(No Model.)

5 Sheets—Sheet 1.

G. D. BURTON.

METHOD OF AND APPARATUS FOR WORKING METALS BY ELECTRICITY.

No. 438,525. Patented Oct. 14, 1890.

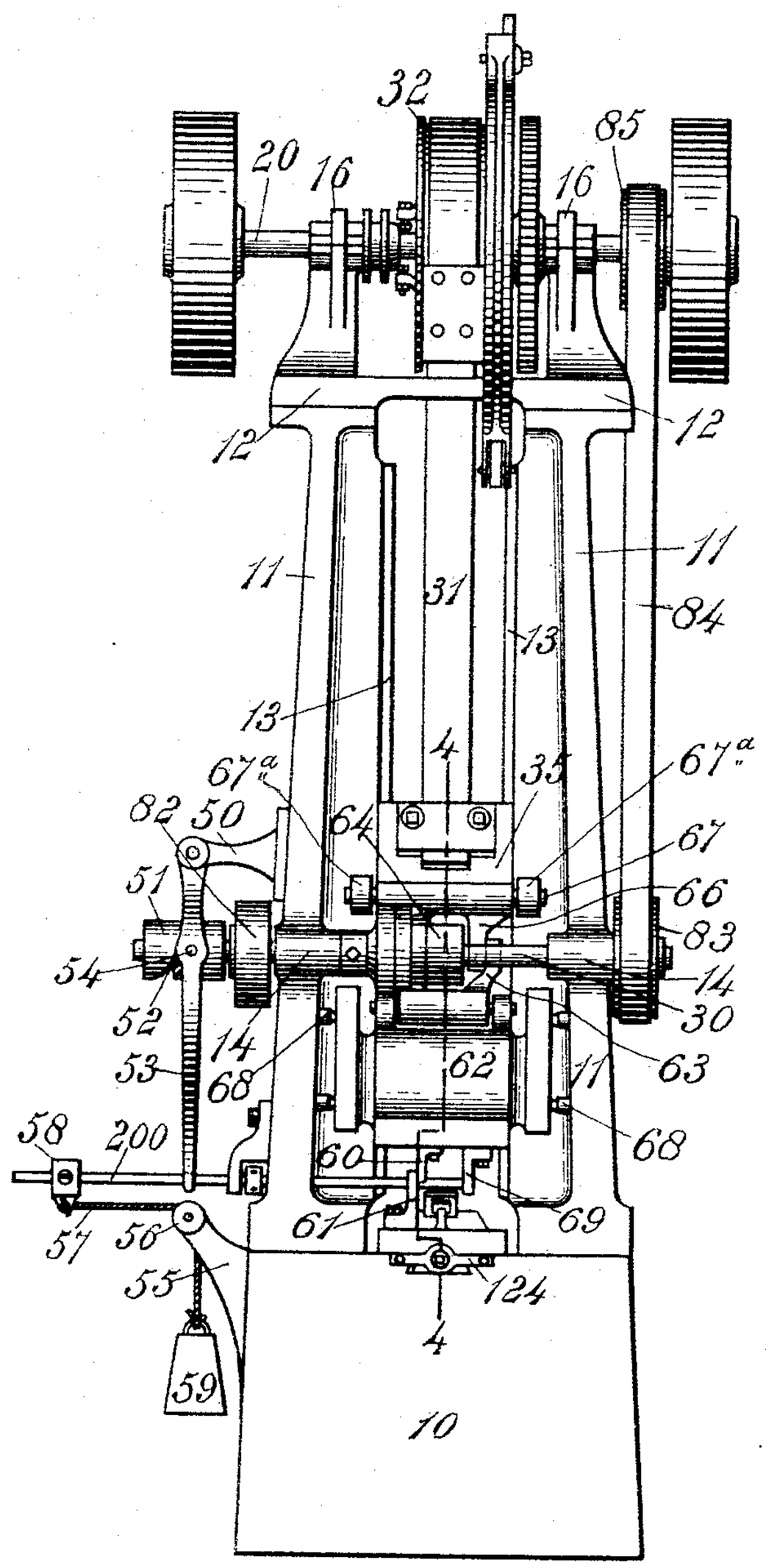

Fig. 1.

WITNESSES
C. A. Weed.
R. E. Somes.

INVENTOR
George D. Burton.
By F. G. Somes,
Attorney

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

(No Model.) 5 Sheets—Sheet 2.

G. D. BURTON.

METHOD OF AND APPARATUS FOR WORKING METALS BY ELECTRICITY.

No. 438,525. Patented Oct. 14, 1890.

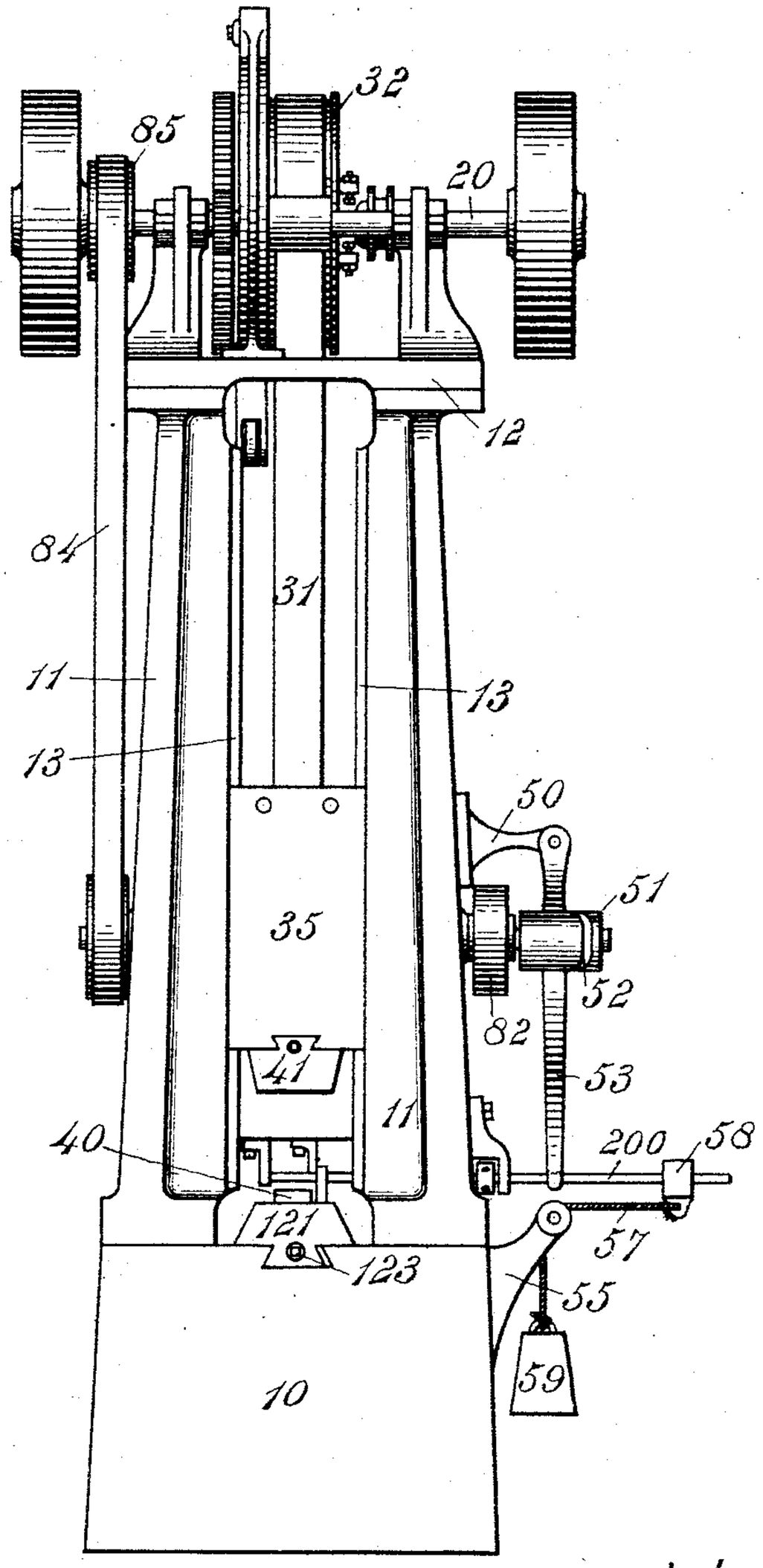

FIG. 2.

WITNESSES
C. A. Weed.
R. E. Somes.

INVENTOR
George D. Burton
By F. C. Somes
Attorney.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

(No Model.) 5 Sheets—Sheet 3.

G. D. BURTON.

METHOD OF AND APPARATUS FOR WORKING METALS BY ELECTRICITY.

No. 438,525. Patented Oct. 14, 1890.

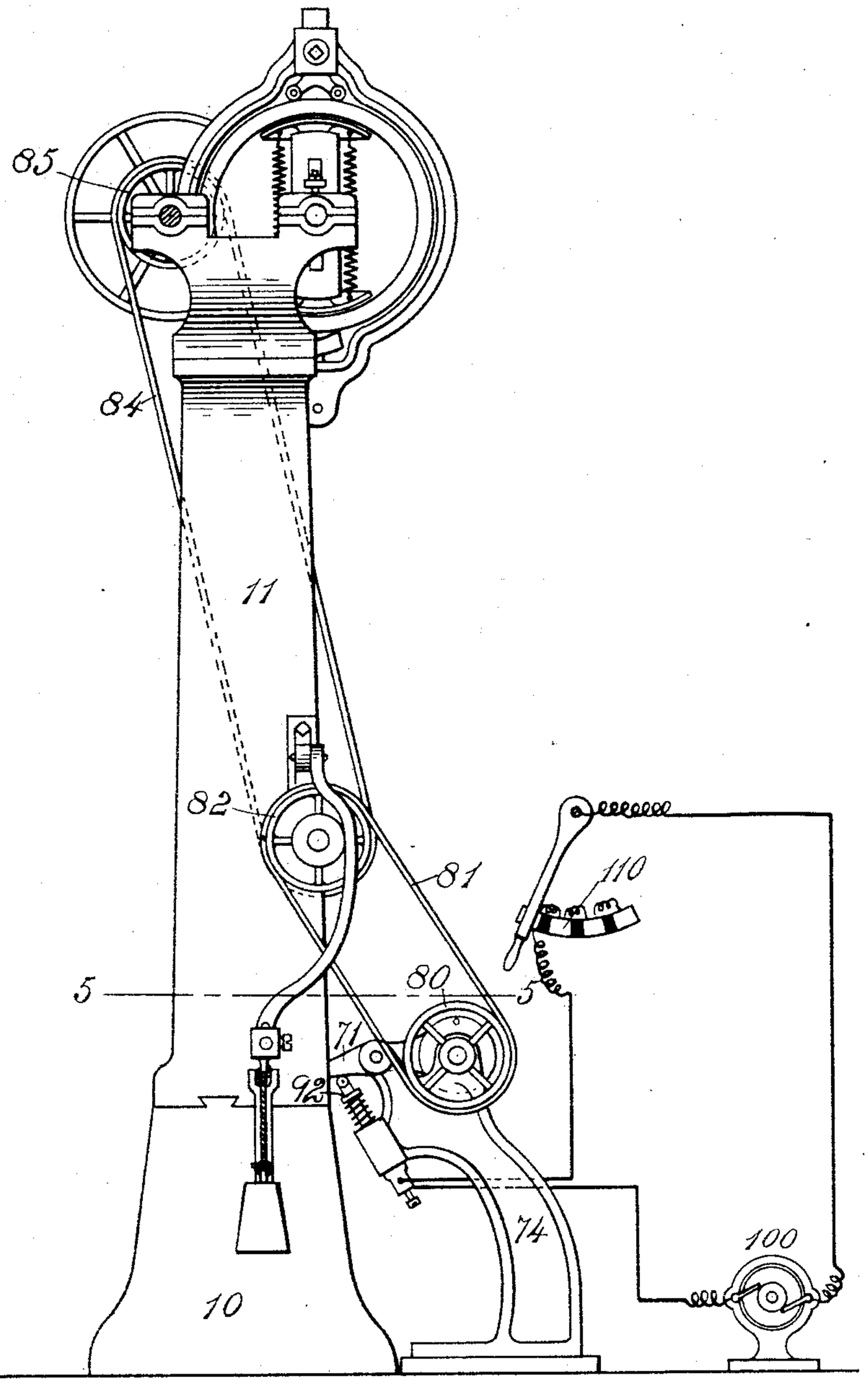

Fig. 3.

WITNESSES
C. A. Weed.
R. E. Somes.

INVENTOR
George D. Burton
By F. C. Somes
Attorney.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

(No Model.) 5 Sheets—Sheet 4.

G. D. BURTON.

METHOD OF AND APPARATUS FOR WORKING METALS BY ELECTRICITY.

No. 438,525. Patented Oct. 14, 1890.

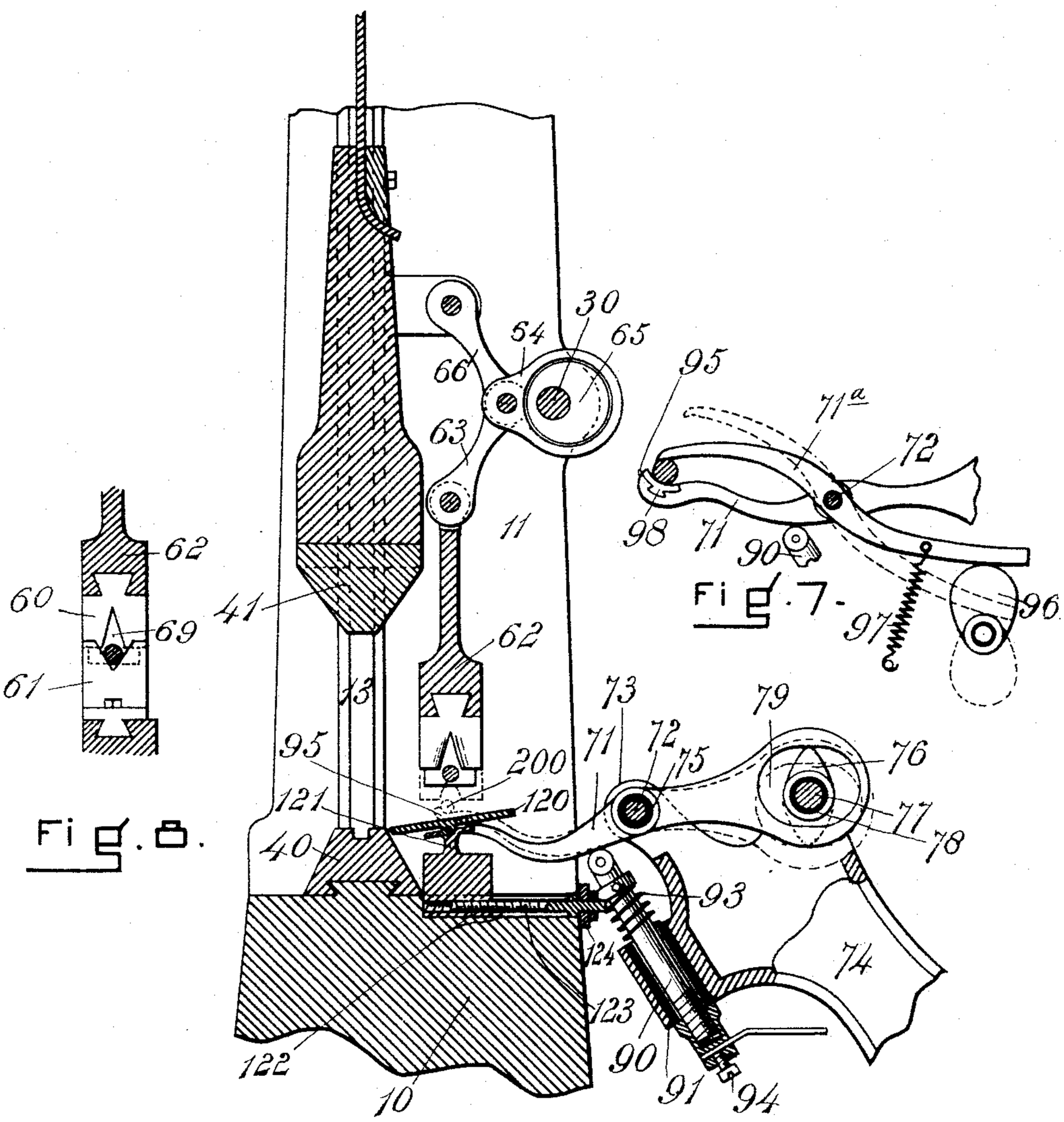

Fig. 8.

Fig. 7.

Fig. 4.

WITNESSES
C. A. Reed
R. E. Somes.

INVENTOR
George D. Burton
By F. G. Somes,
Attorney.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

(No Model.) 5 Sheets—Sheet 5.

G. D. BURTON.

METHOD OF AND APPARATUS FOR WORKING METALS BY ELECTRICITY.

No. 438,525. Patented Oct. 14, 1890.

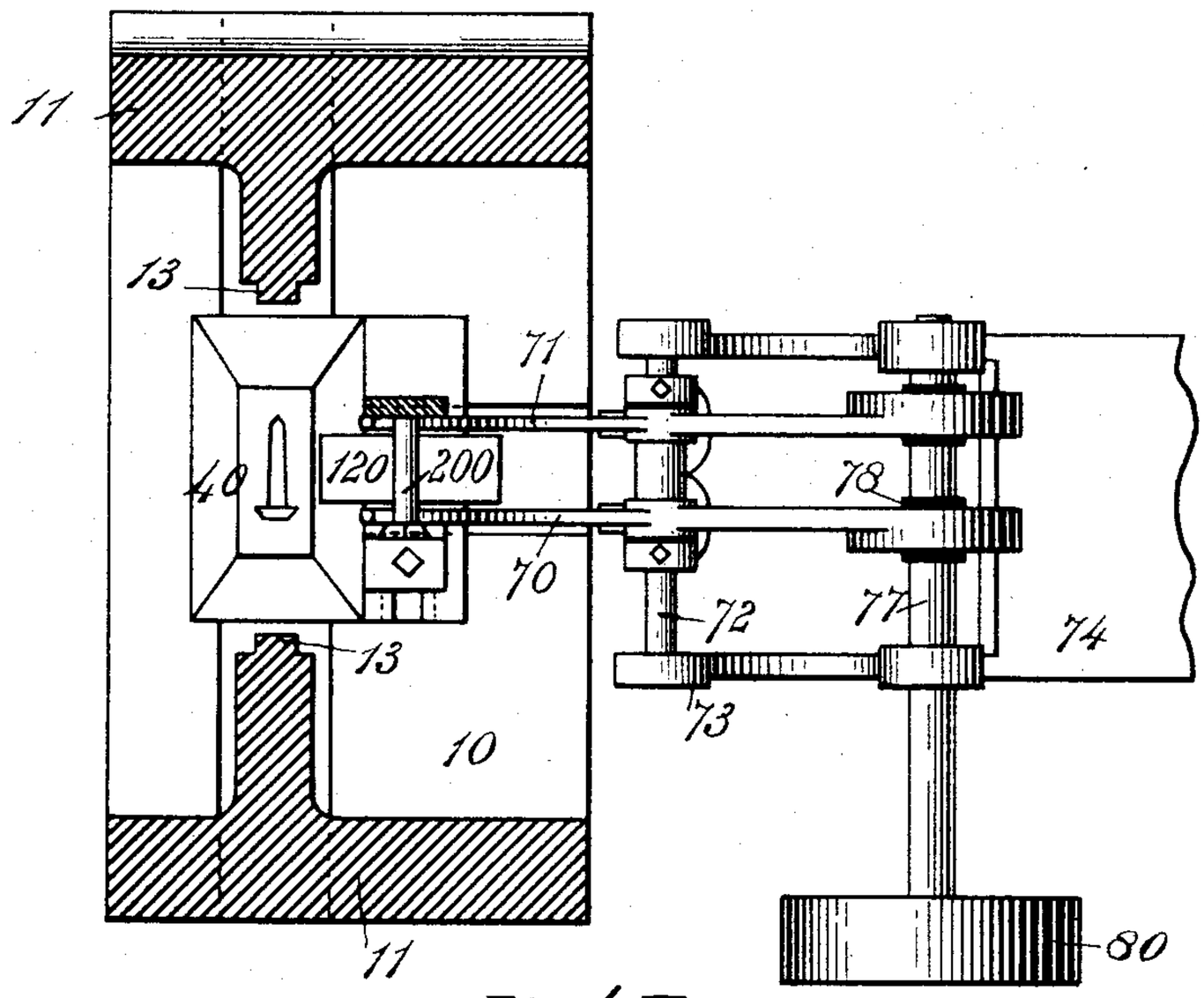

Fig. 5.

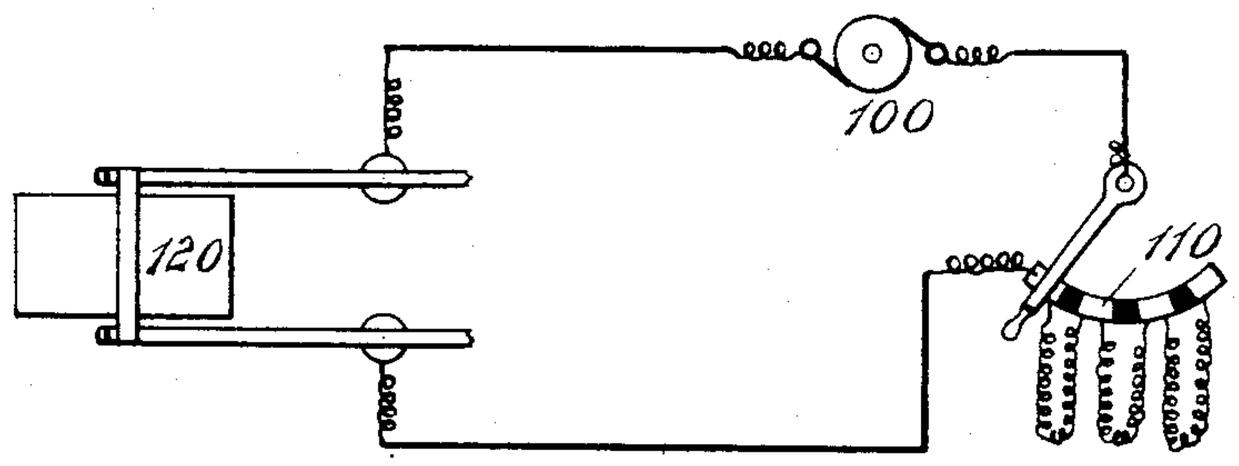

Fig. 6.

WITNESSES
E. L. Reed
R. E. Somes.

INVENTOR
George D. Burton
By F. E. Somes
Attorney

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

GEORGE D. BURTON, OF BOSTON, MASSACHUSETTS.

METHOD OF AND APPARATUS FOR WORKING METALS BY ELECTRICITY.

SPECIFICATION forming part of Letters Patent No. 438,525, dated October 14, 1890.

Application filed August 12, 1890. Serial No. 361,778. (No model.)

To all whom it may concern:

Be it known that I, GEORGE D. BURTON, a citizen of the United States, residing at Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Methods of and Apparatus for Working Metals by Electricity, of which the following is a specification.

This invention relates to a method of and apparatus for working metals, in which electricity is employed as a heating agent for softening the metal to be worked.

The invention has special reference to methods and apparatus for working a succession of articles from a metallic bar.

The principal objects of the invention are to avoid repeated heating of the bar from which the articles are produced, to secure a proper regulation of the electric current, and to separate the electrodes from the forging or shaping mechanism.

The invention consists in the method of forming or shaping articles from a metal rod or bar by feeding said bar a given distance for the length of the article to be made, then cutting off from said bar a blank of the required length, then softening said blank by passing an electric current therethrough, then cutting off said current and feeding the softened blank to the working-dies, and then subjecting the blank to a forging or shaping operation.

The invention consists, further, in a bar-feeder, a bar-cutter for cutting off a blank from the bar being worked, a metal-working mechanism, and an electric heater disposed between the cutter and the metal-working mechanism for heating the blank after it is cut from the bar and before it is subjected to the forging or other metal-working mechanism, whereby that portion only of the material to be worked is subjected to the electric current and repeated heating and reheating of the bar avoided. The electric heater may also serve as a feeder for feeding the blank to the working mechanism, or a separate blank-feeder may be employed.

The invention consists, further, in the combination of forging-dies, a feeder for feeding the metal to be worked to said dies, electrodes for heating said metal while out of contact with the dies, an electric circuit connected with said electrodes, and a variable resistance in said circuit between the source of electricity and said electrodes for regulating the current passed through said metal while out of contact with the dies.

The invention consists, further, in certain combinations of parts, hereinafter set forth, for carrying out the process herein described.

Figure 1 of the accompanying drawings is a front elevation of a forging-machine adapted for use in connection with my improved electric heating and feeding mechanism, the electrodes and their supports being omitted. Fig. 2 is a rear elevation thereof. Fig. 3 is a side elevation thereof, showing the bar-heater and the electric circuit provided with resistance-coils. Fig. 4 is an enlarged vertical longitudinal section of a portion of this improved metal-working apparatus and its appurtenances, the forging mechanism being on line 4 4 of Fig. 1. Fig. 5 is an enlarged horizontal section thereof on line 5 5 of Fig. 3. Fig. 6 is a diagram representing a variable resistance-circuit and my improved blank-supporting electrodes disposed therein. Fig. 7 illustrates one species of the electrodes used in this apparatus. Fig. 8 represents a vertical section of the cutting-off dies.

Similar numerals of reference indicate corresponding parts in the different figures.

Any suitable metal forging or shaping mechanism may be employed in connection with my improvements. The mechanism herein illustrated for this purpose is a drop forging-machine. The frame of this machine comprises a bed 10, upright standards 11, attached to said bed, and a cross-web 12, connecting the upper ends of said standards. The standards are provided on their inner faces with vertical guideways 13 and with horizontal shaft-bearings 14, and the cross-web is also provided with pedestals having shaft-bearings. A driving-shaft 20 is journaled in one set of bearings at the top of the frame, and a counter-shaft 30 is journaled in the horizontal bearings 14. A plunger 35 reciprocates vertically in the guideways 13 of the standards, and is connected by a strap-belt 31 with a pulley 32 on the driving-shaft 20, said pulley being controlled by a clutch

mechanism in any suitable manner. The fixed die 40 is attached to the bed 10 by any suitable means, and the movable die 41 is attached to the lower end of the plunger.

The bar from which the articles are to be forged is preferably fed to the apparatus by a mechanical intermittent feeder. The feeder herein shown for this purpose comprises a lateral arm 50, attached to one of the standards 11, a cam 51 on the counter-shaft 30 and provided with a cam-groove 52, and a lever 53, pivoted at its upper end to said arm and provided with a pin 54, which projects into the groove of said cam, the lower end of said lever being adapted to grasp the bar. The bed 10 is provided with an arm 55, carrying an anti-friction pulley 56, and a cord 57 passes over this pulley and is connected at its upper end to a clamp 58 adjustable on the bar. The lower end of said cord is provided with a weight 59, which tends to feed the bar forward when it is released by the lever 53. Any suitable bar-feeder may be employed as the equivalent of that herein described.

A blank-cutter for cutting off a blank of the required size from the metal bar from which the articles are to be made is disposed adjacent to the metal forging or working mechanism. This blank-cutter, as herein illustrated, comprises a vertically-reciprocating cutter-die 60 and a fixed cutter-die 61. The fixed cutter-die 61 is supported on the bed 10, and the movable cutter-die 60 is attached to a cross-head 62, which is provided with guideways and moves on studs 68, attached to the vertical standards. A toggle-link 63 connects the upper end of the cross-head with a cam-ring 64, which encircles a cam-disk 65, disposed on the counter-shaft 30. This cam-ring is also connected by a toggle-link 66 with a fixed rod 67, supported in lugs 67^a of the standards. The cutting-edges of the cutter-dies are preferably V-shaped. A stop 69 is disposed at one side of the cutter-dies, preferably attached to the cross-head 62.

An electric heater for heating the blank cut off from the bar to soften it for the forging operation operates between the cutter-dies and the forging or metal-working mechanism. The electric heater herein shown for this purpose comprises two electrodes in the form of levers 70 and 71, which are pivoted on a rod 72, supported in bracket-arms 73 of suitable standards 74. These levers, which serve as carriers for the blank, are composed of highly-conductive material, preferably hard copper, and are insulated from the rod on which they are pivoted by sleeves 75, of insulating material. The outer ends of these levers are actuated by cams 76, disposed on a shaft 77, and insulated therefrom by insulating-sleeves 78. These levers are preferably provided at their outer ends with slots 79, in which the cams 76 work. The cam-shaft 77 is provided with a pulley 80, and a belt 81 passes over said pulley and over a pulley 82 on the counter-shaft 30, and motion is thereby communicated from the counter-shaft to the cam-shaft. The counter-shaft is provided at its opposite end with a pulley 83, which is connected by a belt 84 with a pulley 85 on driving-shaft 20, whereby motion is communicated from the driving-shaft to the counter-shaft. The current is supplied to the electrodes by means of automatically-adjustable contact-pins 90, disposed in two insulated guide-sockets 91 on the standards 74. These contact-pins are provided with collars 92, and springs 93 are interposed between said collars and the guide-sockets, said springs acting expansively to hold the contact-pins in contact with the electrodes. The lower ends of these contact-pins are provided with binding-posts 94 for connecting the positive and negative wires therewith. The inner ends of the lever-electrodes are provided with holding-faces 95 for supporting the blank cut from the bar being worked, as indicated in dotted lines in Fig. 4, or in other form. Each of the electro-levers may constitute one part of a pair of clamping-tongs, as illustrated in Fig. 7, for holding the blank while it is being heated. In this case the upper member 71^a of the clamping-tongs is pivoted on the rod 72 and insulated therefrom, and is controlled by a separate cam 96 and a spring 97, which act in unison with the cams 76 of the lower member 71 to open and close the tongs. The levers where they support the blank to be worked or forged are preferably provided with platinum faces 98, which facilitate the passage of the current from the electrodes to the blank.

The electric circuit for passing a heating-current through the metal to be worked is illustrated in diagram in Fig. 6, in which a dynamo, storage-battery, or other source of electricity is represented at 100. A number of resistance-coils 110 are disposed in this circuit, by means of which the volume of the current can be regulated to suit the requirements of the work, whereby a uniform heat may be obtained for the forging operations.

A blank-feeder for feeding the blank cut off from the bar to the dies may be disposed between the electrodes and the dies. The blank-feeder herein shown for this purpose consists of an inclined table 120, disposed beneath the cutter-dies adjacent to the forging-dies. This table is preferably hinged to an adjustable support 121, which is dovetailed in a recess 122 in the bed 10. An adjustable screw 123 passes through a plate 124, attached to the bed 10, and takes into a screw-threaded hole in the support. When the blank is released by the electrodes it drops upon the table, which tilts toward the dies under the weight of the blank and feeds said blank to the dies.

The operation of the apparatus is as follows: A metallic bar 200, from which the articles are to be forged, is fed by the bar-feeder between the cutter-dies 60 and 61 against the stop 69, and the cam-disk 65, operating on the cam-ring 64, straightens the toggle-links 63

and 66 and forces down the upper die 60, whereby a blank of the desired length is severed from the bar. This blank then drops upon the inner ends of the electrodes 70 and 71, which are then in the position indicated by dotted lines in Fig. 4. The blank closes the electric circuit between the electrodes and causes an electric current of sufficient volume to soften the blank to pass therethrough. The inner ends of the electrodes are then swung down under the action of the cams 76 and release the blank, which falls upon the table 120, which conducts it to the dies. The plunger 40, carrying the upper forging-die, is then brought into action and the blank forged thereby into the desired shape.

It will be observed that the metal to be worked is subjected to a single heat, and the final effect of the current of electricity after the metal becomes cold is to harden or compact the particles thereof.

I claim as my invention—

1. The method of forging an article from a metal bar, which consists in cutting off from said bar a blank of the required length for the article to be forged, then softening said blank by passing an electric current therethrough, then withdrawing the current, and then subjecting the blank to a forging operation, substantially as set forth.

2. In an electric metal-working machine, the combination of a bar-feeder, a bar-cutter for cutting a blank from the bar, electrodes for passing an electric current through the blank after it is cut off, and means for delivering said blank for the action of forging-dies.

3. In an electric metal-working machine, the combination of a bar-feeder, a bar-cutter for cutting a blank from the bar, electrodes for passing an electric current through the blank after it is cut off, and a blank-feeder for feeding said blank to the dies after it is released by said electrodes.

4. In an electric metal-working machine, the combination of a bar-feeder, a bar-cutter for cutting a blank from the bar, electrodes for passing an electric current through the blank after it is cut off, and a blank-feeder consisting of an inclined table for feeding said blank to the dies after it is released by the electrodes.

5. In an electric metal-working machine, the combination of two pivoted levers for supporting a blank to be worked, means for actuating said levers, and sliding contact-pins connected with an electric circuit and engaging said levers.

6. In an electric metal-working machine, the combination of two movable carriers provided with holding-faces for supporting the blank to be heated, said carriers being connected with an electric circuit and serving as electrodes.

7. In an electric metal-working machine, a heating device consisting of two pairs of clamping-tongs, electric conductors in connection therewith, and means for opening and closing said tongs.

8. In an electric metal-working machine, the combination of metal-working mechanism and an electric heater having electrodes provided with platinum holding-faces for holding the metal to be heated.

9. In an electric metal-working machine, the combination of cutter-dies, forging-dies, a feeder for feeding the metal to be worked to said forging-dies, electrodes for heating said metal while out of contact with the dies, an electric circuit connected with said electrodes, and a variable resistance in said circuit between the source of electricity and said electrodes for regulating the current passed through said metal while out of contact with the dies.

10. In an electric metal-working machine, the combination of the supporting-standards 74, provided with sockets 91, the rod 72, the shaft 77, provided with insulated cams 78, the lever-electrodes 70 and 71, pivoted on said rod and insulated therefrom, said electrodes being provided with holding-faces at their inner ends and with slots at their outer ends engaged by said cam, the spring-actuated contact-pins 90, movable in said sockets, and electric connections for said pins.

11. The method of making a metal forging, which consists in forming a blank of a determinate size for the forging to be produced, then softening said blank by passing an electric current therethrough, then withdrawing the electric current from the prepared blank, and then subjecting said blank to a forging operation.

In testimony that I claim the invention above set forth I affix my signature in presence of two witnesses.

GEO. D. BURTON.

Witnesses:
CHESTER MARR,
CHAS. F. ADAMS.