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F. W. JESSOP.

ELECTROMAGNETIC METAL WORKING MACHINE.

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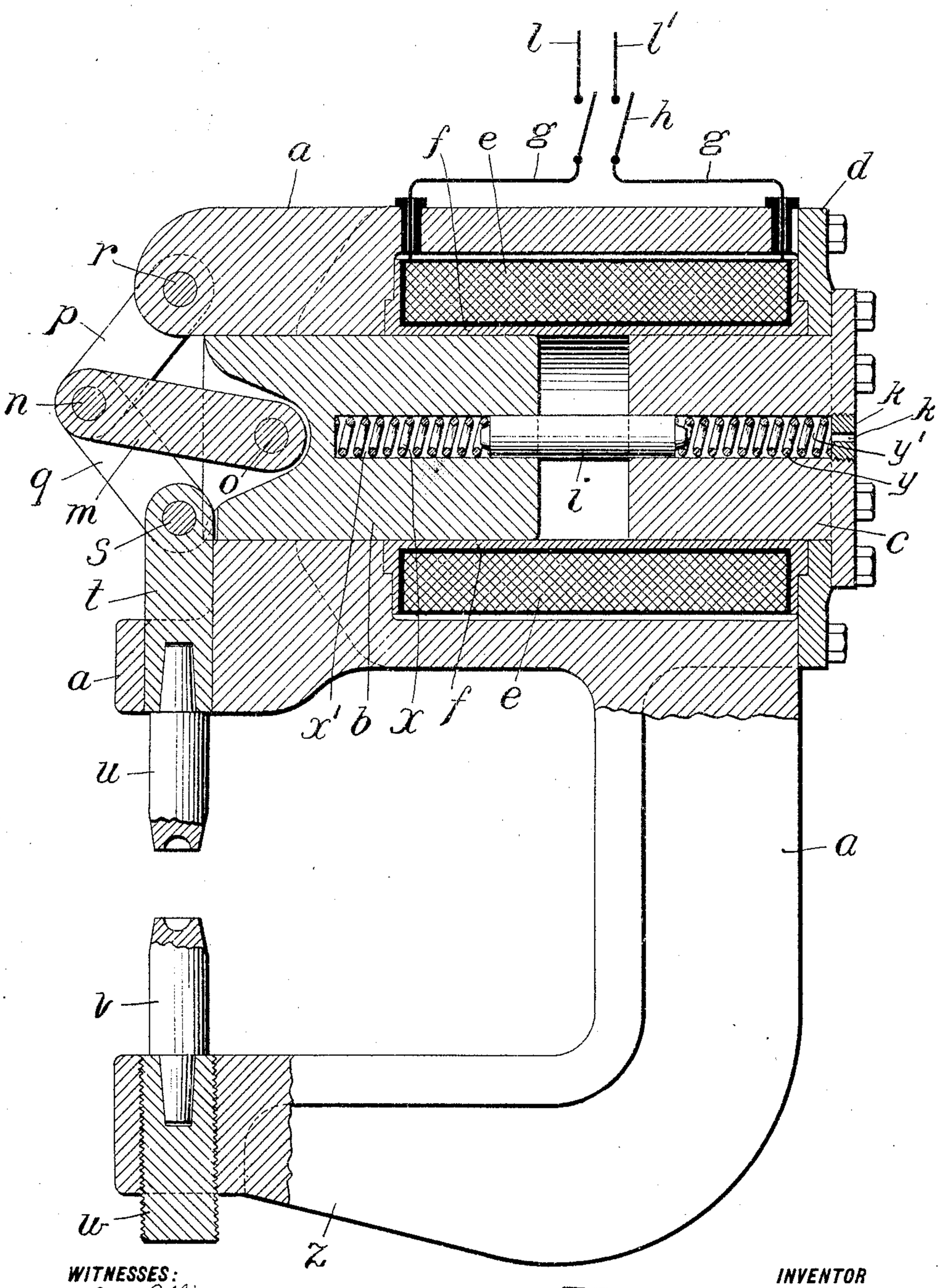

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UNITED STATES PATENT OFFICE.

FRANCIS WOODWARD JESSOP, OF CLEVELAND, OHIO.

ELECTROMAGNETIC METAL-WORKING MACHINE.

SPECIFICATION forming part of Letters Patent No. 779,427, dated January 10, 1905.

Application filed March 30, 1904. Serial No. 200,715.

To all whom it may concern:

Be it known that I, FRANCIS WOODWARD JESSOP, a citizen of the United States, residing at Cleveland, county of Cuyahoga, and State of Ohio, have invented a new and useful Improvement in Electromagnetic Metal-Working Machines, of which the following is a full, clear, and exact description, reference being had to the accompanying drawing, which forms a part of this specification.

My invention relates to metal-working machines—such as machines for riveting, punching, shearing, forming, and compressing—and more particularly relates to machines in which the metal-working operation is effected by a single stroke.

The invention has for its object to enable the application to this purpose of an electromagnet.

The invention consists in combining with the die, punch, shears, hammer, or other tool an electromagnet and power-multiplying mechanism intermediate thereof, whereby a powerful blow or stroke may be imparted to the tool, and also in certain general and specific details of construction relating to the construction and arrangement of the magnet, multiplying mechanism, containing and supporting frame, and auxiliary mechanism.

In the drawing the figure is a sectional view of a riveting-machine embodying my invention.

a represents a cast-iron frame, the body of which is cored out to receive a brass spool *f*, carrying on it but insulated from it an electric solenoid *e*. One end of the spool acts as a guide for the steel armature *b* of the solenoid, said armature being of the plunger type ordinarily used in solenoids, and therefore adapted to move in a right line as distinguished from the rotating armature employed in the ordinary electric motor. *d* is an annular steel cover-plate bolted to the frame and abutting against the other end of the spool. *c* is a steel core extending within the same end of the spool and having a flange bolted to the cover-plate *d*. The spool *f*, solenoid *e*, cover-plate *d*, core *c*, and plunger *b* form an electromagnet.

The plunger *b* is connected by the links *m* and pins *n* and *o* with the middle joint of a toggle formed of the links *p* and *q*, the links *p* being connected to the frame by pin *r* and the links *q* being connected to the ram *t* by pin *s*. The ram is movable in a guide in the frame *a*.

h is a switch, the two members of which are connected by conductors *g g'* with the terminals of the solenoid *e*.

l l' are the terminals of the line-circuit, adapted to be respectively connected with the conductors *g g'* by means of the switch.

When the switch *h* is closed, the solenoid *e* is energized, attracting the plunger *b* to the core *c*, pulling the links *p q* of the toggle-joint into alinement with each other and with the ram *t*, thus forcing the latter down. To retract the plunger, I provide the following means: Within the plunger and extending from its inner end toward its outer end and along its longitudinal center is bored an orifice *x'*. A similar orifice *y'* extends through the longitudinal center of core *c*. *x* is a spring seated in orifice *x'* in the plunger. *i* is a bronze bridging-piece, one end of which extends into the orifice *x'*, while the other end extends into the orifice *y'* in the core. *k* is a plug closing the outer end of the orifice *y'*. *y* is a spring confined in the orifice *y'* between the piece *i* and the plug *k*. When the switch *h* is closed, as before described, the inward movement of the plunger *b* compresses springs *x* and *y*. When the switch is opened, the springs expand, acting upon piece *i* and reacting upon plunger *b* and plug *k* of core *c* and restoring the plunger and ram to their normal positions. The hole *k'* in plug *k* is adapted to relieve the air-pressure.

The ram *t* is shown adapted for performing the operation of riveting by being tipped with a concave steel set *u* for forming the rivet-heads, while the lower angular arm *z* of the frame *a* is provided with a screw-threaded orifice in which is secured an adjustable holder *w*, carrying a steel die *v*.

It will be understood that any desired tool—such as a shear-blade, a punch, or a forming-tool—may be secured to the ram *t* and a suitable bottom piece substituted for the die *u*.

While electromagnetic power has heretofore been adapted to the operation of a metal-working tool, its use has either been confined

to the purpose of holding the frame of the machine in position to do the work or else when it has been adapted to actuate the riveting-set it has been directly secured thereto and the riveting effected by repeated light blows, as it is impracticable to build a directly-connected electromagnet strong enough to do heavy work by a single stroke. In my invention, however, the interposition of power-multiplying mechanism, such as the toggle-levers *p q* and link *m*, enables a powerful, short, and rapid stroke to be transmitted to the ram by means of an electromagnet of practicable strength. It will be understood, however, that my invention is not confined to an embodiment wherein the toggle-levers are utilized as a multiplying medium, as any suitable equivalent therefor may be employed. Indeed, the machine hereinbefore described possesses other novel features of construction and arrangement which will be found available for use whether the metal-working tool is directly connected with the plunger or connected therewith by means of multiplying-levers; nor is my invention confined to the details of construction and arrangement shown. For example, the invention is not restricted to the employment of a tension device for returning the plunger nor to the specific construction and arrangement of springs shown.

Having now fully described my invention, what I claim, and desire to protect by Letters Patent, is—

1. The combination, with the frame, of a ram carried by said frame, an electromagnet having a plunger-armature, and power-multiplying mechanism between said magnet and ram.

2. The combination, with the frame, of a ram carried by said frame, an electromagnet, and toggle-levers interposed between said magnet and ram.

3. The combination, with the frame, of a ram movable in a guide in said frame, an electromagnet, toggle-levers, one connected to the frame and the other to the ram, and a link connecting the plunger of the electromagnet with the joint of the toggle.

4. The combination, with the frame, of a ram movable therein, an electromagnet, the plunger of which is connected with said ram, and a tension device tending to hold said plunger in its inoperative position.

5. The combination, with the frame, of a ram movable therein, an electromagnet, power-multiplying mechanism between said magnet and ram, and a tension device adapted to restore said ram to its normal position.

6. The combination, with the frame, of a ram carried thereby, a solenoid, a plunger adapted to be energized by said solenoid, toggle-lever power-transmitting mechanism between said plunger and ram, and a tension device acting in opposition to said solenoid.

7. The combination, with the frame, of a ram movable in a guide in said frame, a solenoid in said frame, a stationary core extending within said solenoid, a plunger partly within and partly without said solenoid and adapted to be actuated thereby, said plunger being connected with said ram, and a tension device interposed between said core and plunger.

8. The combination, with the frame, of a ram, a solenoid supported in said frame, a stationary core extending within said solenoid, a plunger also extending within said solenoid and adapted to be energized thereby, said core and plunger each having an orifice, a spring seated in each orifice, and a piece bridging the space between said core and plunger, one end thereof extending into the core and abutting against the spring confined therein, and the other end extending into the plunger and abutting against the spring confined in the latter.

9. The combination, with the frame, of a spool confined therein, a solenoid carried on and insulated from said spool, an annular cover-plate secured to the frame and abutting against said spool, a stationary core extending through said cover-plate and within said spool and abutting against and secured to said cover-plate, a plunger extending within said spool and adapted to be actuated by the energizing of said solenoid, a tension device confined between said core and plunger, and a ram connected with and adapted to be operated by said plunger.

10. The combination, with the frame, of a spool confined therein, a solenoid carried on and insulated from said spool, an annular cover-plate secured to the frame and abutting against said spool, a stationary core extending through said cover-plate and within said spool and abutting against and secured to said cover-plate, a plunger extending within said spool and adapted to be actuated by the energizing of said solenoid, said core and plunger each having an orifice, a spring seated in each orifice, a piece bridging the space between said core and plunger and extending into said orifices and abutting against said springs, and a ram connected with and adapted to be operated by said plunger.

11. The combination, with a frame having an angular arm extending below its main body, the solenoid and plunger of an electromagnet, the body of said frame being cored out to receive the same, a ram slidable in a guide in the overhanging end of the body of the frame, the fixed and movable tools, the latter carried by said ram and the former by said arm, and power-multiplying mechanism between said plunger and ram.

12. The combination, with a frame having an angular arm extending below its main body, the solenoid and plunger of an electromagnet, the body of said frame being cored out to receive the same, a ram slidable in a guide in the overhanging end of the body of the frame,

the fixed and movable tools, the latter carried by said ram and the former by said arm, power-multiplying mechanism between said plunger and ram, and a tension device acting upon said plunger in opposition to said solenoid.

13. The combination with a frame having an angular arm extending below its main body, the solenoid and plunger of an electromagnet, the body of said frame being cored out to receive the same, a ram movable in a guide in the overhanging end of the body of the frame, toggle-levers the ends whereof are attached respectively to said frame and ram, a link connecting the joint of the toggle with the ram, a tension device acting upon said plunger in opposition to said solenoid, a movable tool carried by said ram, and a fixed tool carried by said extending arm.

14. The combination, with a frame having an angular arm extending below its main body, the body of the frame being cored from end to end, a spool inserted in the cored-out portion of said frame, a solenoid carried thereby, an annular cover-plate secured to the frame and abutting against said spool, a core extending within said spool and through said cover-plate and secured to the latter, a plunger extending within said spool and adapted to be actuated by said solenoid, springs seated in orifices in said core and plunger, a bridging-piece between said core and plunger extending into said orifices and engaging said springs, a ram movable in a guide in the outer end of the overhanging portion of said body, toggle-levers connected respectively to said frame and ram, a link connecting said plunger with the joint of the toggle, a tool secured to said ram, and a tool secured to the end of said angular arm.

In testimony of which invention I have hereunto set my hand, at Cleveland, on this 12th day of March, 1904.

FRANCIS WOODWARD JESSOP.

Witnesses:
C. W. COMSTOCK,
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