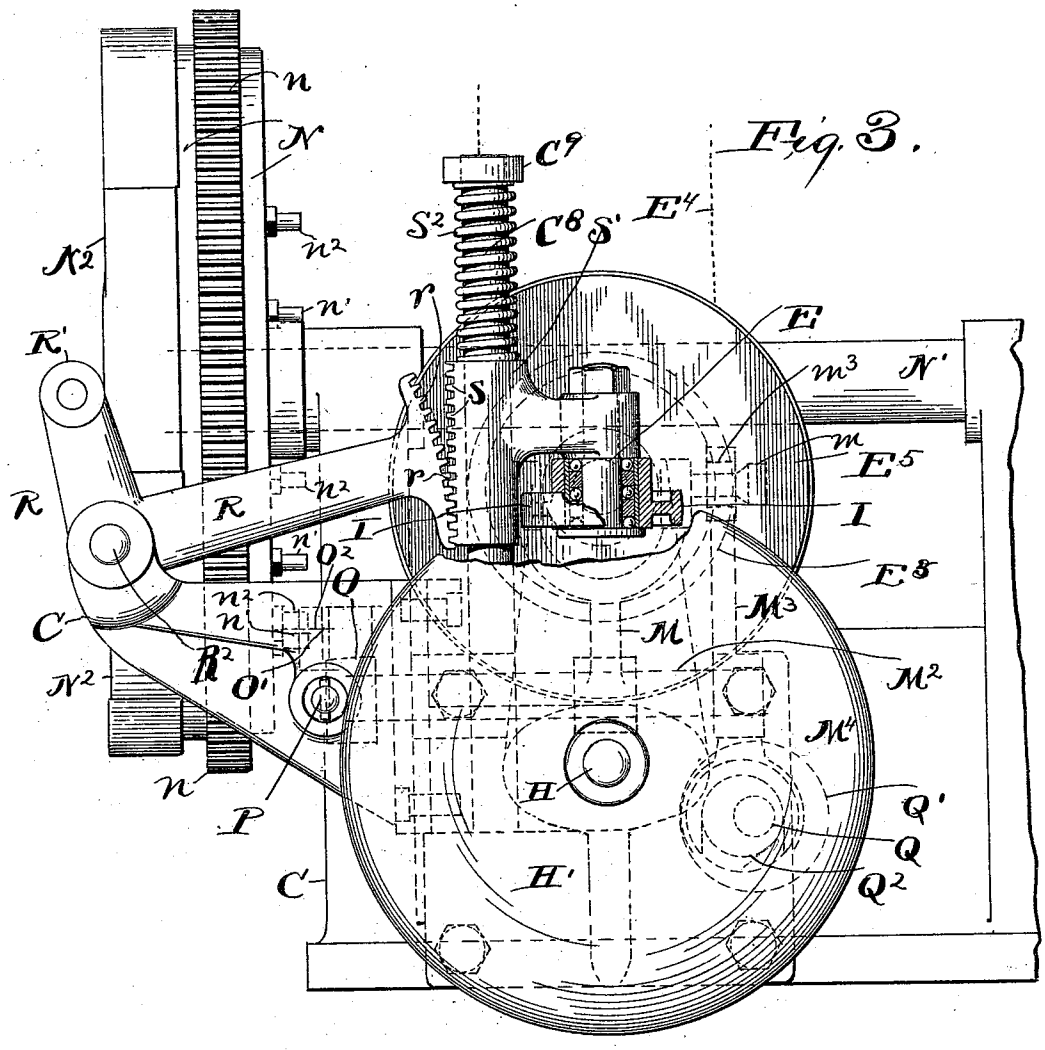
(No Model.) 5 Sheets—Sheet 3.

# J. B. CLYNE.

## MACHINE FOR MAKING SCREWS, NIPPLES, &c.

No. 554,814. Patented Feb. 18, 1896.

Fig. 3.

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(No Model.) 5 Sheets—Sheet 4.

# J. B. CLYNE.

## MACHINE FOR MAKING SCREWS, NIPPLES, &c.

No. 554,814. Patented Feb. 18, 1896.

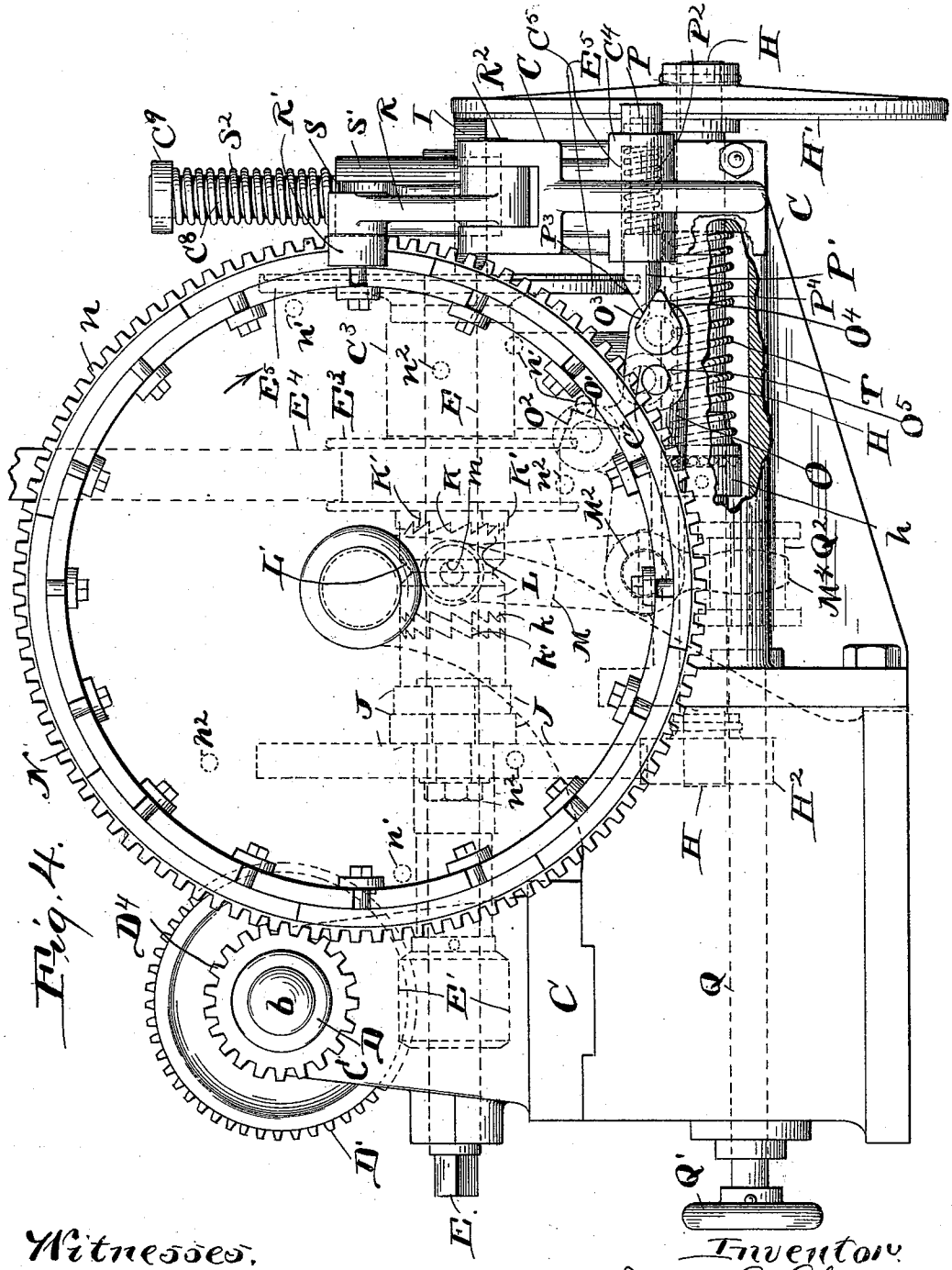

Fig. 4.

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(No Model.) 5 Sheets—Sheet 5.

# J. B. CLYNE.

## MACHINE FOR MAKING SCREWS, NIPPLES, &c.

No. 554,814. Patented Feb. 18, 1896.

Fig. 5.

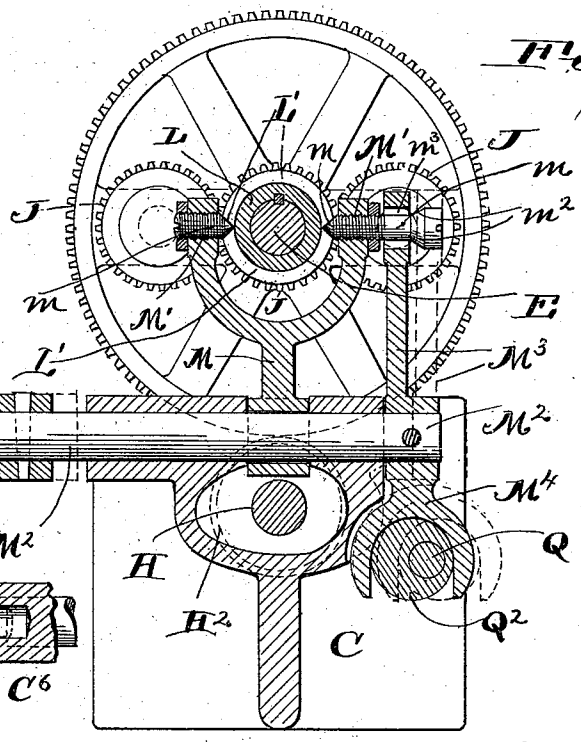



Fig. 6.

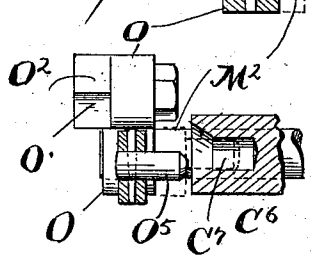
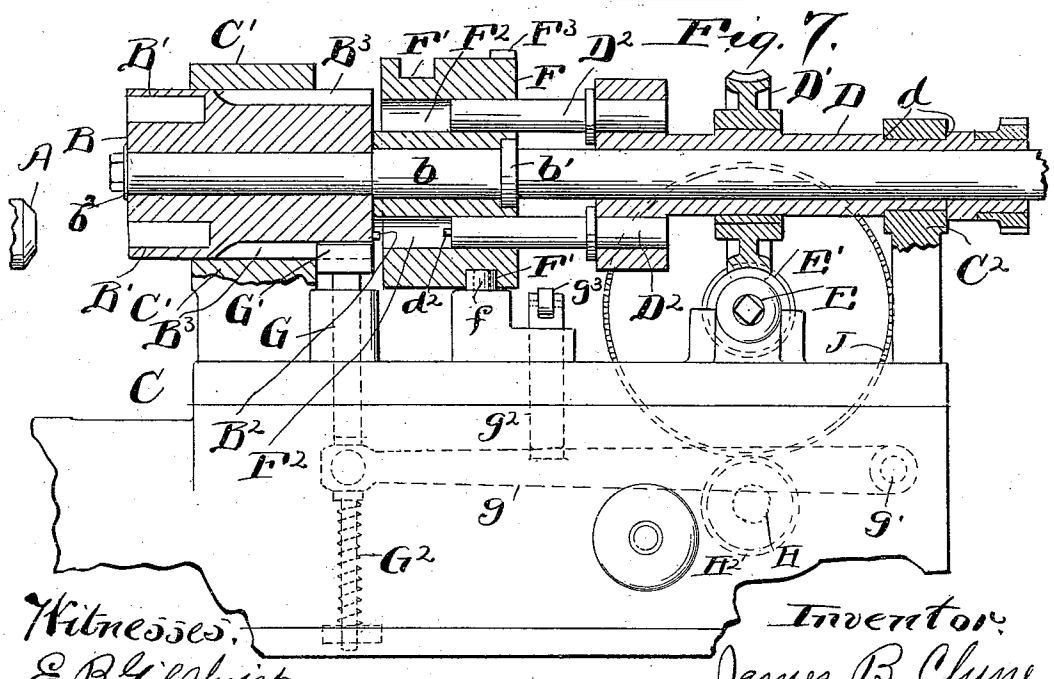



Fig. 7.

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# UNITED STATES PATENT OFFICE.

JAMES B. CLYNE, OF CLEVELAND, OHIO, ASSIGNOR TO THE CLEVELAND MACHINE SCREW COMPANY, OF SAME PLACE.

## MACHINE FOR MAKING SCREWS, NIPPLES, &c.

SPECIFICATION forming part of Letters Patent No. 554,814, dated February 18, 1896.

Application filed August 15, 1895. Serial No. 559,320. (No model.)

*To all whom it may concern:*

Be it known that I, JAMES B. CLYNE, of Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Lathes or Metal-Working Machines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it pertains to make and use the same.

My invention relates to improvements in lathes or metal-working machines more especially designed for making screws, nipples used in the attachment of the spokes of a bicycle-wheel to the wheel-rim, &c.; and it consists in certain features of construction and combinations of parts hereinafter described and pointed out in the claims.

In the accompanying drawings, Figure 1 is a top plan of a machine embodying my invention. A portion of shaft N′ is broken away in this figure to more clearly show the construction. Fig. 2 is a top plan, partly in section, of the greater portion of the machine. Portions are also broken away in this figure and the parts are illustrated on a larger scale than in Fig. 1. Fig. 3 is a right-hand side elevation relative to Fig. 2, and portions are broken away and in section in this figure to more clearly show the construction. Fig. 4 is a front side elevation relative to Fig. 2. Portions are broken away and in section in this figure to more clearly show the construction. Fig. 5 is a vertical section on line 5 5, Fig. 2, looking in the direction of the arrow. Fig. 6 is a vertical section on line 6 6, Fig. 2, looking in the direction of the arrow. Fig. 7 is a side elevation of the tool-stock, its shaft, rotary sleeve upon said shaft, and the means employed for establishing operative connection between the tool-stock and said sleeve and for reciprocating said stock longitudinally.

Referring to the drawings, A (see Figs. 1 and 7) designates the work-holder that is rotated in any approved manner. It is not considered necessary to show the mechanism for rotating the work, because the same forms no part of my present invention.

B designates the tool-stock that is suitably mounted upon a horizontally-arranged shaft *b* suitably supported from the stationary framework C of the machine. In the case illustrated the tool-stock is mounted upon one end of shaft *b* and has bearing in a box C′ rigid with framework C, and the shaft at or near its opposite end is supported, as will hereinafter appear. The tool-stock within its tool-bearing end is provided with any suitable number of pockets B′ (see Fig. 7) for the reception of tools (not shown) required in the operation of the machine.

I would here remark that work of the character indicated—such, for instance, as screws, nipples, &c.—is made from wire or metallic rods, and the wire or rod is automatically fed through the work-holder while it is rotated with the holder, and that in the manufacture of said work two or more tools are required. The tools should be advanced slowly in performing their function, and, to increase the capacity of the machine, should be rapidly withdrawn from the work after the performance of their function, and the different tools employed in the formation or construction of a piece of work are required to be advanced at different speeds, respectively. The tool-receiving pockets B′, and consequently the tools (not shown) of the tool-stock, are arranged at suitable intervals about the axis of the stock, and the arrangement of parts is such that the axis of the tool-stock is located such a distance out of line with the axis of the work-holder that the tools of the tool-stock shall be adapted to be brought successively into engagement with the work (not shown) to be operated upon.

A sleeve D (see Fig. 7) is loosely mounted upon the tool-stock-bearing shaft a suitable distance from the tool-stock. Sleeve D has bearing in a box $C^2$ rigid with frame C, and is provided with two annular shoulders *d d* at opposite ends, respectively, of said box, which shoulders prevent endwise displacement of the sleeve. A worm-wheel D′ is operatively mounted upon sleeve D and meshes with a worm E′ formed upon the driving-shaft E. A sleeve F (see Fig. 7) is loosely mounted upon the tool-stock-bearing shaft between the tool-stock and sleeve D. Sleeve F at one end engages the tool-stock and at its other end engages an annular shoulder or collar *b′*,

formed upon the tool-stock-bearing shaft, and a collar $b^2$ is formed upon shaft $b$ at and engages the outer end of the tool-stock, by which construction the tool-stock and its supporting-shaft are moved endwise or longitudinally with sleeve F when the latter is reciprocated, as will presently appear. Operative connection between sleeve F and sleeve D is established in any approved manner—for instance, by horizontal pins $D^2$ suitably secured to sleeve D and projecting into corresponding holes $F^2$ extending through sleeve F. One of pins $D^2$ is provided at its free end with a dog or projecting member $d^2$ that is adapted to be engaged upon one side by a similar dog or projecting member $B^2$, formed or constructed upon the rear or inner end of the tool-stock, when the latter is moved inwardly or rearwardly with sleeve F and the supporting-shaft. Sleeve F upon its periphery is provided with a groove F′ that is engaged by a roller $f$, suitably supported from the supporting-frame of the machine. Groove F′ extends circumferentially of the sleeve and has such trend that the sleeve during its rotation is, by means of the engaging-roller, caused to reciprocate endwise, resulting in the reciprocation of the tool-stock-bearing shaft, and consequently the tool-stock, as required, to advance the operating-tool during its operation and to withdraw the tool from the work after it has performed its function, and the arrangement of parts is such that when the tool-stock is moved rearwardly or withdrawn from the work after the tool has performed its function operative connection is established between said stock and sleeve D through the medium of dogs or projecting members $B^2$ and $d^2$, and the tool-stock is thereupon given the fractional turn required in order to bring the next succeeding tool into position for operation, and the trend of groove F′ is furthermore such that immediately upon the actuation of a tool of the tool-stock into position for operation the tool-stock, and consequently the tool, shall be moved forwardly or advanced, as required, during the operation of the tool.

To prevent circumferential displacement or vibration of the tool-stock during the operation of the tool, means for positively locking the tool-stock in the operative position of the tool is provided, and consists preferably of an upright bolt G, (see Fig. 7,) provided at its upper end with a head G′, adapted to snugly engage longitudinal grooves or recesses $B^3$, formed in the periphery and arranged longitudinally of the tool-stock, and a spiral spring $G^2$, suitably confined upon said bolt, acts in the direction to retain the bolt in its operative position. The tool-stock is provided with as many recesses or grooves $B^3$ as there are tool-receiving pockets B′, and the arrangement of said grooves or recesses is such that one of them is opposite the head of the bolt in the operative position of any one of the tools with which the tool-stock is provided. Bolt G extends downwardly through the adjacent portion of the stationary part of the machine and at its lower end is operatively connected with the outer end of the vertically-tilting lever $g$, that is fulcrumed at its opposite end, as at $g'$, to a stationary member of the machine and at any suitable point between its fulcrum and outer end supports an upright pin or member $g^2$, that extends upwardly through the adjacent portion of the stationary part of the machine, and at its upper end is provided with a roller $g^3$, adapted to be engaged by a cam or projection $F^3$, formed upon the periphery of sleeve F, and the arrangement of parts is such that said cam shall have come into engagement with roller $g^3$ and shall have depressed pin $g^2$ to actuate the engaging-lever $g$ in the direction and to the extent required to render bolt G inoperative immediately before operative engagement is completed between the tool-stock and the rotating sleeve D.

The driving-shaft E, whose speed is to be controlled or regulated, is shown arranged horizontally and at right angles to the tool-stock-bearing shaft. Shaft E is supported in any approved manner from the supporting-frame of the machine, and a sleeve $E^2$ (see Figs. 1 and 2) is loosely mounted upon one end of said shaft. Said sleeve $E^2$ is shown journaled in a box $C^3$ rigid with the stationary framework of the machine. The driving-pulley $E^3$ is operatively mounted upon the inner end of sleeve $E^2$ at the inner end of box $C^3$, and said pulley is rapidly driven, preferably by means of a belt $E^4$, from a counter-shaft. (Not shown.) Sleeve $E^2$ at its outer end terminates in a friction-disk $E^5$, that is preferably integral with the sleeve, and antifriction-balls $E^6$ are preferably confined between said disk and the outer end of box $C^3$ around sleeve $E^2$.

H designates a suitably-supported shaft a suitable distance below and preferably in the same vertical plane as shaft E. Shaft H is arranged horizontally and parallel with shaft E and extends a suitable distance beyond the friction-disk-bearing end of shaft E. A friction-disk H′ is operatively mounted upon the outer end of shaft H, and a suitably-supported friction-roller I is interposed and operatively engages the opposing flat faces of disks $E^5$ and H′, whereby motion is communicated from disk $E^5$ to disk H′, said friction-roller being movable radially of the overlapping portions of the disks. The diameter of the driven disk H′ is preferably such that said disk extends upwardly opposite, or nearly opposite, the central portion of disk $E^5$. (See Figs. 3 and 4.) Shaft H, at its inner end, is provided with a gear $H^2$, (shown in dotted lines, Fig. 4,) that is operatively mounted upon the shaft and operatively engages a system of differential gearing J independent of shaft E and provided for effecting a great reduction in the speed of the tool-stock when the said system of gearing, which may be of any approved construction, is operatively con-

nected with said shaft. It will, therefore, be observed that shaft E, and consequently the tool-stock-actuating sleeve D, is rapidly driven when operative connection is established between the driving-pulley and said shaft, which rapid movement is desirable during the idle movements of the tool-stock. When, however, the driving-pulley is not operatively connected with shaft E and operative connection is established between said shaft and the system of differential gearing, motion will be communicated from the driving-pulley to said shaft E through sleeve $E^2$, disk $E^5$, friction-roller I, friction-disk H', shaft H, gear $H^2$ and system of differential gearing, in which case said shaft E, and consequently the tool-stock, is actuated very slowly, as required, during the advancing or working movement of said stock.

A clutch for establishing operative connection between the driving-pulley and shaft E is provided, and another clutch for establishing operative connection between said shaft and the system of differential gearing is also provided. Toothed clutches are employed in the case illustrated, and referring, first, to the clutch employed for establishing an interrupting operative connection between the driving-pulley and shaft E, K (see Fig. 2) designates the movable member of the clutch, and K' the relatively stationary member of said clutch. Clutch member K' consists preferably of tooth-shaped heads formed upon pins $K^2$, that are employed in establishing operative connection between said pulley and its supporting-sleeve $E^2$, which pins engage holes $e^3$ in the hub of the pulley and recesses or grooves $e^2$ in the supporting-sleeve. Movable clutch member K is preferably integral with a sleeve L operatively and slidably mounted upon shaft E, and said sleeve is provided with an external annular groove L', that is engaged by two set-screws $m$ arranged at opposite sides, respectively, of sleeve L and extending through correspondingly-threaded holes M' (see Fig. 5) formed in the different members, respectively, of the forked end of an arm M, that is loosely mounted or fulcrumed at its lower end upon the horizontally-arranged shaft $M^2$ supported in any approved manner from the stationary framework of the machine a suitable distance below and arranged parallel with shaft E.

Referring to the clutch employed for establishing operative connection between shaft E and the system of differential gearing, $k$ designates the movable member of said clutch, and $k'$ the relatively stationary member of the clutch. Member $k'$ is operatively connected with said system of gearing in any approved manner, and member $k$ is rigid and preferably integral with sleeve L, to which reference has already been made. It will therefore be observed that the movable members of both clutches are operatively connected with one and the same sliding sleeve L, and that operative engagement is established between the members of the one or the other clutch, according as said sleeve is actuated into the one or the other of its extreme positions, and that the movable members of both clutches are disengaged from their companion and relatively stationary members when the sleeve is in its intermediate position. It follows, therefore, that the driving-pulley or the system of differential gearing is operatively connected with shaft E according as sleeve L is actuated into the one or the other of its extreme positions.

Suitable means for automatically actuating sleeve L is provided, and comprises preferably the following: A horizontally-arranged shaft N' is arranged at right angles to and a suitable distance above shaft E, (see Figs. 1, 2, 3, and 4,) and is suitably supported from the supporting-frame of the machine. A drum N is operatively mounted upon one end of said shaft N', and said drum is suitably intergeared with sleeve D by means of a spur-gear $D^4$ operatively mounted upon sleeve D and meshing with a gear-wheel $n$ formed upon the periphery of drum N. Drum N upon its inner face is provided with two series, $n'$ and $n^2$, respectively, of inwardly-projecting pins or members. Said series of pins or projecting members are arranged concentrically with the axis of the supporting-drum, and the members of each series are arranged at suitable intervals. In the case illustrated $n'$ designates the outer series and $n^2$ the inner series. The members of the outer series, $n'$, of drum-pins are adapted during their revolution to engage an incline or shoulder O' formed or constructed upon an arm or lever O (see Figs. 2 and 4) that is operatively mounted upon shaft $M^2$. A shoulder or incline $O^2$ is also formed or constructed upon said lever and is adapted to be engaged by the members of the inner series of drum-pins $n^2$.

The shank of one of set-screws $m$ extends a suitable distance beyond the outer side of the supporting-arm of the forked end of arm M, (see Fig. 5,) and said set-screw, between its head and shank, is provided with an annular beveled shoulder $m^2$. An upright arm or lever $M^3$ is operatively mounted upon shaft $M^2$ below said long set-screw, and said arm or lever $M^3$ at its upper end embraces the shank of the set-screw in the normal position of parts, and the hole $m^3$ in said arm or lever, and through which the set-screw extends, is somewhat larger in diameter than the diameter of the embraced portion of the shank of the screw, as shown in Fig. 5, and the arrangement of parts is such that when lever $M^3$, and consequently sleeve L, are in their intermediate position the aforesaid set-screw shall extend through the central portion of hole $m^3$, and hence when shaft $M^2$, and consequently lever $M^3$, is actuated into the one or the other of its extreme positions there is some lost motion before said lever is brought into operative engagement with the screw, and conse-

quently into operative connection with the forked arm M and sleeve L. Inclines or shoulders $n'$ $n^2$ are engaged alternately by one of the respective pins of drums N and lever O, and consequently shaft $M^2$ and lever $M^3$ are actuated in the one direction or the other according as incline or shoulder O′, or shoulder or incline $O^2$, is engaged by one of the drum-pins. The engagement of incline or shoulder $O^2$ by one of pins $n^2$ depresses lever O, and thereby actuates shaft $M^2$ and its arm or lever $M^3$ in the direction of the driving-pulley, and said lever O is elevated upon the engagement of incline or shoulder O′ by one of pins $n'$, and thereby actuates shaft $M^2$ and lever $M^3$ in the direction of the system of differential gearing. Pins $n'$ and $n^2$ of drum N are not capable of actuating arm M and the movable clutch members K and $k$ the distance required to establish operative engagement between the members of either clutch, and in order to actuate lever $M^3$, and consequently sleeve L, in the one or the other of their extreme positions, as required to establish operative engagement between one or the other of the clutch members operatively connected with said lever and sleeve and the companion clutch member, some means for establishing or throwing lever O farther than said lever is thrown by pins $n'$ $n^2$ is provided, and consists preferably of two shoulders or inclines $O^3$ and $O^4$ (see Fig. 4) suitably formed or constructed upon and at or near the free end of lever O. The trend of incline or shoulder $O^3$ is downwardly and in the direction of the free extremity of the lever, and the trend of shoulder or incline $O^4$ is upwardly and in the direction of said extremity of the lever, so that both inclines converge and meet, or substantially meet, at their adjacent ends. Incline $O^3$ is adapted to be engaged by a corresponding incline $P^3$, formed upon the head P′ of a horizontally-arranged pin P that is adapted to move endwise of the chamber $C^5$ of a box $C^4$, rigid with the stationary frame work of the machine. Head P′ of pin P is also provided with another incline $P^4$ that corresponds with and is adapted to engage incline $O^4$ upon lever O. Inclines $P^3$ and $P^4$ therefore converge in the direction of the outer end of pin-head P′ and meet, or substantially meet, at their adjacent extremities, and the arrangement of parts is such that incline $O^3$ of lever O engages incline $P^3$ of pin P, or incline $O^4$ of said lever engages incline $P^4$ of the pin, according as clutch members K and K′, or clutch members $k$ and $k'$, operatively engage each other, and, in the case illustrated in Fig. 4, incline $O^3$ of lever O engages incline $P^3$ of pin P when clutch members K and K′ operatively engage each other, and hence incline $O^4$ is engaged by incline $P^4$ when clutch-members $k$ $k'$ operatively engage each other. The arrangement of parts is therefore such that when lever $M^3$, and consequently sleeve L, are in the one or the other extreme position and operative connection is established between one of the clutch members operatively connected with said sleeve and the companion clutch member incline or shoulder $O^3$, or shoulder or incline $O^4$, is engaged by the corresponding incline on pin P, and the parts are furthermore so arranged and timed that when the position of parts is as just described the next succeeding pin of drum N will, during the rotation of said drum, actuate lever O so as to move the meeting or adjacent extremities of shoulders or inclines $O^3$ and $O^4$ of said lever opposite and a trifle beyond the meeting ends of inclines $P^3$ and $P^4$ of pin P, and thereby actuate said pin P against the action of a spiral spring $P^2$, suitably confined upon said pin, and acting to retain the pin in its advanced or normal position, and when the adjacent ends of inclines or shoulders $O^3$ and $O^4$ have thus been actuated to traverse the adjacent ends of inclines $P^3$ and $P^4$ lever $M^3$, and consequently sleeve L, shall have been actuated into their intermediate position, or approximately intermediate position, (wherein the movable clutch members K and $k$ are located centrally between the relatively stationary clutch members,) whereupon the recoil of said spring $P^2$ will throw the engaging-pin P forwardly so as to bring the other incline thereon into engagement with the corresponding incline or shoulder upon lever O, and thereby establish operative connection between the members of that clutch that was lastly rendered inoperative, and hence it will be observed that the driving-pulley and the system of differential gearing are alternately operatively connected with shaft E, as required in the operation of metal-working machines of the variety indicated.

Suitable means for rendering lever O inoperative—that is, for moving said lever out of the way of the annular paths of the lever-actuating pins $n'$ and $n^2$ of drum N, and for locking sleeve L and the connected movable clutch members in their intermediate and inoperative position—should be provided, and consists preferably of a horizontally-arranged shaft Q that is suitably supported from the supporting-frame of the machine a suitable distance below and at right angles to shaft $M^2$, (see Figs. 4 and 5,) which shaft Q, at one end, is provided with a hand-wheel Q′ or other means for turning the shaft. Said shaft, directly below shaft $M^2$, is shown provided with a cam or eccentric $Q^2$, the peripheral surface whereof is straddled or engaged by the lower forked end of an arm or lever $M^4$ operatively mounted upon or connected with shaft $M^2$.

Arm or lever $M^4$ in its normal position, which it assumes during the operation of the machine, operates idly during the operation of the machine, but the arrangement of parts is such that shaft $M^2$, by means of the cam or eccentric upon shaft Q and the engaging shaft, arm, or lever, can, upon turning said shaft Q in the required direction, be shifted endwise in the direction required to move lever $M^3$ over the head of the embraced set-screw and

to shift lever O and the shoulders or inclines thereon inwardly away from pin P and away from the annular paths of pins $n'$ $n^2$ of drum N, and the head of the aforesaid set-screw is preferably large enough to fit the hole in the embracing-lever and thereby remove the lost motion had between the lever and screw. Lever O, upon its inner side, is also provided with an inwardly-projecting lug or pin $O^5$, that, when said lever is actuated from its operative to an inoperative position, enters a hole $C^7$ formed within a stationary lug or member $C^6$ of the supporting-frame, (see Figs. 1, 2, and 6,) and thereby locks said lever and the connected parts in the inoperative position of said parts. Lever O is shown in its inoperative position in dotted lines, Figs. 2 and 6, and lever $M^3$ is shown engaging the head of the embraced set-screw in dotted lines, Fig. 5.

Drum N upon its peripheral surface, or at any other suitable place, is provided with cams $N^2$ that are adapted to engage the roller R′ borne by the one arm of a bell-crank lever R that is fulcrumed at $R^2$ (see Fig. 3) to any suitable stationary member of the machine. The other arm of said lever at its outer end is provided with a segmental gear or rack $r$ that meshes with an upright rack S formed upon a vertically-sliding sleeve S′ suitably mounted and adapted to slide endwise of an upright stationary post or rod $C^8$, and friction-roller I is supported in any approved manner from said vertically-sliding sleeve. A spiral spring $S^2$, suitably confined upon said upright post or rod $C^8$ between the upper end of sleeve S′ and a shoulder or collar $C^9$ formed upon and at or near the upper extremity of said rod or post, is preferably provided and acts to depress the engaging-roller bearing-sleeve.

The speed of shaft H and of shaft E when the latter has the system of differential gearing operatively connected therewith is, it will be observed, increased or decreased according as roller I is shifted from the central portion of disk $E^5$ and outer portion of disk H′ toward the axis of the latter and periphery of the former, or according as roller I is shifted toward the periphery of disk H′ and axis of disk $E^5$. Cams $N^3$, that form a cam-wheel upon or at the outer face of drum N, have such trend and shape as required to actuate the segmental-rack-bearing lever in the direction required to elevate the friction-roller-bearing sleeve and thereby reduce the speed of shaft H and connected parts, and spring $S^2$, that is compressed by sleeve S′ when the latter is elevated, acts, as already indicated, in the direction to depress said sleeve and thereby increase the speed of shaft H and connected members when said depression of the sleeve is permitted by the cam-wheel, and the spring of course acts to retain the roller of the segmental-rack-bearing lever in engagement with the cam-wheel. Hence it will be observed that in my improved machine the regulation of the speed of shaft H, and consequently the regulation of the speed of shaft E when the latter is operatively connected with the system of differential gearing that operatively engages shaft H, is automatic.

I would also remark that a spiral spring T, as shown in Fig. 4, is preferably confined upon shaft H in any approved manner and presses against a collar $h$ fixed upon said shaft a suitable distance inwardly from disk H′, and thereby acts to retain disk H′ in the desired frictional engagement with roller I.

What I claim is—

1. In a metal-working machine, the combination of a suitably-supported shaft, E; a suitably-actuated driving pulley or wheel, $E^3$, loosely mounted upon said shaft; a system of differential gearing located a suitable distance from the driving-wheel; a suitably-actuated sleeve operatively and slidably mounted upon said shaft between the driving-wheel and system of differential gearing; two clutches, one member of each clutch being operatively connected with the sleeve, and the other two members of the clutches being operatively connected with the pulley and system of differential gearing, respectively; another suitably-supported shaft H, operatively connected with the system of differential gearing, and means establishing operative connection between the last-mentioned shaft and the driving-wheel, substantially as set forth.

2. In a metal-working machine, the combination of a suitably-supported shaft, E; a suitably-actuated driving pulley or wheel, $E^3$, loosely mounted upon said shaft; a system of differential gearing located a suitable distance from the driving-wheel; two clutches interposed between the driving-wheel and system of differential gearing, one member of each clutch being operatively and slidably mounted upon the aforesaid shaft, and the other two members of the clutches being operatively connected with the driving-wheel and aforesaid system of gearing, respectively; means for rendering the two clutches operative alternately, and another suitably-supported shaft, H, operatively connected with the aforesaid driving-wheel and system of gearing, substantially as set forth.

3. In a metal-working machine, the combination with an endwise-slidable tool-stock and its engaging-shaft; a rotary sleeve, D, loosely mounted upon said shaft a suitable distance from the tool-stock; another sleeve, F, loose upon said shaft and operatively connected with the tool-stock so far as endwise movement of said stock is concerned, said sleeve F being provided with the peripheral groove F′ having a trend substantially as indicated; the stationary roller $f$ engaging said groove; means operatively connecting said sleeve F with the rotary sleeve D, and means establishing operative connection between the tool-stock and said sleeve D upon the inward or receding movement of the stock, all arranged and operating substantially as indicated; of a suitably-supported shaft E operatively con-

nected with the tool-stock shaft; a suitably-actuated driving pulley or wheel, $E^3$, loose upon said shaft E; a system of differential gearing operatively connected with the driving-wheel; means for automatically establishing and interrupting operative connection between the driving-wheel and its shaft E, and means for automatically establishing and interrupting operative connection between said shaft E and the aforesaid system of gearing, and the parts being so arranged and timed that said system of gearing and the aforesaid driving-wheel shall be operatively connected with the shaft alternately, substantially as and for the purpose set forth.

4. In a metal-working machine, the combination with an endwise-slidable tool-stock and its engaging-shaft; a rotary sleeve, D, loosely mounted upon said shaft a suitable distance from the tool-stock; another sleeve, F, loose upon said shaft and operatively connected with the tool-stock so far as endwise movement of said stock is concerned, said sleeve F being provided with the peripheral groove F′ having a trend substantially as indicated; the stationary roller *f* engaging said groove; means operatively connecting said sleeve F with the rotary sleeve D, and means establishing operative connection between the tool-stock and said sleeve D upon the inward or receding movement of the stock, all arranged and operating substantially as indicated; of a suitably-supported shaft E operatively connected with the tool-stock shaft; a suitably-actuated driving pulley or wheel, $E^3$, loose upon said shaft; a system of differential gearing located a suitable distance from but operatively connected with the driving-wheel; two clutches interposed between said wheel and system of differential gearing, one member of each clutch being operatively and slidably mounted upon the supporting-shaft, and the other two members of the clutches being operatively connected with the driving-wheel and aforesaid system of gearing, respectively, and means for automatically rendering the two clutches operative alternately, substantially as and for the purpose set forth.

5. In a metal-working machine, the combination with a suitably-supported shaft, E; a suitably-actuated driving pulley or wheel, $E^3$, loose upon the shaft; a system of differential gearing located a suitable distance from but operatively connected with the said wheel; two clutches interposed between the driving-wheel and aforesaid system of gearing, one of the two members of each clutch being operatively and slidably mounted upon the aforesaid shaft, and the other two clutch members being operatively connected with the pulley and aforesaid system of gearing, respectively; of a suitably-supported shaft, $M^2$, arranged a suitable distance from and transversely of shaft E, said shaft $M^2$ being provided with an arm or lever $M^3$ for actuating the slidable clutch members as required to effect operative engagement between the members of one of the clutches and interrupt operative engagement between the members of the other clutch, and said shaft $M^2$ having also an arm or lever O provided with the inclines or shoulders $O'$ $O^2$ and the shoulders or inclines $O^3$ $O^4$; the pin P provided with the inclines or shoulders $P^3$ $P^4$; the spring $P^2$, and the suitably-supported and suitably-actuated rotating drum or wheel N provided with any suitable number of pins or projecting members $n'$ $n^2$, all arranged and operating substantially as shown, for the purpose specified.

6. In a metal-working machine, the combination with a suitably-supported shaft, E; a suitably-actuated driving pulley or wheel, $E^3$, loose upon the shaft; a system of differential gearing operatively connected with the driving-wheel; two clutches interposed between said wheel and aforesaid system of gearing, one of the two members of each clutch being operatively and slidably mounted upon the aforesaid shaft, and the other two clutch members being operatively connected with the driving-wheel and aforesaid system of gearing, respectively; of a suitably-supported shaft, $M^2$, arranged a suitable distance from and transversely of shaft E, said shaft $M^2$ being provided with an arm or lever $M^3$ for actuating the slidable clutch members as required to effect operative engagement between the members of one of the clutches and interrupt operative engagement between the members of the other clutch, and said shaft $M^2$ having also an arm or lever O provided with the inclines or shoulders $O'$ $O^2$ and the shoulders or inclines $O^3$, $O^4$; the pin P provided with the inclines or shoulders $P^3$ $P^4$; any suitable number of suitably-supported revolving pins or members $n'$ $n^2$, and means for communicating motion from the aforesaid shaft E to said revolving pins or members all arranged and operating substantially as shown, for the purpose specified.

7. In a metal-working machine, the combination with a suitably-supported shaft E; a suitably-actuated driving pulley or wheel, $E^3$, loose upon the shaft; a system of differential gearing operatively connected with the driving-wheel; two clutches interposed between said wheel and aforesaid system of gearing, one of the two members of each clutch being operatively and slidably mounted upon the aforesaid shaft and the other two clutch members being operatively connected with the driving-wheel and aforesaid system of gearing, respectively; a suitably-supported shaft $M^2$ arranged a suitable distance from and transversely of shaft E, said shaft $M^2$ being provided with an arm or lever $M^3$ provided with a lateral hole $m^3$ and adapted to actuate the slidable clutch members as required to effect operative engagement between the members of one of the clutches and interrupt operative engagement between the members of the other clutch; a screw or member *m* extending through and smaller in diameter than the aforesaid hole $m^3$ and operatively con-

nected with the slidable clutch members; the arm or lever O operatively connected with the aforesaid shaft $M^2$ and provided with inclines or shoulders O' $O^2$ and shoulders or inclines $O^3$, $O^4$; the pin P provided with the inclines or shoulders $P^3$, $P^4$; the spring $P^2$, and the suitably-supported and suitably-actuated rotating drum or wheel N provided with any suitable number of projecting members $n'$ $n^2$, all operating substantially as shown, for the purpose specified.

8. In a metal-working machine, the combination of the shaft E; the pulley or wheel $E^3$; system of differential gearing J; the sleeve L provided with the annular groove L'; the clutch K K'; the clutch $k$ $k'$; the forked arm M; the shaft $M^2$ provided with arm or lever $M^3$ having the lateral hole $m^3$; the set-screws $m$ $m$, one whereof extends through the aforesaid hole $m^3$; the arm or lever O provided with inclines or shoulders O' $O^2$ and the shoulders or inclines $O^3$ and $O^4$; the pin P having inclines or shoulders $P^3$ $P^4$; the spring $P^2$, and the suitably-actuated drum or wheel N provided with any suitable number of pins or projecting members $n'$ $n^2$, all arranged and operating substantially as shown, for the purpose specified.

9. In a metal-working machine, the combination of a suitably-supported shaft E; the tool-stock-rotating sleeve D operatively connected with said shaft; a suitably-actuated driving pulley or wheel $E^3$ loose upon the shaft; a system of differential gearing, J, operatively connected with the driving-wheel; two clutches interposed between said wheel and system of differential gearing; one of the two members of each clutch being operatively and slidably mounted upon the aforesaid shaft, and the other two clutch members being operatively connected with the driving-wheel and the aforesaid system of gearing, respectively; a suitably-supported shaft $M^2$ arranged a suitable distance from and transversely of shaft E; said shaft $M^2$ being provided with an arm or lever $M^3$ for actuating the slidable clutch members as required to effect operative engagement between the members of one of the clutches and interrupting operative engagement between the members of the other clutch, and said shaft $M^2$ having also an arm or lever O provided with the inclines or shoulders O', $O^2$, and the shoulders or inclines $O^3$, $O^4$; a pin P provided with the inclines or shoulders $P^3$, $P^4$; a spring $P^2$, and the suitably-supported and suitably-actuated rotating drum or wheel N operatively connected with the aforesaid tool-stock-actuating sleeve and provided with any suitable number of pins or projecting members $n'$ $n^2$, all arranged and operating substantially as shown, for the purpose specified.

10. In a metal-working machine, the combination of a suitably-supported shaft E; a suitably-actuated driving pulley or wheel $E^3$ loosely mounted upon said shaft; a system of differential gearing operatively connected with the driving-pulley; two clutches interposed between the pulley and said system of gearing, one member of each clutch being operatively and slidably mounted upon the aforesaid shaft, and the other two members of the clutches being operatively connected with the pulley and aforesaid system of gearing, respectively; means for automatically establishing operative engagement between the companion members of both clutches alternately, and means for rendering the slidable members of both clutches inoperative and locking said clutch members in their inoperative position, substantially as set forth.

11. In a metal-working machine, the combination with a suitably-supported shaft E; a suitably-actuated driving pulley or wheel $E^3$ loose upon the shaft; a system of differential gearing operatively connected with the driving-wheel; two clutches interposed between said wheel and aforesaid system of gearing, one of the two members of each clutch being operatively and slidably mounted upon the aforesaid shaft, and the other two clutch members being operatively connected with the driving-wheel and aforesaid system of gearing, respectively; a suitably-supported shaft $M^2$ arranged a suitable distance from and transversely of shaft E, said shaft $M^2$ being provided with an arm or lever $M^3$ for actuating the slidable clutch members, and having also an arm or lever O provided with the inclines or shoulders O' and $O^2$ and the shoulders or inclines $O^3$, $O^4$; the pin P provided with inclines or shoulders $P^3$ $P^4$; the spring $P^2$, and the suitably-supported and suitably-actuated rotating wheel or drum N provided with any suitable number of pins or projecting members $n'$ $n^2$ adapted to engage and traverse inclines O' $O^2$, respectively, of suitable means for shifting the aforesaid shaft $M^2$ endwise in the direction required to move shoulders or inclines O' $O^2$ out of the annular paths in which said pins $m'$ $m^2$ move during their revolution, substantially as and for the purpose set forth.

12. In a metal-working machine, the combination of a suitably-supported shaft E; a suitably-actuated driving pulley or wheel $E^3$ loosely mounted upon said shaft; a system of differential gearing operatively connected with the driving-wheel; two clutches interposed between said wheel and system of gearing, one member of each clutch being operatively and slidably mounted upon the aforesaid shaft, and the other two members of the clutches being operatively connected with the driving-wheel and aforesaid system of gearing, respectively; a suitably-supported shaft $M^2$ arranged a suitable distance from and transversely of shaft D, said shaft $M^2$ being provided with an arm or lever $M^3$ for actuating the slidable clutch members, and having also an arm or lever O provided with the inclines or shoulders O' and $O^2$ and the shoulders or inclines $O^3$, $O^4$ and pin or lug $O^5$; the pin P provided with inclines or shoulders $P^3$

$P^4$; the spring $P^2$, and the suitably-supported and suitably-actuated rotating wheel or drum N provided with any suitable number of pins or projecting members $n'$ $n^2$ adapted to engage and traverse inclines O' $O^2$, respectively; of the stationary lug $C^6$ provided with the bore or hole $C^7$, and suitable means for shifting the aforesaid shaft $M^2$ endwise, all arranged and operating substantially as shown, for the purpose specified.

13. In a metal-working machine, the combination with a suitably-supported shaft E; a suitably-actuated driving pulley or wheel $E^3$ loose upon the shaft; a system of differential gearing operatively connected with the driving-wheel; two clutches interposed between said wheel and system of gearing, one of the two members of each clutch being operatively and slidably mounted upon the aforesaid shaft and the other two clutch members being operatively connected with the driving-wheel and aforesaid system of gearing, respectively; a suitably-supported shaft $M^2$ arranged a suitable distance from and transversely of shaft E, said shaft $M^2$ being provided with an arm or lever $O^3$ for actuating the clutch members and with another arm or lever O provided with inclines or shoulders O' $O^2$ and the shoulders or inclines $O^3$ $O^4$; the pin P provided with inclines or shoulders $P^3$ $P^4$; the spring $P^2$, and the suitably-supported and suitably-actuated wheel or drum N provided with any suitable number of pins or projecting members $n'$, $n^2$, of the stationary lug $C^6$ having a bore or hole $C^7$; the shaft Q provided with the cam or eccentric Q', and the forked lever $M^4$ having its fork straddling the peripheral surface of said cam or eccentric and being operatively connected with the aforesaid shaft $M^2$, all arranged and operating substantially as shown, for the purpose specified.

14. In a metal-working machine, the combination of a suitably-supported shaft E; a sleeve $E^2$ loosely mounted upon one end of said shaft; a driving pulley or wheel $E^3$ operatively connected with said sleeve; a friction-disk $E^5$ formed upon or operatively connected with the outer end of the sleeve; another shaft H arranged a suitable distance below and parallel with the aforesaid shaft E, said shaft H extending a suitable distance beyond the friction-disk-bearing end of shaft E; a friction-disk H' operatively mounted upon shaft H a suitable distance from the disk $E^5$ and having such diameter that its inner face overlaps, or extends opposite to or approximately opposite to the axis of, said disk $E^5$, and a suitably-supported and suitably-reciprocated friction-roller I interposed between the opposing faces of the disks, all arranged and operating substantially as shown, for the purpose specified.

15. In a metal-working machine, the combination with a suitably-supported horizontally-arranged shaft E; sleeve $E^2$ loosely mounted upon one end of said shaft; a driving pulley or wheel $E^3$ operatively connected with said sleeve; a friction-disk $E^5$ formed upon or operatively connected with the outer end of the sleeve; another shaft H arranged a suitable distance below and parallel with the aforesaid shaft E, said shaft H extending a suitable distance beyond the friction-disk-bearing end of the upper shaft; a friction-disk H' operatively mounted upon the lower shaft a suitable distance from the disk on the upper shaft and having such diameter that its inner face overlaps the opposing or outer face of the disk on the upper shaft; a suitably-supported and suitably vertically-reciprocated friction-roller I interposed between the opposing faces of the two friction-disks, and a spiral spring confined upon the lower shaft and acting to retain the disk upon said shaft in the desired frictional engagement with the friction-roller, all arranged and operating substantially as shown, for the purpose specified.

16. In a metal-working machine, the combination of a suitably-supported shaft E; a sleeve $E^2$ loosely mounted upon one end of said shaft; a suitably-actuated driving pulley or wheel $E^3$ operatively connected with said sleeve; a friction-disk $E^5$ formed upon or operatively connected with the outer end of said sleeve; a system of differential gearing J; two clutches interposed between the driving-wheel and differential gearing, one member of each clutch being operatively and slidably mounted upon the aforesaid shaft, and the other two members of the clutches being operatively connected with the driving-wheel and aforesaid system of gearing, respectively; means for rendering the slidable clutch members operative alternately; another suitably-supported shaft H arranged a suitable distance from and parallel with the aforesaid driving-wheel-bearing shaft and operatively connected with the aforesaid system of gearing, said shaft H extending a suitable distance beyond the friction-disk-bearing end of the driving-wheel-bearing shaft; a friction-disk operatively connected with said shaft H a suitable distance from the disk on the driving-wheel-bearing shaft and overlapping said last-mentioned disk substantially as indicated, and a suitably-supported and suitably-adjusted friction-roller I interposed between and engaging the opposing surfaces of the two friction-disks, substantially as shown, for the purpose specified.

17. In a metal-working machine, the combination of a suitably-supported shaft E; a sleeve $E^2$ loosely mounted upon one end of said shaft; a driving pulley or wheel $E^3$ operatively connected with said sleeve; a friction-disk $E^5$ formed upon or operatively connected with the outer end of the sleeve; another shaft H arranged a suitable distance below and parallel with the driving-wheel-bearing shaft, the lower shaft extending a suitable distance beyond the friction-disk-bearing end of the upper shaft; a friction-disk H' operatively mounted upon the lower shaft a suitable distance from the disk on the upper shaft and having such diameter that

its inner face overlaps the opposing face of the upper disk, and a suitably-supported and automatically-actuated vertically-movable friction-roller I interposed between and engaging the opposing surfaces of the two friction-disks, substantially as set forth.

18. In a metal-working machine, the combination of a suitably-supported shaft E; a sleeve $E^2$ loosely mounted upon one end of said shaft; a driving pulley or wheel $E^3$ operatively connected with said sleeve; a friction-disk $E^5$ formed upon or operatively connected with the outer end of the sleeve; another shaft H arranged a suitable distance below and parallel with the driving-wheel-bearing shaft, the lower shaft extending a suitable distance beyond the friction-disk-bearing end of the upper shaft, a friction-disk H′ operatively mounted upon the lower shaft a suitable distance from the disk on the upper shaft and having such diameter that its inner face overlaps the opposing face of the upper disk; the upright stationary post $C^8$ provided with the shoulder or collar $C^9$; the sleeve S′ mounted upon and adapted to slide up and down said post; the spring $S^2$; the friction-roller I suitably supported from said sleeve and engaging the opposing faces of the two friction-disks, and means for actuating the sleeve against the action of the aforesaid spring, all arranged and operating substantially as shown, for the purposes specified.

19. In a metal-working machine, the combination of a suitably-supported shaft E; a sleeve $E^2$ loosely mounted upon one end of said shaft; a driving pulley or wheel $E^3$ operatively connected with said sleeve; a friction-disk $E^5$ formed upon or operatively connected with the outer end of the sleeve; another shaft H arranged a suitable distance below the driving-wheel-bearing shaft; a friction-disk H′ operatively mounted upon the lower shaft a suitable distance from the disk on the upper shaft and having such diameter that its inner face overlaps the opposing or outer face of the upper disk; the upright stationary post $C^8$ provided with the shoulder or collar $C^9$; the sleeve S′ mounted upon and adapted to slide up and down said post; the spring $S^2$; the friction-roller I suitably supported from said sleeve and engaging the opposing faces of the two friction-disks; a suitably-actuated cam-wheel, and lever mechanism for actuating the aforesaid roller-bearing sleeve against the action of the aforesaid spring and adapted to be actuated by said cam-wheel, all arranged and operating substantially as and for the purpose specified.

20. In a metal-working machine, the combination with a suitably-supported shaft E; a sleeve $E^2$ loosely mounted upon one end of said shaft; a driving pulley or wheel $E^3$ operatively connected with said sleeve; a friction-disk $E^5$ formed upon or operatively connected with the outer end of the sleeve; another shaft H arranged a suitable distance below the driving-wheel-bearing shaft; a friction-disk H′ operatively mounted upon the lower shaft a suitable distance from the disk on the upper shaft and having such diameter that its inner face overlaps the opposing or outer face of the upper disk; the upright stationary post $C^8$, the sleeve S′ mounted upon and adapted to slide up and down said post; the spring $S^2$; the friction-roller I suitably supported from said sleeve and engaging the opposing faces of the two friction-disks; the rack S formed upon said sleeve; the suitably-supported bell-crank lever R; the segmental rack *r* formed upon the outer end of one arm of said lever, the other arm of said lever being provided with a roller R′; and a suitably-actuated cam-wheel engaging said last-mentioned roller and arranged and constructed to actuate the bell-crank lever in the direction required to effect the movement of the aforesaid roller-bearing sleeve against the action of the aforesaid spring, all arranged and operating substantially as shown, for the purpose specified.

21. In a metal-working machine, the combination of a rotary tool-stock-actuating sleeve; a horizontally-arranged shaft E operatively connected with said sleeve; a sleeve $E^2$ loose upon said shaft; a driving pulley or wheel and a friction-disk operatively connected with said last-mentioned sleeve; another shaft arranged below and parallel with the driving-wheel-bearing shaft; a friction-disk operatively connected with the lower shaft and located a suitable distance from and having its inner face overlapping the outer or opposing face of the upper friction-disk; and a suitably-supported and suitably-adjusted friction-roller interposed between and engaging the opposing faces of the friction-disks, substantially as indicated; a system of gearing operatively connected with the lower shaft; means for establishing and interrupting operative connection between said gearing and upper shaft, and means for establishing and interrupting operative connection between the driving-wheel and said upper shaft, substantially as set forth.

22. In a metal-working machine, the combination of a rotary tool-stock-actuating sleeve; a horizontally-arranged shaft E operatively connected with said sleeve; a sleeve $E^2$ loose upon said shaft; a driving pulley or wheel and a friction-disk operatively connected with said last-mentioned sleeve; another shaft H arranged a suitable distance from and parallel with the driving-wheel-bearing shaft; a friction-disk operatively connected with said shaft H and located a suitable distance from and having its inner face overlapping the outer or opposing face of the disk on the driving-wheel-bearing shaft; a friction-roller interposed between and movable radially or approximately radially of and engaging the overlapping portions of the disks; means acting to move said roller in the one direction; mech-

anism for actuating said roller in the opposite direction, and means operatively connected with the tool-stock-actuating sleeve for actuating said mechanism; gearing operatively connected with the aforesaid shaft H; means for establishing and interrupting operative connection between said gearing and the driving-wheel-bearing shaft, and means for establishing and interrupting operative connection between said shaft and the driving-wheel, substantially as set forth.

In testimony whereof I sign this specification, in the presence of two witnesses, this 7th day of August, 1895.

JAMES B. CLYNE.

Witnesses:
E. W. HULET,
C. H. DORER.