No. 619,724. Patented Feb. 21, 1899.

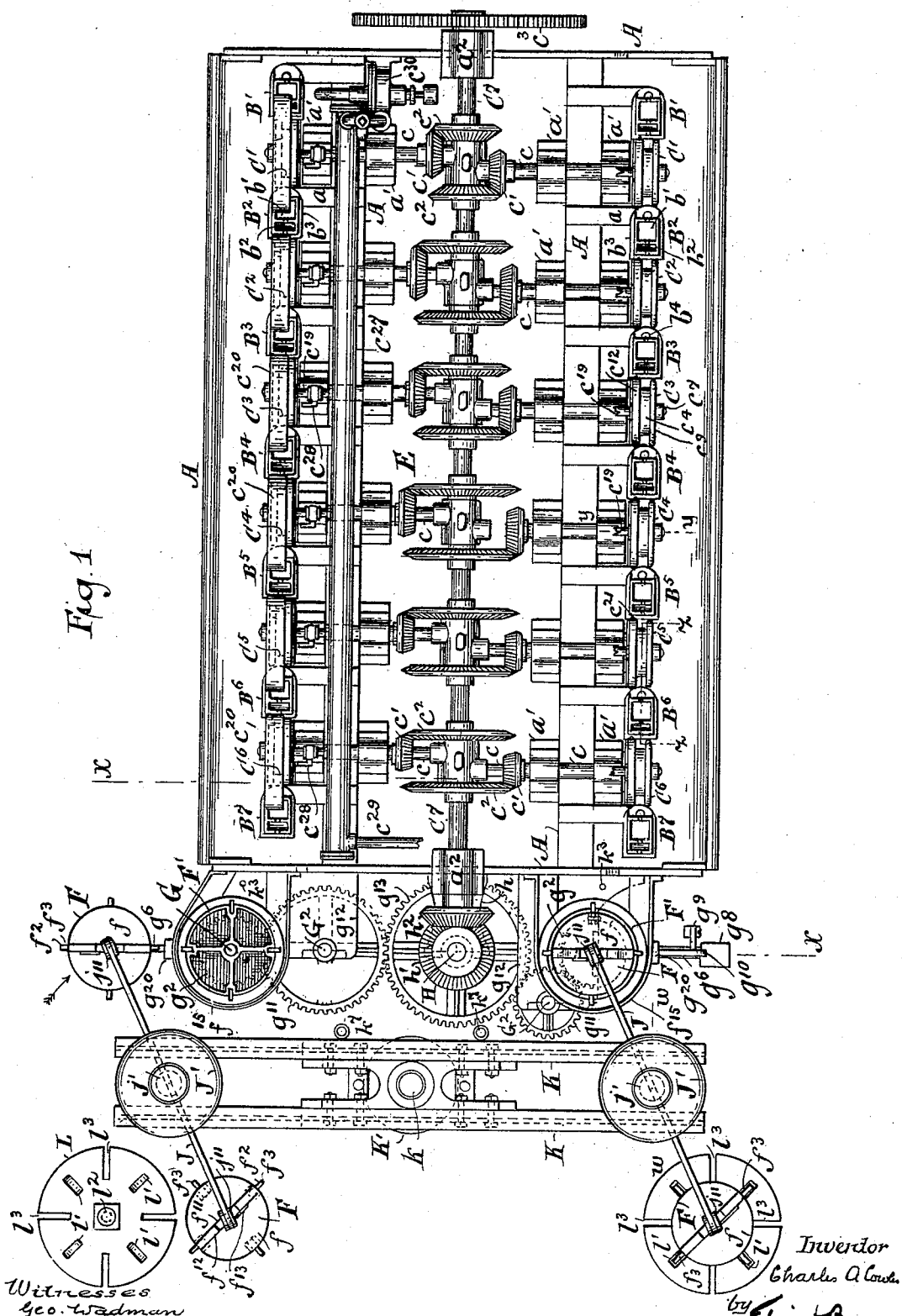
C. A. COWLES.

WIRE DRAWING MACHINE.

(Application filed Feb. 23, 1897.)

(No Model.) 5 Sheets—Sheet 1.

Fig. 1



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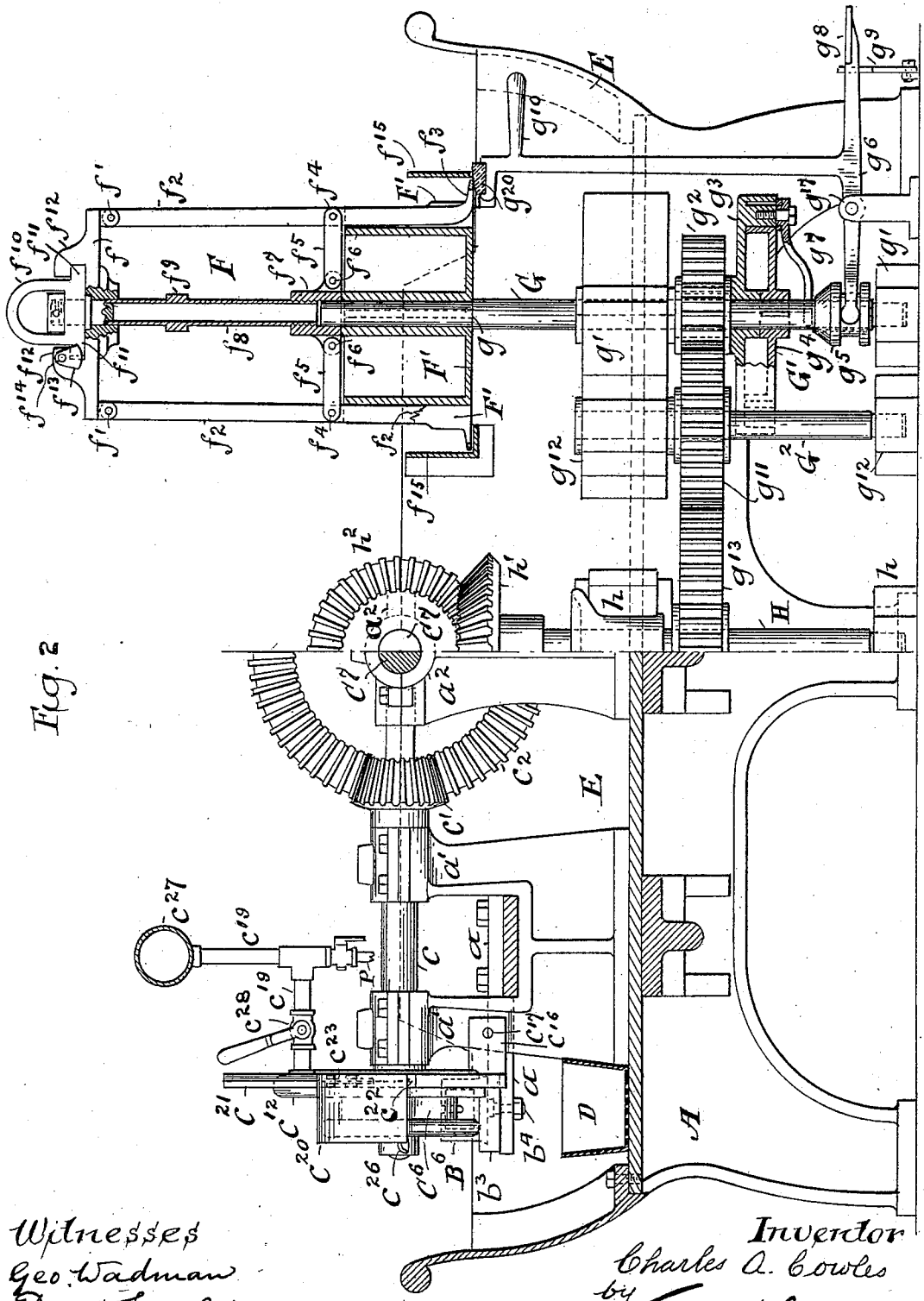


Fig. 2

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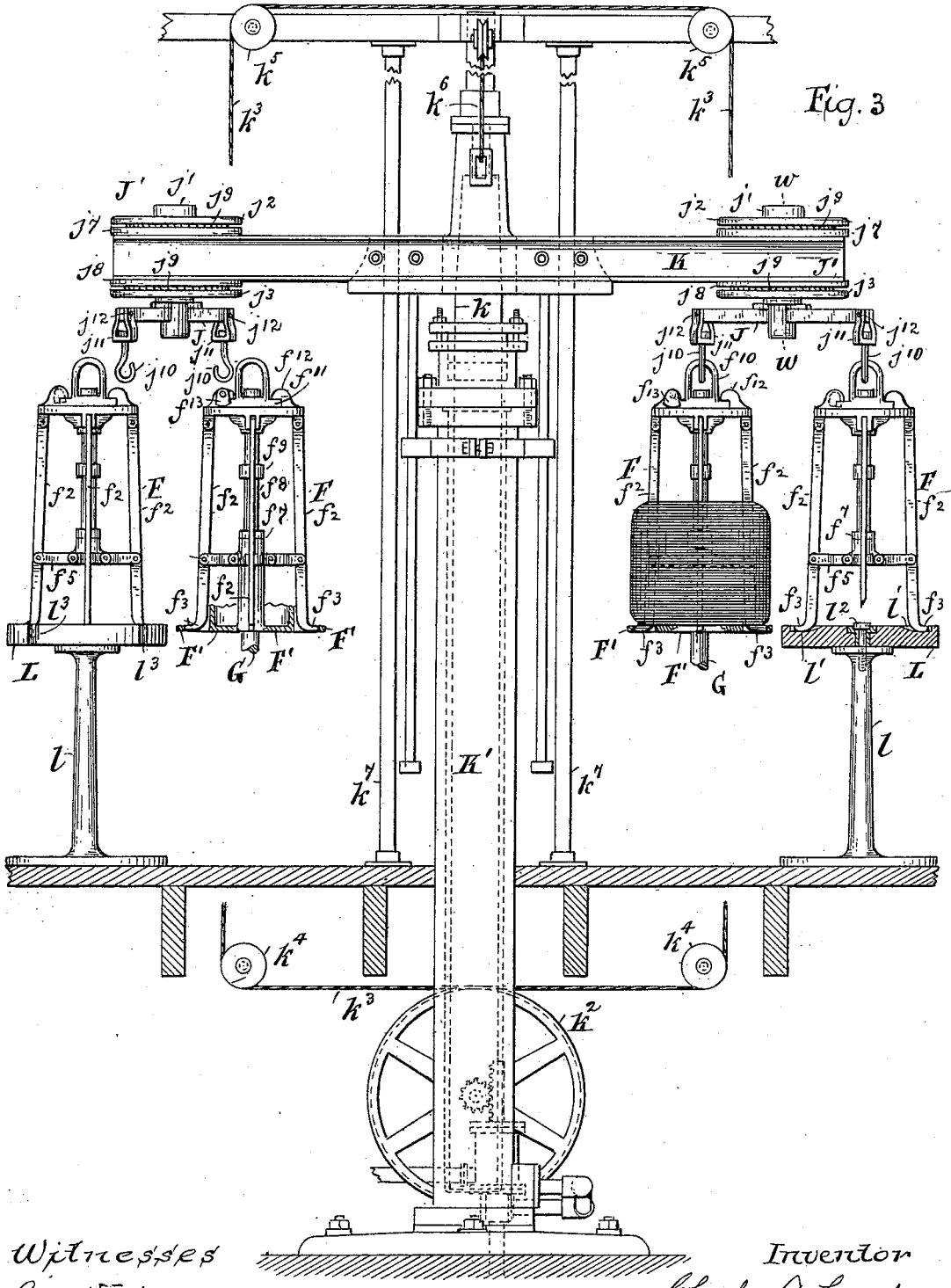
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Fig. 3



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Fig. 5

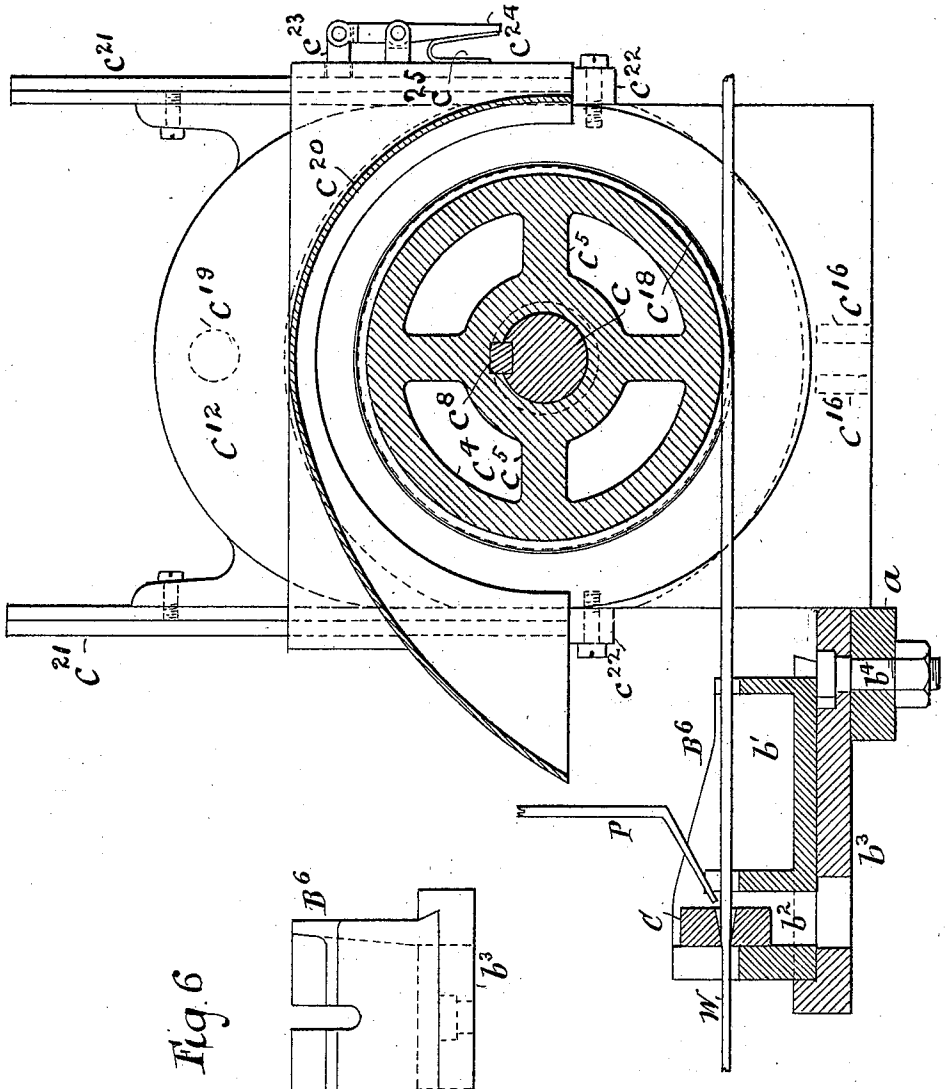
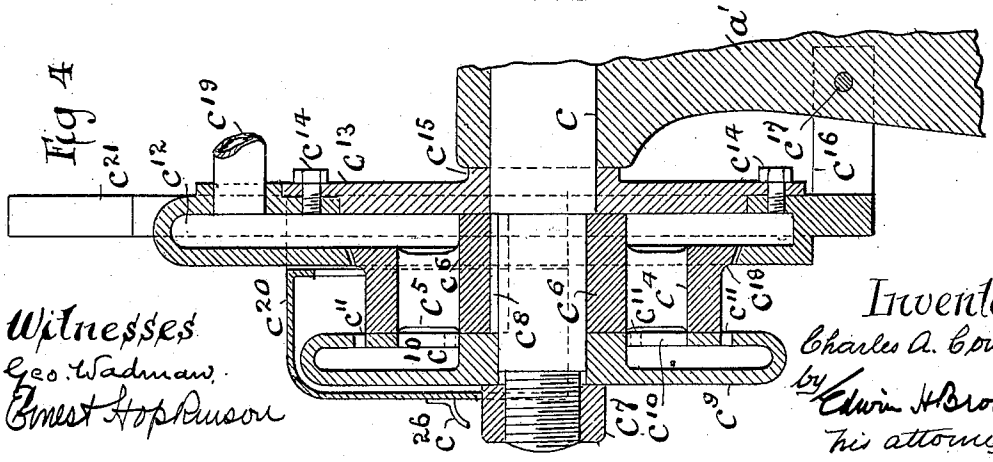


Fig. 6

Fig. 4



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C. A. COWLES.

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(No Model.) 5 Sheets—Sheet 5.

Fig. 10

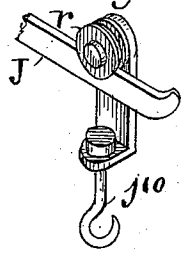


Fig. 7

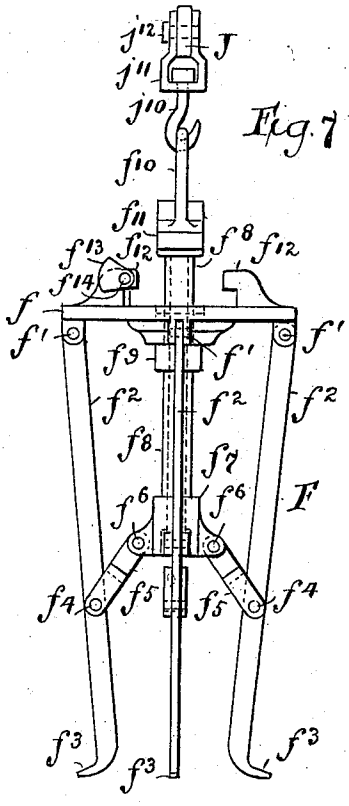


Fig. 8

Fig. 11

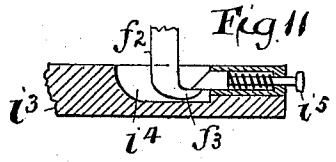
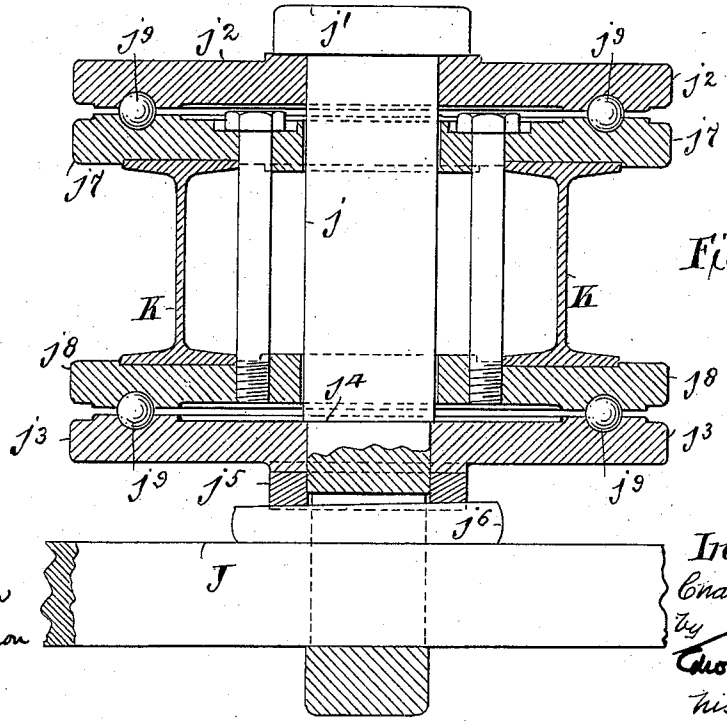


Fig. 9



Witnesses
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UNITED STATES PATENT OFFICE.

CHARLES A. COWLES, OF ANSONIA, CONNECTICUT.

WIRE-DRAWING MACHINE.

SPECIFICATION forming part of Letters Patent No. 619,724, dated February 21, 1899.

Application filed February 23, 1897. Serial No. 624,693. (No model.)

To all whom it may concern:

Be it known that I, CHARLES A. COWLES, of Ansonia, county of New Haven, State of Connecticut, have invented a new and useful Improvement in Wire-Drawing Machines, of which the following is a specification, reference being had to the accompanying drawings.

I will describe a machine embodying my improvement and then point out the novel features in claims.

In the accompanying drawings, Figure 1 is a plan or top view of a machine embodying my improvement, certain parts being omitted on one side to reveal parts located on a lower plane. Fig. 2 is an enlarged transverse section taken on the planes indicated by the dotted line x x, Fig. 1. Fig. 3 is a partly-sectional end elevation of parts of the machine, comprising reels upon which the drawn wire is wound, this view being made upon a scale larger than that of Fig. 1, but smaller than that of Fig. 2. Fig. 4 is an enlarged transverse vertical section on the plane of the dotted line y y, Fig. 1. Fig. 5 is an enlarged longitudinal vertical section taken upon the longitudinal plane indicated by the dotted lines z z, Fig. 1. Fig. 6 is an enlarged rear elevation of one of the drawing-die boxes. Fig. 7 is an elevation of a reel for holding drawn wire. Fig. 8 is a side view of a hand-truck for carrying such a reel. Fig. 9 is an enlarged vertical section of a turn-head, the plane of the section being indicated by the dotted line w w in Figs. 1 and 3. Fig. 10 is a detailed view illustrating a modification. Fig. 11 is another detailed view illustrating a modification.

Similar letters of reference designate corresponding parts in all figures.

A designates the frame of the machine. It may be made of iron and of any approved form.

B' B^2 B^3 B^4 B^5 B^6 B^7 designate boxes for holding the drawing-dies. As shown, they are seven in number, but may be more or less numerous at the pleasure of the constructor. These boxes or holders, as here shown, are of rectangular form and are divided into two compartments b' b^2. The rear compartment b' receives a lubricating and cooling liquid and the forward compartment b^2 accommodates a drawing-die C, which may be of any suitable form. As here shown, it is made in the form of a rectangular plate, with a tapering hole passing through it from rear to front. In the direction of the length of its drawing-hole it measures less than the compartment b^2, so that it may have a rearward movement in the compartment. When in use, it is supported by the wire W being drawn. The compartment b^2 being entirely open at the bottom, the tension of the wire holds the die against the forward wall of the compartment b^2.

It will be seen that in the top of the rear wall of the compartment b' is a groove, that in the wall which separates the two compartments there is a similar groove, and that in the front wall of the compartment b^2 there is also one of such grooves. All of these grooves extend below the plane of the wire while the drawing operation occurs. The lubricating and cooling liquid may flow from the rear compartment b' over into the compartment b^2 around and upon the drawing-die C. Most of it will pass off through the bottom of the compartment b^2, although some may pass from the front wall of such compartment. I may additionally use a pipe P for discharging the liquid into a hole in each die. Thus all the dirt and other extraneous matter may be washed off and prevented from interfering with the operation of the die.

Each drawing-die box is supported upon a plate b^3, which, as here shown, is at the rear end pivotally connected by a bolt b^4 to an arm a, extending laterally from the main portion of the frame A. Hence it may move transversely. The upper part of the plate b^3 is provided with a longitudinal dovetailed groove, in which the drawing-die box is engaged, so as to be free to slide lengthwise. At the forward end the groove of each plate b^3 is closed. Obviously the die-box may move rearwardly out of the normal position by sliding along the plate b^3. The advantage of providing for this rearward movement of the die in its compartment and the rearward movement of the die-box is that when the block has been stopped and is given a slight movement in the reverse direction the loops surrounding the drawing-rollers will be made larger, thereby preventing friction between the wire and drawing-

rollers. It also takes off the strain from the parts that are engaged by the die-holder during the drawing operation.

Under each die-box is a receptacle D, perforated at the bottom. It rests upon the frame A or an appurtenance thereof. When a die is dropped, it falls into the receptacle. In this way dies may accumulate until such time as they are needed, when the receptacle will be lifted out, the liquid within it will run off, and the dies may be picked out.

Intermediate of the die-boxes are drawing-rollers C′ C^2 C^3 C^4 C^5 C^6. They are affixed to the outer ends of shaft *c*, that are journaled in bearings *a*′, attached to the frame A, and provided with bevel gear-wheels *c*′. The bevel gear-wheels *c*′ engage with bevel gear-wheels c^2, affixed to a shaft C^7, which is journaled in bearings a^2, affixed to the frame A. Any suitable means may be employed for imparting rotary motion to the shaft C^7—as, for example, gearing engaging with the gear-wheel c^3, affixed to said shaft.

It will be observed that the bevel gear-wheels *c*′ c^2 for the different rollers C′ C^2 C^3 C^4 C^5 C^6 are differently proportioned. This is for the purpose of producing such drawing action as will be commensurate for the elongation of the wire produced by the drawing operation.

The rollers are of hollow construction to provide for the circulation of the cooling and lubricating liquid. Their construction may best be understood by reference to Figs. 4 and 5. Each has a body portion c^4 of cylindric form, which is connected by spokes c^5 with a hub c^6. As here shown, the shaft *c*, upon which the body of each roller fits, is reduced in diameter at the outer extremity, so as to receive the hub c^6. The hub rests against the shoulder formed where the shaft is reduced. The outer extremity of the shaft is screw-threaded and has a nut c^7 fitted to it. A spline c^8 engages the shaft and the hub of the roller, so that the two will rotate together.

Adjacent to the outer side of the body of each roller is a flange c^9. This also fits the shaft *c*. It is clamped between the side of the face portion c^4 and of the hub c^6 of the body of the roller on one side and the nut c^7 on the other side. It has an opening c^{10}, which is coincident with the spaces between the hubs c^6 of the roller-body. It also has openings c^{11}, which are outward of the face portion c^4 of the roller-body.

The cooling and lubricating liquid used in the drawing operation may circulate through the body portion of each roller and also through the flange portion and around the wire which embraces the roller.

A chamber c^{12}, constituting a flange, is arranged adjacent to the inner side of each roller. It is hollow throughout and is fitted into a rabbet formed in a plate c^{13}, bolts c^{14} being used to secure it in place. The plate c^{13} is provided with a hub c^{15}, that fits upon the shaft *c*. A lug or lugs c^{16}, extending from the chamber c^{12} to one side of one of the bearings of the shaft *c*, is fastened to such bearing by a screw c^{17} or other suitable means. The outer wall of the chamber c^{12} has a circular opening, into which projects a flange c^{18}, with which the face portion of the body of the roller is provided. There is, however, an annular space left between this flange c^{18} and the outer wall of the chamber c^{12}, so that the cooling and lubricating liquid may pass through. A pipe c^{19} supplies the liquid to the chamber c^{12}, and from the chamber it flows through the annular space just mentioned over the outer surface of the roller-body. It also flows from the chamber c^{12} through the space between the spokes c^5 of the body of the rollers and thence through the opening c^{10} into the flange c^9 and finally out of the latter through the openings c^{11} over the roller-body and the wire which embraces the same. Over each roller is a hood c^{20}, which may advantageously be made of sheet metal and having an extended portion a^{20}. The hood is designed to prevent any excessive throw of the cooling and lubricating liquid from the rolls and also to deflect the fluid thrown off by the centrifugal force through the extended portion into the die-box. Hence it will normally be in close relation to its roller. It is fitted to slide vertically along guides c^{21}, which are attached to the chamber c^{12}. When in its normal position, it will rest upon blocks c^{22}, but when raised it may be supported by a bolt c^{23}, bearing upon the top of one of the guides c^{21}. As here shown, the bolt c^{23} is pivotally connected to one end of a hand-lever c^{24}, which at the other end is combined with a spring c^{25}, acting in such direction as to throw the bolt over the top of the adjacent guide whenever the shield is lifted sufficiently high. To lower it, the lever may be manipulated against the resistance of the spring. A handle c^{26}, arranged upon one side of the shield, facilitates moving it upward. Obviously the hand-levers c^{24} may all be operated together by a simple connecting contrivance.

The pipes c^{19} for the various rollers lead from the pipes c^{27}, that run lengthwise of the series of rollers and drawing-dies. As may be seen by reference to Fig. 2, the pipes c^{19} extend downwardly from the lower portions of the pipes c^{27} and are provided with controlling-cocks c^{28}, by which the flow of the cooling and lubricating liquid may be regulated. In Fig. 1 I have shown a pipe c^{27} along one side of the machine, but have omitted it from the other side in order that I might better illustrate other parts. The two pipes c^{27} at their forward ends communicate with a pipe c^{29}. One of the pipes c^{27} at the other end communicates with a circulating-pump c^{30}. If desired, there may be a circulating-pump c^{30} for each of the pipes c^{27}.

Below the two series of rollers and drawing-dies is a large tank E, into which the cooling and lubricating liquid flows and from which it is raised again by the circulating-pump c^{30}.

At the forward end of the two series of rollers and drawing-dies are reels F for taking up the wire from the block after the completion of the drawing operation. Each reel is adapted to be fitted upon and engaged to rotate with an upright shaft G. By describing the construction of the reel I will describe the means for supporting and rotating it.

Each shaft G has its upper portion reduced in size, so as to form a shoulder g, upon which rests a reel holder or block F'. This block is adapted to interlock with a reel, and it surrounds the upper portion of the shaft G, being engaged therewith to rotate simultaneously. The bearings g' support the shafts G. Below these bearings the shafts G have gear-wheels g^2 loosely mounted upon them, and to these gear-wheels are affixed the upper portions g^3 of clutches G'. This part g^3 of the clutch rests upon the hub of the part g^4 of the clutch, the latter being fastened rigidly to the shaft. Below the part g^4 of the clutch is a cone g^5, which rotates with the shaft G, but is capable of being moved up and down thereon by means of a lever g^6. When moved upwardly, it swings sidewise an arm g^7, that is carried by the part g^3 of the clutch. By shifting this arm sidewise it produces an engagement between the two parts g^3 and g^4 of the clutch. This constitutes a device for operating the block, whereby the block may be started with a graduated movement. As this clutch of itself forms no part of my invention, it will not be necessary to describe it further than to add that the sidewise movement of the arm g^7 draws together or permits the separation of the ends of a divided ring, which is attached to the upper part g^3 of the clutch for the purpose of engaging or disengaging the said ring and the part g^4 of the clutch.

The lever g^6 is fulcrumed to a bracket g^{17} and, as here shown, is provided with a foot-piece g^8, so that it may be operated by the foot of the attendant, a pivoted catch g^9 being preferably used for the purpose of engaging the foot-piece when it is desired to occupy one position for any length of time—as, for instance, during the drawing operation—while filling any reel F. This constitutes a means for throwing into and out of action the device which may be employed for starting the block with a graduated movement and for doing this without stopping the driving-shaft.

I have shown the lever g^6 as provided with an arm extending upwardly and provided with a handle g^{10}. After the filling of any reel the operator disengages the catch g^9 from the lever g^6 by means of his foot and then with his hand presses the lever forward, so as to lower the cone g^5. Thus the disengagement of the shaft G with the gear-wheel g^2 will be effected. If, as here shown, the upper part of the lever g^6 shall be provided with a brake g^{20}, the latter will be moved into engagement with the block F' when the lever g^6 is pressed in, as just described, by the hand of the operator.

The gear-wheel g^2 engages with a gear-wheel g^{11}, affixed to a shaft G^2, supported in bearings g^{12}. The gear-wheel g^{11} engages with the gear-wheel g^{13}, that is affixed to a shaft H, that is journaled in a bearing h. Affixed to the upper end of this shaft H is a beveled gear-wheel h', that meshes with a beveled gear-wheel h^2, affixed to the shaft C^7. Thus it will be seen that the motion is transmitted from the shaft C^7 for the rotation of the reels F.

The reels F each have a head, to the outer portion of which are pivoted by pins f' a number of arms f^2. As here shown, there are four of these arms f^2. Their lower extremities are turned outwardly to form supports f^3. Between their ends these arms f^2 are pivotally connected by pins f^4 with the outer ends of links f^5, whose inner ends are pivotally connected by pins f^6 with a socket f^7, that is connected with the head f of the reel F by means of a tube f^8, forming a central stem.

Below the head f the tube f^8 is provided with a collar or circular projection f^9, and at the upper end the tube is adapted to slide longitudinally through the head f. Above the head a suspending-eye f^{10} is connected with the tube f^8, so as to swivel upon the same. At the lower end this swivel-eye has lugs f^{11}, which when the swivel-eye occupies its normal position are under hook-shaped lugs f^{12}, with which the head f is provided. When the lugs f^{11} of the swivel-eye are thus engaged with the lugs f^{12} of the head f, the tube f^8 will be incapable of sliding longitudinally through the head f. A locking-piece f^{13}, pivotally connected by a pin f^{14} to one of the lugs f^{12} of the head f, serves to prevent the disengagement of the lugs f^{11} from the lugs f^{12}.

By a rotary movement of the swivel-eye in one direction a rotary movement in the other direction is precluded by reason of having an abutment in the lugs f^{12} for the ends of the lugs f^{11}. This abutment may be formed by simply inclining the outer ends of the lugs f^{11} and correspondingly shaping the opposite surfaces of the lugs f^{12}. If this locking-piece f^{13} be swung to one side, it will become possible to swivel the eye f^{10} so as to disengage its lugs f^{11} from the lugs f^{12} of the head f. Then the tube f^8 may be slid upwardly through the head f. The raising of the socket f^7 incident to this sliding motion of the tube f^8 will draw the links f^5 inward, and thus the lower ends of the arms f^2 will be moved toward each other. The reel will thus be collapsed, so that the wire may be disengaged from it. Indeed, the coil of wire will ordinarily drop off as soon as the reel is collapsed. During the winding operation a reel F is engaged with a block F', so as to rotate with the latter, and hence with the shaft G, and wind the drawn wire upon itself.

In the circumference of the block F′ are a number of vertical grooves corresponding to the number of arms f^2 in the reel, and when the reel is in place its arms engage with these grooves. The socket f^7 rests upon the top of a hub with which the block is provided and fits upon the upper extremity of the shaft G.

Preferably a guard-band f^{15} extends around the lower part of each block F′, and consequently around the lower part of each reel F, to prevent the wire from flying outward away from the reel at the end of winding. After the proper quantity of wire shall have been wound upon the reel it is lifted off by means of its swivel-eye f^{10} to make place for another reel.

If a filled reel is to be taken to another place, so that the wire upon it may be drawn still finer, a convenient way of removing it would be to place it upon a carriage I, as shown in Fig. 8. This carriage has a platform i, supported by two pairs of wheels i', the forward pair of which may be swiveled to the platform, if desired. Above the platform i a post i^2 extends upward. A table i^3 is supported by the post i^2 in such a manner as to be free to swivel or rotate about the same. In its upper surface are recesses i^4 for the reception of the supports f^3, formed at the lower extremities of the reel-arms f^2. Obviously this table i^3 may rotate for unwinding a coil of wire upon a reel F, which is supported upon the post i^2.

It would be advantageous to use two reels in connection with each of the series of rollers and drawing-dies and to alternate these two reels in the position for taking wire. To facilitate the alternation of the reels, I combine them with a bar J. As here shown, this bar J is supported by a turn-table J′, (shown best in Fig. 9,) comprising a center bolt j, through the lower end of which the bar J passes. The upper end of the center bolt j has a head j', that rests above a plate j^2. A corresponding plate j^3 surrounds the lower part of the center bolt j below a shoulder j^4, with which the said bolt is provided. Beneath the plate j^3 is a washer j^5. Beneath this washer a key j^6 passes through that slot in the center bolt through which the bar J passes, the key being longitudinally inclined and serving to effect the clamping of said bar J in the center bolt. Between the plates j^2 and j^3 are plates j^7 and j^8, which are affixed to bars K, forming part of an elevator. Between the plates j^2 j^7 and also between the plates j^3 j^8 are antifriction-rollers j^9. Obviously the plates j^2 j^3, together with the center bolt j, may rotate relatively to the plates j^7 j^8. By this means the bar J may be oscillated about the center bolt j as an axis of motion. Each bar J has at its end hooks j^{10}. These hooks may be swiveled in stirrups j^{11}, which are pivotally connected by pins j^{12} with the ends of the bar J. As shown in Fig. 10, each hook j^{10} may have a swiveling connection with a hanger provided with a peripherically-grooved roller r, adapted to travel along the upper edge of the bar J.

The elevator-bars K are attached to the plunger k of a hydraulic engine K′, that is controlled by any suitable valve and, as here shown, through the agency of a wheel k^2 and an adjustable rope k^3, which is applied to the said wheel k^2 and extended around the guide-pulleys k^4 k^5 to positions where it will be convenient of access.

A table L is arranged in convenient relation to each of the blocks F′. As here shown, it is supported by a post l, extending from the floor. In its upper surface are recesses l' for the supports f^3 of a reel. This table may be precisely like the table i^3 heretofore described in connection with the carriage I. A swiveling connection is formed between each table L and each post l by means of a center screw l^2 or in any other convenient way. Each table has a number of radial notches l^3 extending inward from its circumference. Reference to Fig. 1 will show that the approved arrangement is one wherein the center of a block F′, the center of a turn-table J′, and the center of a table L will be intersected by one straight line. When the parts are thus arranged, the adjustment of a bar J into such position that one of its hooks j^{10} will engage with a reel F which is taking wire will cause the other hook j^{10} of said bar J to occupy a position over the table L. Hence two reels may be engaged with one bar J at the same time.

Whenever a reel has been filled with wire, the bar J will be swung around and lowered, so that one of its hooks f^{10} may be engaged with the swivel-eye j^{10} of that reel. At the same time the other hook j^{10} of said bar J will be engaged with a reel resting upon the corresponding table L. Then the elevator will be raised, and afterward by hand the bar J will be turned, so as to transpose the two reels, the filled reel being thus deposited upon the table L and the empty reel being deposited upon the block F′, ready to take wire from the adjacent series of rollers and drawing-dies. The wire upon the reel deposited on the table L may now be prepared for removal by inserting wires or cords through the notches l^3 of the table L up into the inside of the coil of wire in order that it may be bound to preserve it in coil form. Afterward the reel may be collapsed by swinging aside the catch f^{13} and engaging one of the hooks of the bar J and elevating the reel by means of the elevator. The elevator may be counterbalanced. I have shown a counterbalance-cable k^6, which is intended to lead to a weight conveniently located.

By reason of the clutch G′, which, as will have already been understood, is a friction-clutch, I can start and stop the reel holder or block F′ at pleasure and do so gradually, while the rollers C′ to C^6 are left running. When it is started, it will tighten the coil of

wire upon the roller C^6 and cause that to draw the wire forward. This will have the effect of tightening the wire upon the roller C^5, and so one roller after the other will be caused to act upon the wire to draw it forward. Whenever the reel holder or block is stopped, the loops of wire surrounding the rollers will become slack and the wire will no longer be moved forward by the rollers.

I desire to cover a means at any suitable part of the machine for starting the block with a graduated movement and without stopping the driving-shaft, as in this way it will be possible to operate at a higher speed than otherwise could be done.

The combination of parts for changing reels, including the hydraulic elevator, facilitates the drawing of wire rapidly, and therefore conduces to the main object of my invention.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In a wire-drawing machine, the combination of a die, rotatable drawing-block, a drawing-roll, means for rotating the said drawing-roll, a starting and stopping mechanism for starting the drawing-block with a graduated movement, and means for throwing said starting and stopping mechanism into and out of action without stopping the drawing-roll, substantially as described.

2. In a wire-drawing machine, the combination of a die, a drawing-block, a driving-shaft, a continuously-rotating drawing-roll operated from said driving-shaft, a starting and stopping mechanism between the driving-shaft and drawing-block for starting the block with a graduated movement, and means for throwing into and out of action said starting and stopping mechanism, without stopping the driving-shaft, substantially as described.

3. In a wire-drawing machine, the combination of a die, a rotatable drawing-block, a drawing-roll, means for rotating the drawing-roll, a friction-clutch for starting the block with a graduated movement and means for throwing said clutch into and out of action without stopping the drawing-roll, substantially as described.

4. In a wire-drawing machine, the combination of a series of dies, continuously-rotating drawing-rolls, intermediate said dies, a drawing-block, a driving-shaft for operating said drawing-rolls and drawing-block, a starting and stopping mechanism between said block and driving-shaft for starting the drawing-block with a graduated movement and means for throwing said starting and stopping mechanism into and out of action without stopping the driving-shaft, substantially as described.

5. In a wire-drawing machine, the combination of a series of dies, a rotatable drawing-block, drawing-rolls, means for positively rotating said drawing-rolls, a starting and stopping mechanism for starting the drawing-block with a graduated movement and means for throwing into and out of action said starting and stopping mechanism without stopping the drawing-rolls, substantially as described.

6. In a wire-drawing machine, the combination of a series of dies, a rotatable drawing-block, drawing-rolls, means for positively and uniformly rotating said rolls, a starting and stopping mechanism for starting the drawing-block with a graduated movement, and means for throwing into and out of action said starting and stopping mechanism without stopping the drawing-rolls, substantially as described.

7. In a wire-drawing machine, the combination of a series of dies, a rotatable drawing-block, drawing-rolls, means for positively, uniformly and continuously rotating said rolls, a starting and stopping mechanism for starting the drawing-block with a graduated movement, and means for throwing into and out of action said starting and stopping mechanism without stopping the rolls, substantially as described.

8. In a wire-drawing machine, the combination of a die, a drawing-block, means for operating said block, a starting and stopping mechanism comprised in said operating means for starting the block with a graduated movement, means for throwing said starting and stopping mechanism into and out of action, and a brake for said block adapted to be operated when the said starting and stopping mechanism is thrown out of action, substantially as described.

9. The method of stringing a wire-drawing machine which has in combination a series of die-holders, continuously-rotating drawing-rolls intermediate the die-holders and a drawing-block in advance of the forward die-holder, said method consisting in stringing a wire with spaced dies that fit in said holders, coiling the wire about each roll in a loop longer than is sufficient to tightly embrace the roll and placing the intermediate dies in the holders, so that not until the block is started and the drawing operation begins through the forward die will the loops be successively tightened to enable the rolls to operate upon them to draw the wire through the successive dies, a gradual action of the rolls upon the wire being thus effected and wearing and heating of the wire being thus prevented.

10. The method of stringing a wire-drawing machine having in combination a series of die-holders, dies fitting in said holders and capable of movement forward and backward in the line of movement of a wire, continuously-rotating drawing-rolls intermediate the die-holders and a block in advance of the forward die-holder, said method consisting in stringing a wire with the dies and coiling the wire about each roll in a loop longer than is sufficient to tightly embrace the roll, so that as the block is started the drawing operation will begin through the forward die, and the loops will be successively tightened to enable

the rolls to operate upon the wire to draw it through the successive die, a gradual action of the rolls upon the wire being effected, and wearing and heating of the wire being thus prevented.

11. The method of stringing a wire-drawing machine which has in combination a series of die-holders, continuously-rotating drawing-rolls intermediate the die-holders, a drawing-block in advance of the forward die-holder, and means for starting the block with a graduated movement, said method consisting in coiling a wire, carrying dies that fit in said holders, about each roll in a loop longer than is sufficient to tightly embrace the roll, so that as the block is started and the drawing operation begins, through the forward die, the loops will be successively tightened to enable the rolls to operate upon the wire to draw it through the successive dies, a gradual action of the rollers upon the wire being thus effected and wearing and heating of the wire being thus prevented, substantially as described.

12. In a wire-drawing machine, the combination of a series of dies supported so as to be capable of movement forward and backward in the line of movement of the wire, continuously-rotating drawing-rolls intermediate the dies, a block in advance of the forward die, means for starting the block with a graduated movement, and the wire, on which the dies are strung, coiled about each roll, said dies being adapted to have a rearward movement therein in the direction of the length of the wire when the drawing-block is stopped from operating, so that the coil of wire about each drawing-roll will be loosened about the roll, substantially as described.

13. In a wire-drawing machine, the combination with sliding die-holders, dies in such holders, a roller intermediate the die-holders, and a block in advance of the forward die-holder, whereby upon the stoppage of the block and the reverse movement thereof the adjacent die may move to enlarge the loop around the roller, substantially as specified.

14. The combination with a device for moving wire through a die, of a longitudinally-sliding die-holder with which the said die is loosely engaged in the direction of the length of the wire, so that when the drawing of the wire is stopped the die may move backward in the die-holder, substantially as specified.

15. The combination with a device for moving wire through a die, of a die-holder, having an opening below the die and a die supported above said opening so that after the wire has been drawn through the die, the die may drop through the opening, substantially as specified.

16. A drawing-roller for a wire-drawing machine having a hollow flange formed with openings, said roller being provided with passages in communication with said hollow flange through which liquid circulates, substantially as described.

17. A drawing-roller for a wire-drawing machine having a flange provided with passages for the circulation of liquid, substantially as specified.

18. In a wire-drawing machine, the combination of a drawing-roller having its body provided with passages for liquid, a stationary head having passages for liquid communicating with the body of the roller, and means for supplying liquid to the stationary head, substantially as specified.

19. In a wire-drawing machine, the combination of a drawing-roller having its body provided with passages, a stationary head arranged in such relation with the body of the roller that a liquid-passage will be left between them, and means for supplying liquid to the stationary head, substantially as specified.

20. In a wire-drawing machine, the combination of a drawing-roller having its body provided with liquid-passages, a hollow flange for receiving liquid having passages which lead to the inside and outside of the body of the roller, and a stationary head provided with passages leading to the inside and to the outside of the body of the roller, substantially as specified.

21. In a wire-drawing machine, the combination with a drawing-roller around which liquid is circulated, of a sliding shield for limiting the throw of liquid from the roller, and means in connection with said shield for holding it in an elevated position above the roller, substantially as described.

22. In a wire-drawing machine the combination with a drawing-roller around which liquid is circulated, of a shield for limiting the throw of liquid from the roller, and means whereby the said shield may be supported in different relations to the roller, substantially as specified.

23. In a wire-drawing machine, the combination with a drawing-roller upon the outside of which liquid is circulated and a die-holder adjacent to said roller, of a shield against which liquid will be thrown from the outside of the roller, and an extension on said shield by which the liquid will be deflected into the die-holder, substantially as described.

24. In a wire-drawing machine, the combination with a block, of a reel the arms of which are adapted to be fitted to the same and to be removed therefrom without collapsing, and means in connection with said arms for collapsing them, substantially as described.

25. In a reel, the combination of a head, of a central stem adapted to slide in said head, arms pivoted at one end to the head, and links pivoted at one end to the arms intermediate their length and at their other end to the central stem, substantially as described.

26. In a reel, the combination of a head, arms pivotally connected to the head, links pivotally connected to the arms, a stem pivotally connected to the links, having a sliding bearing in the center of the head, a swivel-

eye connected to the stem, and means for engaging the swivel-eye so as to prevent the movement of the stem relatively to the head, substantially as specified.

27. In a reel, the combination of a head, arms pivotally connected to the head, links pivotally connected to the arms, a tubular stem pivotally connected to the links, adapted to be fitted upon a support, and having a sliding bearing in the center of the head, and means for locking the said stem and head together, substantially as specified.

28. In a reel, the combination of a head, arms pivotally connected with the head, links pivotally connected to the arms, a stem pivotally connected to the links, and having a sliding connection with the head, a swivel-eye connected with the stem, lugs upon the swivel-eye and upon the head and a catch for holding the lugs of the swivel-eye and of the head in engagement, substantially as specified.

29. The combination of a drawing-block carrying a reel which is rotated therewith, an elevator carrying a turn-table, arms extending from said turn-table, one of said arms adapted to be connected with the reel rotated by the block, while the other of said arms is adapted to be connected with the second reel, substantially as described.

30. In a wire-drawing machine, the combination of an elevator, a support for two reels pivotally connected with a part of the elevator and reels supported so as to be able to rotate relatively to said support, substantially as specified.

31. In a wire-drawing machine the combination of an elevator, a support for two reels pivotally connected with a part of the elevator, and reels supported so as to be able to swing relatively to said support, substantially as specified.

32. In a wire-drawing machine the combination of an elevator, a support for two reels pivotally connected with a part of the elevator, and reels supported so as to be able to travel along said support toward and from its pivotal connection.

33. In a wire-drawing machine, the combination of a die, a drawing-block, a driving-shaft, means for rotating said shaft at a high speed, a device for starting the block with a gradual movement to obtain the full speed of the driving-shaft and means including a handle independent of the driving-shaft, for throwing said device into and out of action without stopping the driving-shaft, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

CHARLES A. COWLES.

Witnesses:
ANTHONY GREF,
F. ROBERTS.