No. 666,048. Patented Jan. 15, 1901.

T. M. FOOTE.

WIRE DRAWING MACHINE.

(Application filed Apr. 14, 1899.)

(No Model.) 3 Sheets—Sheet 1.

Fig. 1

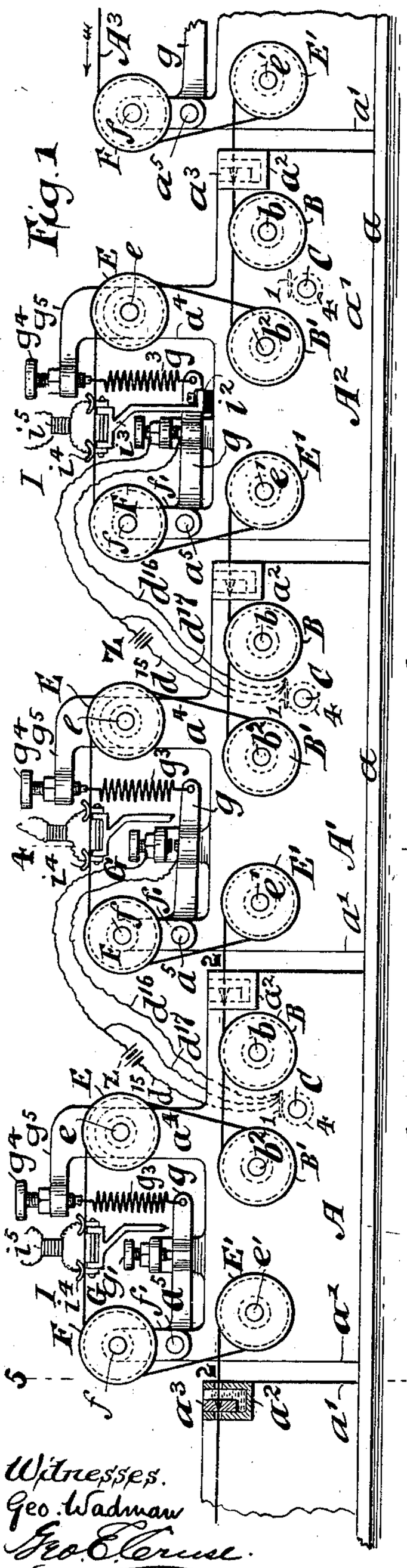


Fig. 5

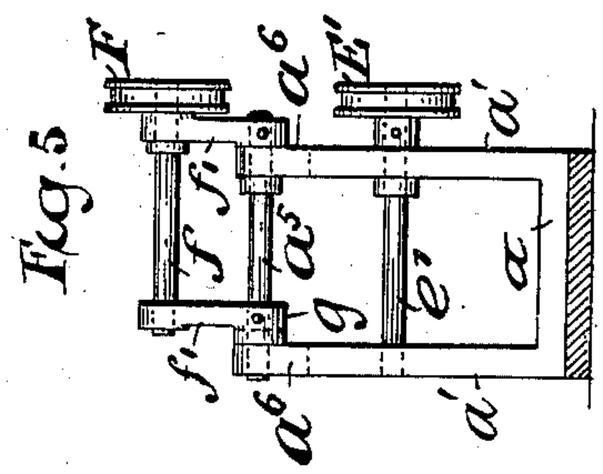


Fig. 4

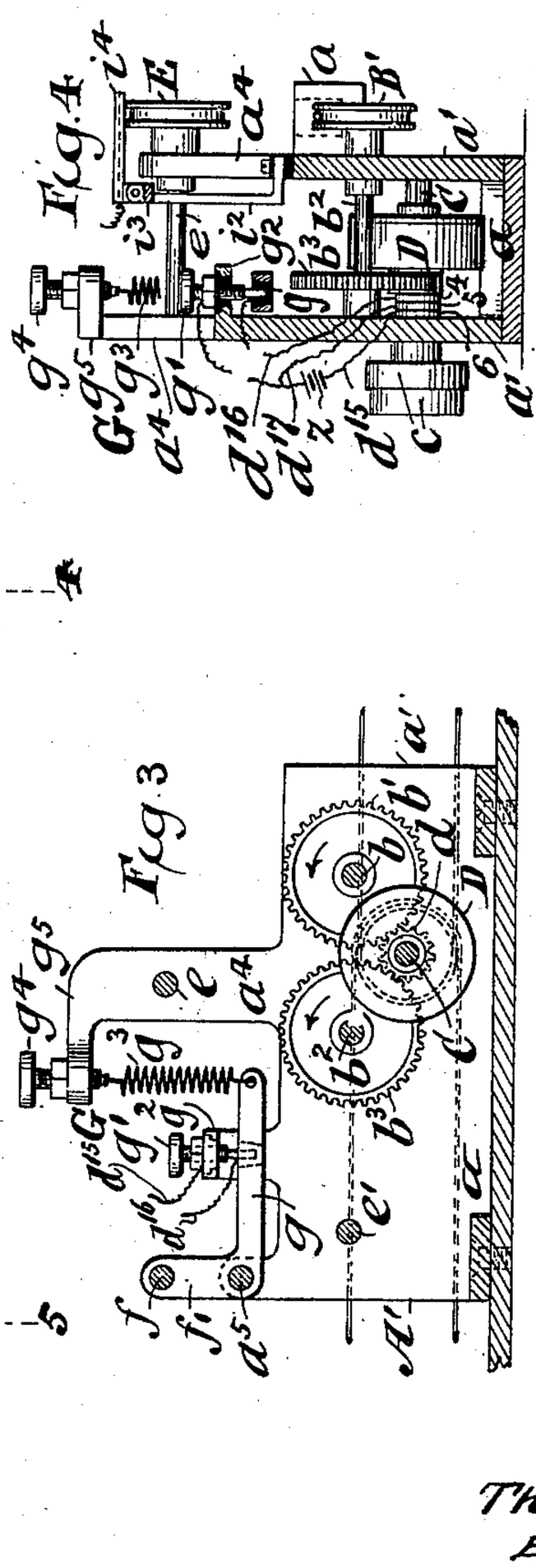
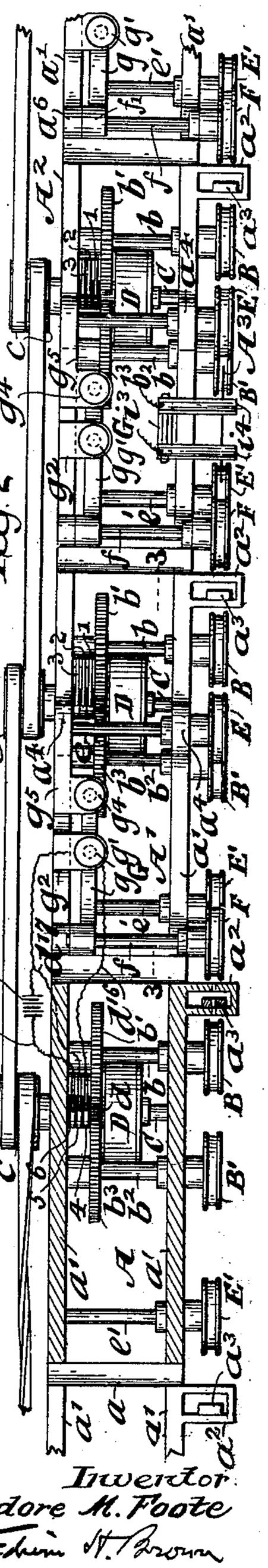


Fig. 3

Fig. 2



Witnesses.
Geo. Wadman
Geo. E. Crouse.

Inventor.
Theodore M. Foote
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His Attys.

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Fig. 6

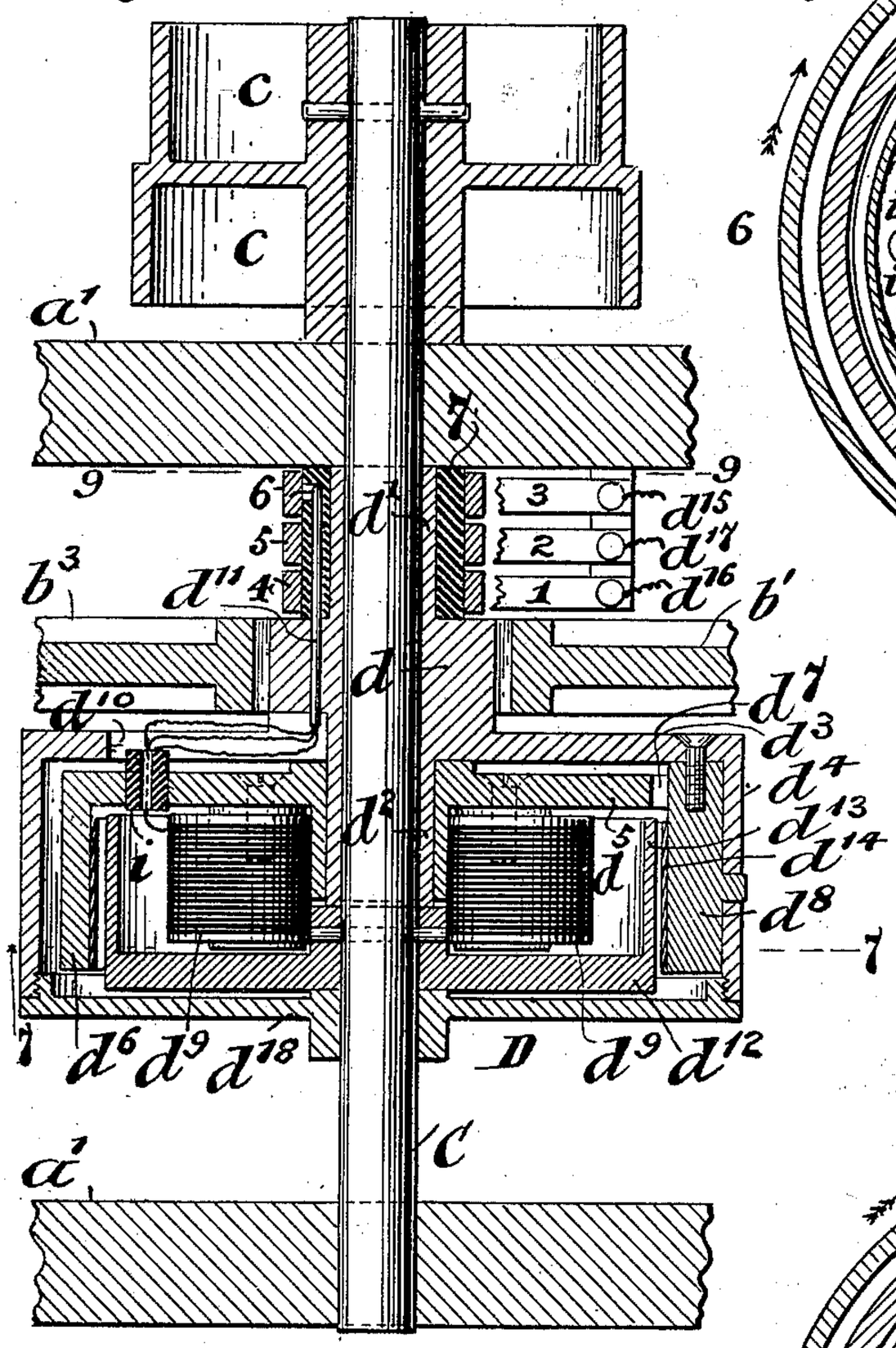


Fig. 7

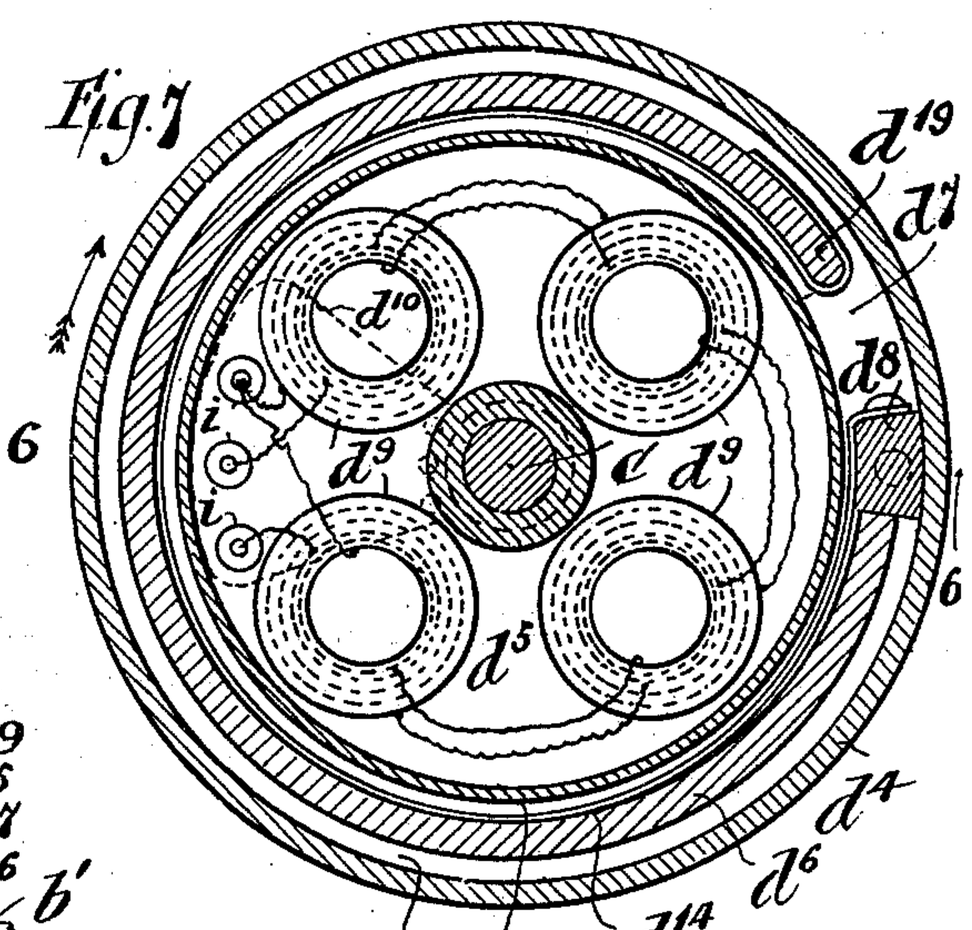


Fig. 8

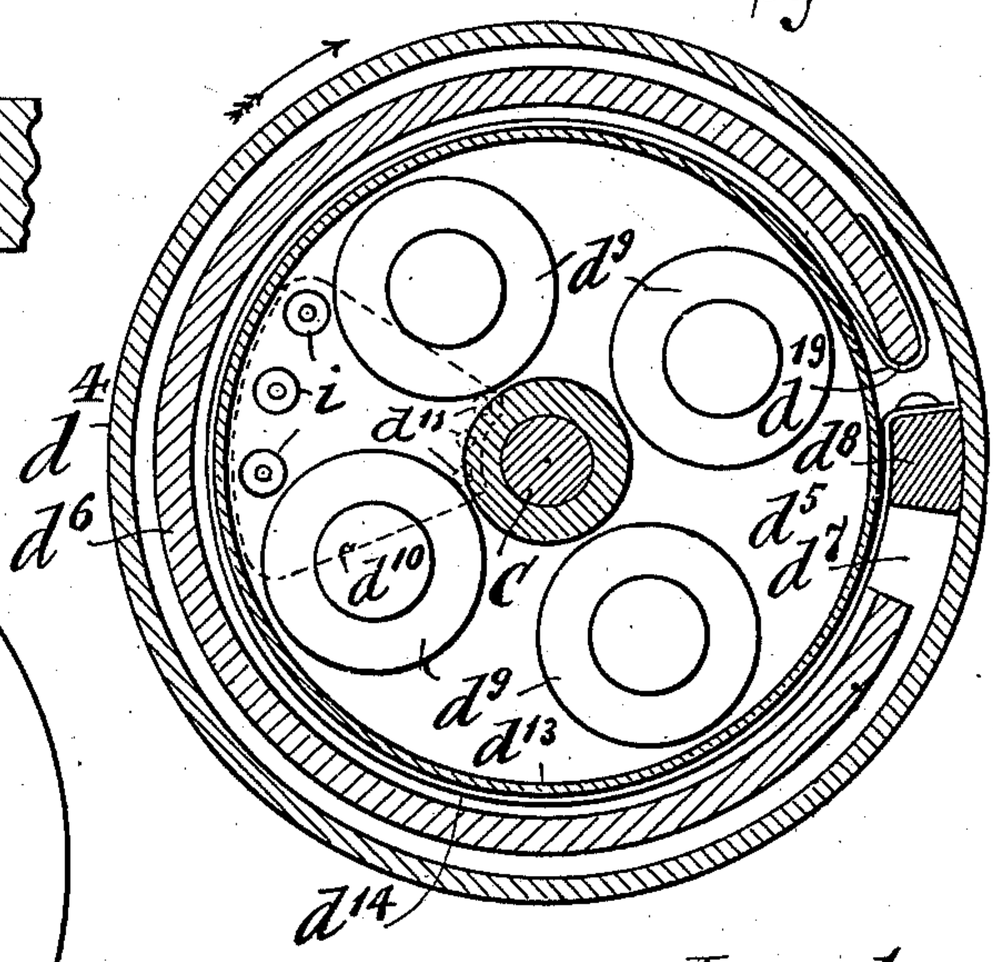
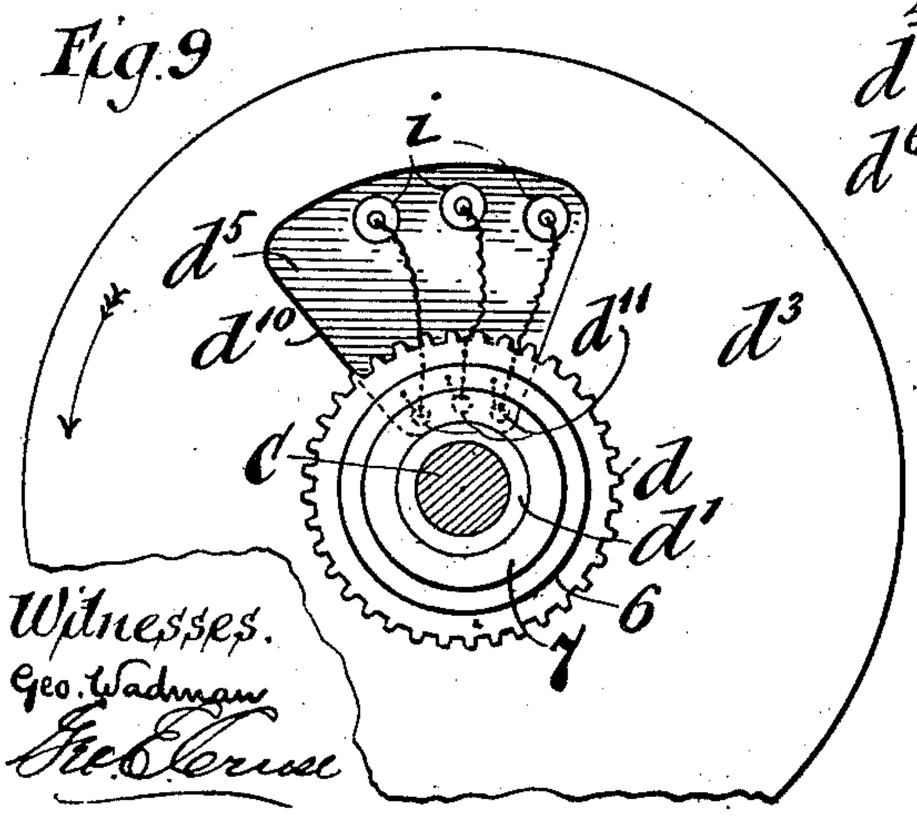


Fig. 9



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(No Model.) 3 Sheets—Sheet 3.

Fig. 10

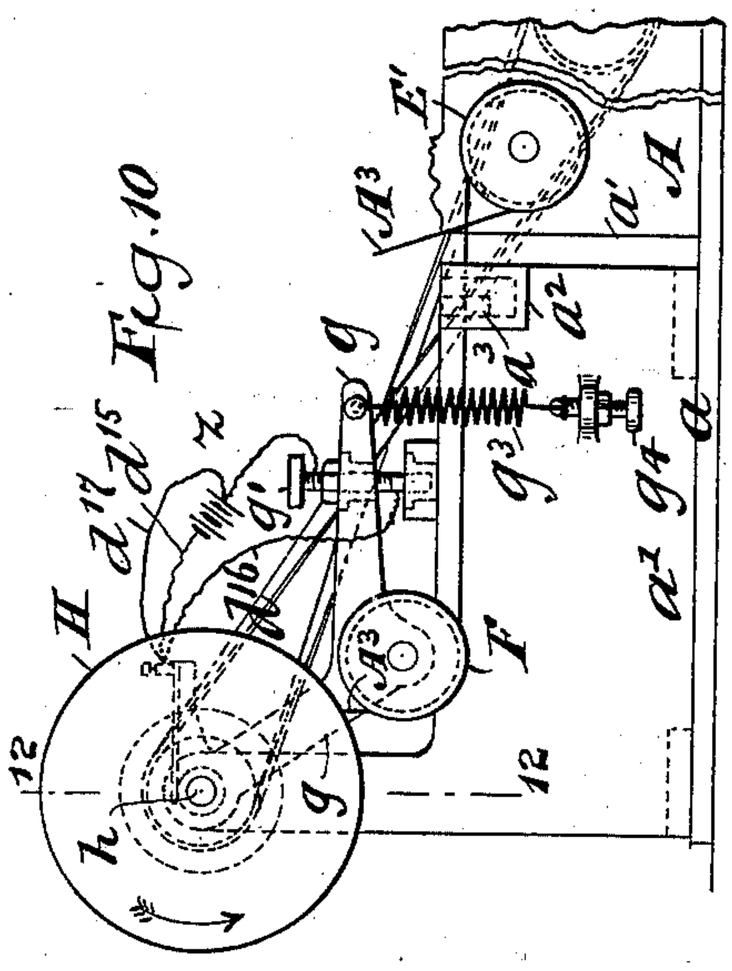


Fig. 11

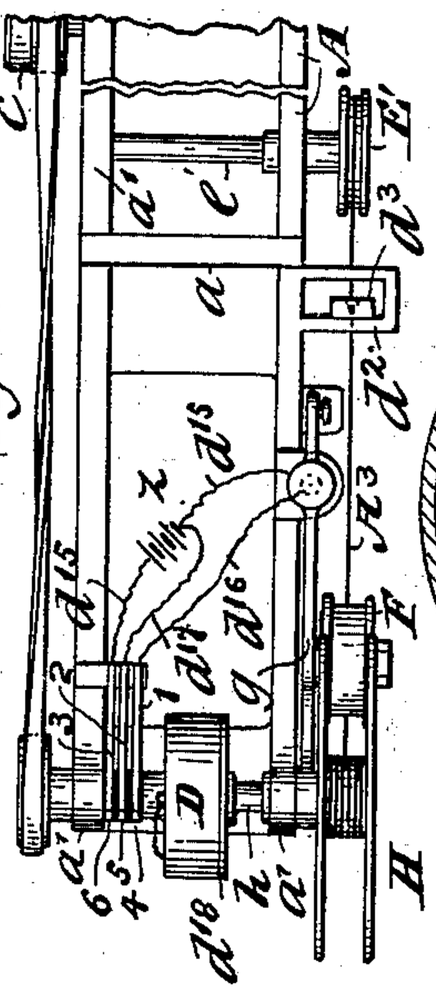


Fig. 14

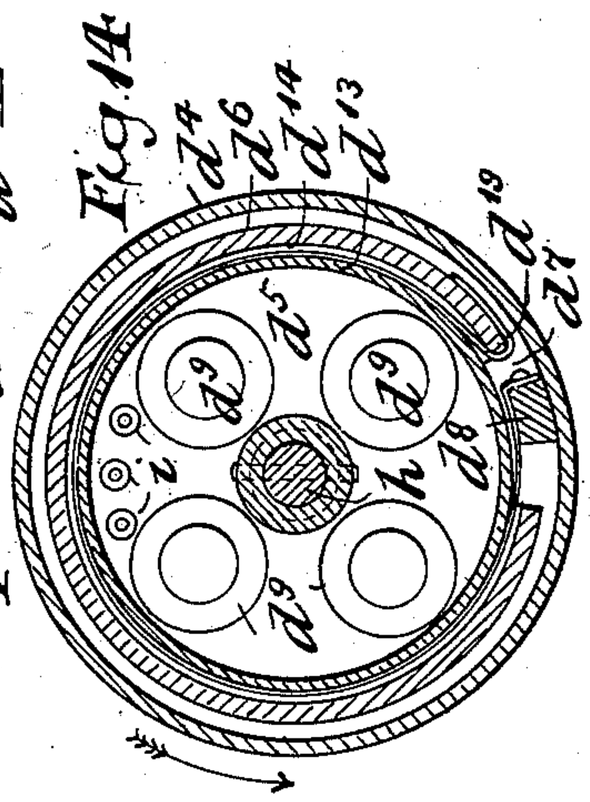


Fig. 12

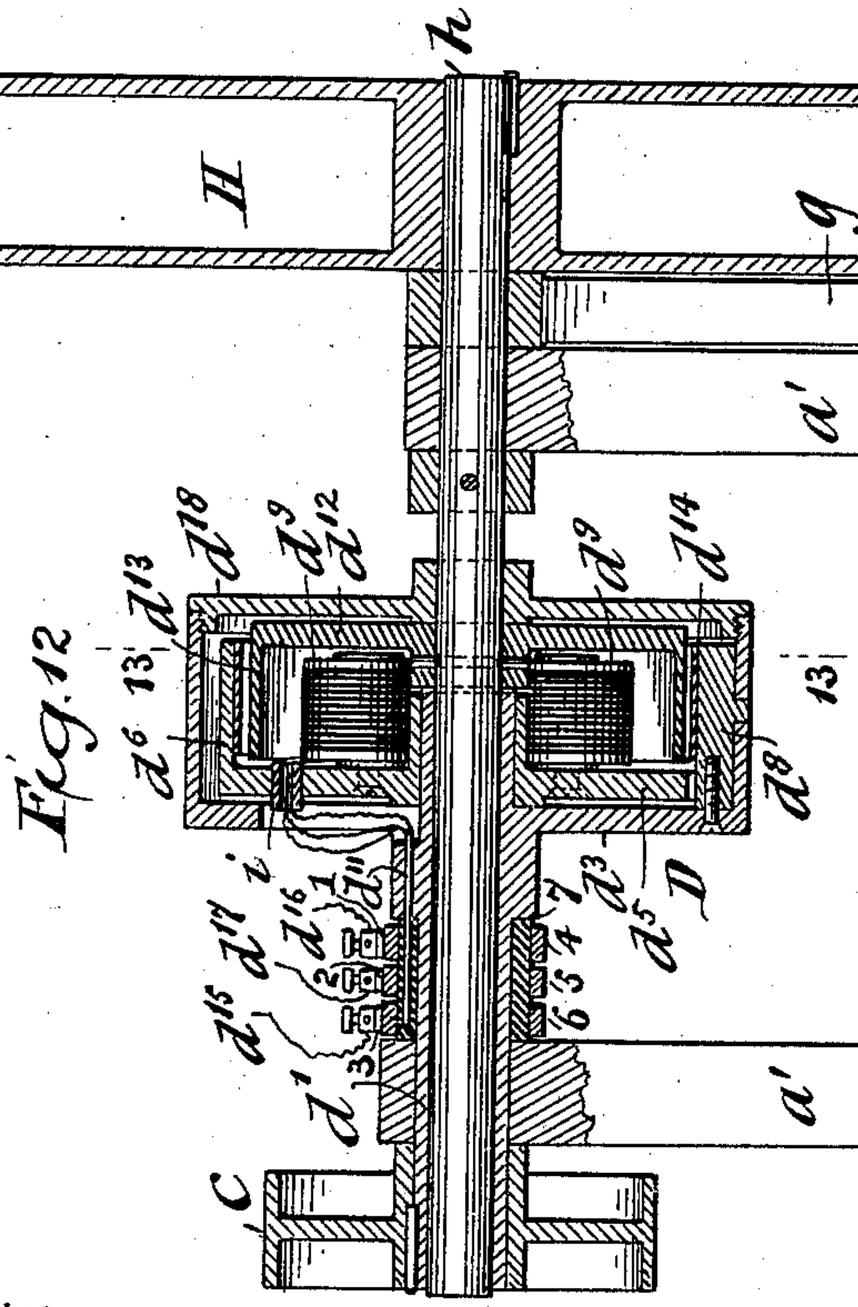
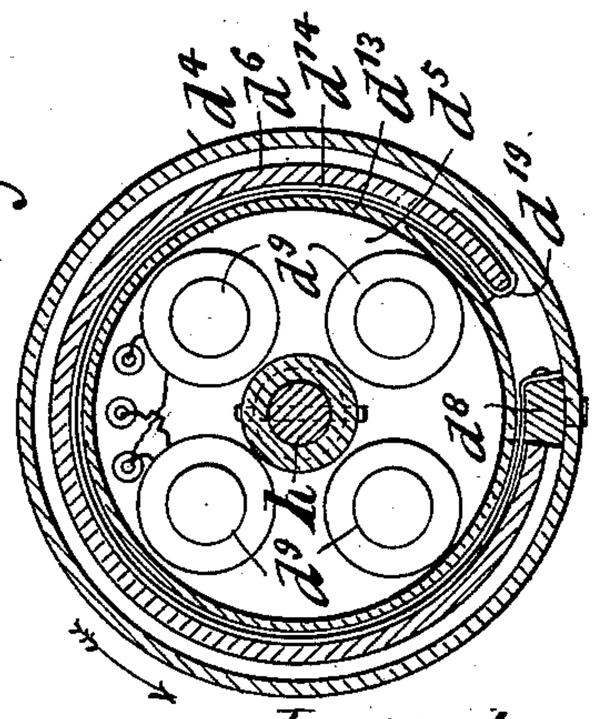


Fig. 13



Witnesses.
Geo. Wadman
H. E. Cruse.

Inventor.
Theodore M. Foote
By Edwin H. Brown
His Atty.

UNITED STATES PATENT OFFICE.

THEODORE M. FOOTE, OF NEW YORK, N. Y., ASSIGNOR TO EDWIN H. BROWN, OF SAME PLACE.

WIRE-DRAWING MACHINE.

SPECIFICATION forming part of Letters Patent No. 666,048, dated January 15, 1901.

Application filed April 14, 1899. Serial No. 712,962. (No model.)

To all whom it may concern:

Be it known that I, THEODORE M. FOOTE, a citizen of the United States of America, residing in the borough of Brooklyn, city and State of New York, have invented certain new and useful Improvements in Wire-Drawing Machines, of which the following is a specification.

My invention relates to wire-drawing machinery.

I will describe a wire-drawing machine and also a reel which may be used in conjunction with the wire-drawing machine, each embodying my invention, and then point out the novel features thereof in the claims.

In the accompanying drawings, Figure 1 is a side elevation of a series of wire-drawing machines and a part of a reel, (the whole reel being shown in Fig. 10,) each embodying my invention, with the electric circuits employed therein conventionally shown. Fig. 2 is a top view of Fig. 1, part of said view being in horizontal section taken on the line 2 2, Fig. 1. Fig. 3 is a longitudinal sectional view taken on the line 3 3, Fig. 2. Fig. 4 is a transverse vertical sectional view taken on the line 4 4, Fig. 1. Fig. 5 is a transverse vertical sectional view taken on the line 5 5, Fig. 1. Fig. 6 is an enlarged horizontal sectional view taken on the line 6 6 of Fig. 7. Fig. 7 is a transverse sectional view taken on the line 7 7, Fig. 6. Fig. 8 is a view similar to Fig. 7, but showing the position of the parts of the clutch after the magnets have been energized. Fig. 9 is a transverse sectional view taken on the line 9 9, Fig. 6. Fig. 10 is a side elevation of the reel in which my invention is embodied and a part of a wire-drawing machine. Fig. 11 is a top view of Fig. 10. Fig. 12 is an enlarged transverse vertical sectional view taken on the line 12 12, Fig. 10. Fig. 13 is a sectional view taken on the line 13 13, Fig. 12. Fig. 14 is a view similar to Fig. 13, but showing the position of the parts of the clutch after the magnets have been energized.

Similar letters of reference designate corresponding parts in all of the figures of the drawings.

A, A′, and A^2 represent a series of wire-drawing machines, which, as shown, are so arranged as to give a successive and continuous reduction to a wire A^3.

H represents a reel placed at the end of the series of machines and which in the example shown also acts as a wire-drawing machine, as it gives the final reduction to the wire. Each machine and the reel may comprise a bed or base *a* and uprights *a′*. Each machine and, if desired, the reel is provided with a die-box a^2, containing a lubricating liquid, and a die a^3, located in said box. Located in advance of each die on each machine is a drawing-head B, which is rotated as hereinafter described to draw the wire. As shown, each drawing-head delivers by way of an idler or idlers to the drawing-head on an adjacent machine, or a drawing-head may deliver directly to a reel. Each machine is provided with means for regulating the draft of a drawing-head, and these means are controlled by the wire delivered from one drawing-head to another. In case of a drawing-head delivering directly to a reel I provide means intermediate the drawing-head and reel for regulating the draft of the reel through the die, which means are also controlled by the wire delivered from the drawing-head to the reel. The means for regulating the draft of the drawing-head or reel comprise a clutch, which is preferably an electromagnetic friction-clutch. The circuit of the magnets in each clutch includes a controller, which controller is in the path of the wire delivered from one drawing-head to another. The controller is of such construction that when excess tension is put upon the wire it will be operated to open the circuit of the clutch of the drawing-head to which the wire is being delivered to stop that drawing-head from operating the wire, and thus relieve the wire of tension.

The machines are all of substantially the same construction, so that the following description, which is of one machine, will apply equally to all the machines.

All the machines combined may be considered as a single machine in which a continuous and successive reduction of wire is effected.

C represents a shaft suitably journaled in the uprights *a′*, and *c* pulleys provided on one

of its ends. As shown, the pulleys of all the machines are belted together, so that a single source of power may operate all of the machines. This shaft C is provided with a clutch D, preferably an electromagnetic friction-clutch, which when operated couples and uncouples the shaft C with the shaft of the drawing-head.

b represents the shaft of the drawing-head, which is suitably journaled in the uprights *a'*, and *b'* represents a gear-wheel fast on said shaft, which meshes with a pinion *d*, that is loose on the shaft C.

In advance of the drawing-head B, I preferably arrange a second drawing-head B', that is fast on a shaft b^2, which shaft is suitably journaled in the uprights *a'*.

b^3 represents a gear-wheel fast on the shaft b^2, which gear-wheel meshes with the pinion *d*. It will therefore be seen that when the shaft C is coupled or uncoupled with the shaft *b* it will also be coupled or uncoupled with the shaft b^2. I wish it to be understood, however, that the drawing-head B' may be omitted, and also, if desired, the clutch D may be provided on the shaft of the drawing-head and so arranged thereon that the head will be rotated when the magnets of the clutch are energized and stopped from rotation when the magnets are deënergized. This is the arrangement preferred for the reel, as will be hereinafter set forth.

The drawing-head B' delivers the wire to an idler E, carried on a shaft *e*, which is journaled in extensions a^4 of the uprights *a'*. From the idler E the wire passes over an idler F to another idler E', carried on a shaft *e'*, which is journaled in the uprights *a'*. The wire then passes from this idler to a disk-die on an adjacent machine. The idler F is carried on a shaft *f*, which is journaled in swinging arms *f'*, which arms are fulcrumed on a rod a^5, held in extensions a^6 of the uprights *a'*. Connected to one of the arms is a lever or extension *g*, which may form part of a controller for one of the clutches D. The controller carried by each machine preferably does not actuate the clutch for the drawing-head of the same machine, but the clutch for the drawing-head of an adjacent machine. With this arrangement the wire intermediate the drawing-head will be relieved of all excess tension, so that a very high speed may be obtained for the machines without at the same time having any additional strain put upon the wire. A clutch and a controller therefor are also provided for the reel. This controller is located in the path of the wire, leaving the last die in the series, and when there is tension upon the wire it operates the controller to stop the reel from further rotation. The form of clutch that I preferably employ is shown more particularly in Figs. 6, 7, 8, and 9.

The pinion *d* is loosely mounted upon the shaft C and is provided with a sleeve *d'* on one side thereof and a sleeve d^2 on the other side thereof. The pinion *d* also carries a circular plate d^3, which may be integral therewith.

d^4 represents an integral peripheral flange extending at right angles from the plate d^3.

d^{18} represents a plate removably connected with the flange d^4.

d^5 represents a circular plate loosely carried on the sleeve d^2, and d^6 an integral peripheral flange thereon, which extends in a direction from the plate d^5 that is parallel with the flange d^4. The flange d^6 is cut away, as shown at d^7, to accommodate a block d^8, that is carried by the flange d^4.

d^9 represents a series of magnets which are secured to the plate d^5. Each of these magnets is provided with two windings of wire, one of which windings, and preferably the outer winding, is composed of a coarser wire than the inner winding. The two windings of each magnet may be wound on the core in opposite directions, so that when a current is passed through both windings in the same direction the magnetism of the inner winding will be opposite to that of the outer winding. Instead the two windings may be wound in the same direction and currents passed through them in opposite directions to obtain the opposite magnetisms. In either case the magnetism of the inner winding is maintained at all times for the purpose of discharging any residual magnetism of the outer winding remaining in the core after the current is cut out of this winding. In Fig. 7 I have shown in outline the two windings of wire and the connections between the magnets. The terminals of the windings are passed through insulated eyes *i*, carried in the plate d^5, and through an opening d^{10} in the plate d^3, through tubes d^{11} to rings or bands to be hereinafter referred to. Opposite the magnets is a circular plate d^{12}, which turns with the shaft C. It is provided with a flange d^{13}, which is inclosed by the flange d^6.

d^{14} represents a band of considerable width which is adapted to be clamped about the flange d^{13}. One end of the band is secured to the block d^8, while its other end is bent over the edge d^{19} of the cut-away portion d^7 of the flange d^6. When this bend is clamped about the flange d^{13}, the plate d^3 and pinion *d* are made to turn with it, and in this manner the drawing-head B is made to rotate. The clamping of this band about the flange d^{13} is accomplished in the following manner: When the outer windings of the magnets are energized, the plate d^{12} will be attracted by the magnets, and through the attraction exerted by the magnets the plate d^5 will move with the plate d^{12}. As the plate d^5 is moved with the plate d^{12} the band d^{14} will be tightened or clamped about the flange d^{13}, as shown in Fig. 8. The friction between the band and flange d^{13} will prevent relative movement of these parts, and thus cause the flange to move the plate d^3 and pinion *d*. As soon as the current is cut out of the outer windings of

the magnets, the cores will be deënergized of the magnetism produced by the outer windings, and the plate d^{12} will rotate without the plate d^3.

d^{15} and d^{16} represent the terminals of the outer windings of the magnets and d^{17} one terminal of the inner windings, the other terminal being connected with one of the terminals of the outer winding.

Z represents a battery located in the terminals of the outer windings, to which the terminal of the inner winding is secured. The terminal d^{17} of the winding is secured to the terminal of the outer winding just referred to in such manner that the battery Z will be included between the terminals of the inner windings, so that the inner windings of the magnets will always contain current, and thus energize the core. The magnetism so produced is not sufficient to attract the plate d^{12} and cause the plate d^5 to rotate with it. The terminals d^{15}, d^{16}, and d^{17} are connected with contact-pieces 1 2 3, which bear upon rings or bands 4, 5, and 6. These rings or bands are separated and secured to a sleeve of insulation 7, which is loose upon the sleeve d'.

G represents a controller provided in the circuit of the outer windings of the magnet. As shown, the controller comprises the arm g and the adjustable screw g', which is carried in a bracket extension g^2 of one of the uprights. The controller on each machine is so arranged as to be normally closed, in which position the magnets of the clutch will be energized and the drawing-head will be rotated. As soon as there is any excess tension on the wire intermediate the drawing-heads on any two machines the idler F is rocked, so as to move the arm g, and thus open the circuit.

g^3 represents a spring, one end of which is connected with the arm g, while the other end is connected with a screw g^4, which is adjustable in an extension g^5. By adjusting the screw g^4 the controller may be made to open under the slightest tension or a very heavy tension.

Referring now to the reel shown in Figs. 10 and 11, H represents the reel which winds the wire after its final reduction through its die. The reel is keyed to a shaft h, which is journaled in extensions of the uprights a', and its rotation is effected through the clutch D, which is provided on the shaft h. The parts of the clutch and their relative positions are the same as hereinbefore described, except that the sleeve d' is extended to carry the driving-pulley c. The driving-pulley is belted with the other pulleys in such a manner that when the reel is coupled to the shaft it will rotate in the direction of the arrow, Fig. 10. Referring now to Figs. 12, 13, and 14, it will be seen that when the pulley c is rotated the sleeve d' and plate d^3 will rotate with it. The plate d^5 will also rotate with the sleeve and plate d^3 by reason of the band d^{13} having its ends connected with these parts. The normal position of the parts during rotation and without the magnets being energized is shown in Fig. 13. As soon, however, as the magnets are energized the attraction thereof will retard the movement of the plate d^5, and thus cause the band d^{13} to be tightened around the flange of plate d^{12}, as shown in Fig. 14. The plate d^{12} will then rotate with the sleeve d', and as it is keyed to the shaft of the reel the end will be caused to rotate with it. The controller employed for the magnets is the same as hereinbefore described, except that it is swung from the shaft h. The operation of the controller is the same as hereinbefore described.

I represents a device for annealing the wire. It comprises a suitable support i^2, which is secured at one end to one of the uprights a' and provided with a yoke i^3 at its other end. Arms i^4 are secured to the yoke i^3, and connected with the arms i^4 are two terminals of a transformer-coil i^5. A low potential current is sent through the coil to heat the arms i^4 to an annealing temperature. As the wire passes from the drawing-head it is passed under the arms i^4, and thus annealed.

What I claim as my invention is—

1. In a continuous wire-drawing machine, the combination of a plurality of dies, a plurality of drawing-heads and a reel, a continuously-rotating shaft for each head and for the reel, the electromagnetic means for operatively connecting and disconnecting each head and the reel with its shaft, and a controller for each of said electromagnetic means which is in the path of travel of the wire, said controllers being adapted to independently actuate each its electromagnetic means, substantially as specified.

2. In a wire-drawing machine the combination of a die, a drawing-head in advance of said die, a continuously-rotating shaft for said head, electromagnetic means for operatively connecting and disconnecting said shaft and head, and a controller for said electromagnetic means which is in the path of travel of the wire.

3. In a wire-drawing machine, the combination of a die, a drawing-head, a continuously-rotating shaft, an electromagnetic friction device for operatively connecting and disconnecting said shaft and head, a circuit and source of power for said electromagnetic device, a controller in said circuit in the path of travel of the wire, said controller having said circuit normally closed to permit the electromagnetic device to always have the shaft and head operatively connected, and adapted when excessive tension is on the wire to open the circuit to disconnect the shaft and head and when said tension is removed to again close the circuit to again cause the electromagnetic device to operatively connect the shaft and head.

4. In a wire-drawing machine, the combination of a plurality of dies and drawing-heads, a continuously-rotating shaft for each

head, an electromagnetic friction device for operatively connecting each drawing-head with a shaft, a circuit and source of power for each electromagnetic device, a controller for each circuit, which controllers are in the path of travel of a wire to be drawn through the dies, said controllers and circuits being independent of one another and each controller arranged to have its circuit normally closed and adapted to open its circuit when the wire passing it is under excessive tension, and to again close its circuit when the excessive tension of the wire is reduced.

5. The combination of a wire-drawing machine having a die and a drawing-head in advance of the die, and a reel; said reel comprising a winding-drum, a continuously-rotating shaft, a device comprising electromagnets for operatively connecting and disconnecting said shaft with said drum, a circuit and source of power for said magnets and a controller in said circuit, said controller being adapted to have said circuit normally closed to permit the device to operatively connect said shaft and drum, and adapted to be operated by the wire passing from the drawing-head to the drum, when the wire is under excessive tension to open said circuit and cause the device to disconnect the shaft and drum.

6. In a wire-drawing machine, the combination of a die, a plurality of drawing-heads in advance of said die, a continuously-rotating shaft, a clutch for operatively connecting and disconnecting said shaft and drawing-heads, and comprising electromagnets, a circuit and source of power for said magnets and a controller included in said circuit which normally keeps said circuit closed and adapted to be actuated by the wire being drawn when under excessive tension to open said circuit.

7. A clutch for use in wire-drawing machines, having in combination a constantly-rotating shaft, a part having a flange moving with the shaft, a second part normally stationary and carrying electromagnets, which when they are energized will cause the part carrying them to rotate with the first-mentioned part, a third part which is geared with a head for drawing wire, and a band carried by said second and third parts, which is adapted to be tightened about the flange of the first-mentioned part, a circuit and source of power for said magnets, and a controller provided in said circuit.

8. The combination in a wire-drawing machine, of a plurality of dies, a rotatable drawing-head and an electromagnetic clutch which controls the operation of said head located in advance of each die, a circuit and source of power for the magnets of each clutch, and a controller included in each circuit, said controllers each comprising a movable idler over which the wire passes as it is delivered from one drawing-head to another, and a spring-actuated lever operatively connected with said idler.

9. The combination in a wire-drawing machine of a plurality of dies, a rotatable drawing-head and an electromagnetic clutch which controls the operation of said head located in advance of each die, a circuit and a source of power for the magnets of each clutch, and a controller in each circuit, said controller comprising a movable idler over which the wire passes as it is delivered from one drawing-head to another, a lever adapted to be moved by said idler against the action of a spring and means for adjusting the tension of said spring.

10. In a wire-drawing machine, the combination of a die, a drawing-head in advance of said die, a constantly-rotating shaft, an electromagnetic friction-clutch for operatively coupling and uncoupling said shaft with the drawing-head, said clutch comprising a flanged plate which rotates with said shaft, a second plate normally stationary and carrying electromagnets, which when they are energized will cause the plate carrying them to rotate with the flanged plate, a third plate also normally stationary which is geared with the drawing-head, a band carried by said second and third plates, and surrounding the flange of the flanged plate, which band is tightened therearound when the plate carrying the magnets is moved with said flanged plate to cause the third plate to rotate with the shaft, and a controller for said clutch.

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

THEODORE M. FOOTE.

Witnesses:

W. LAIRD GOLDSBOROUGH,

J. EUGENE SONNER.