

J. I. AYER.

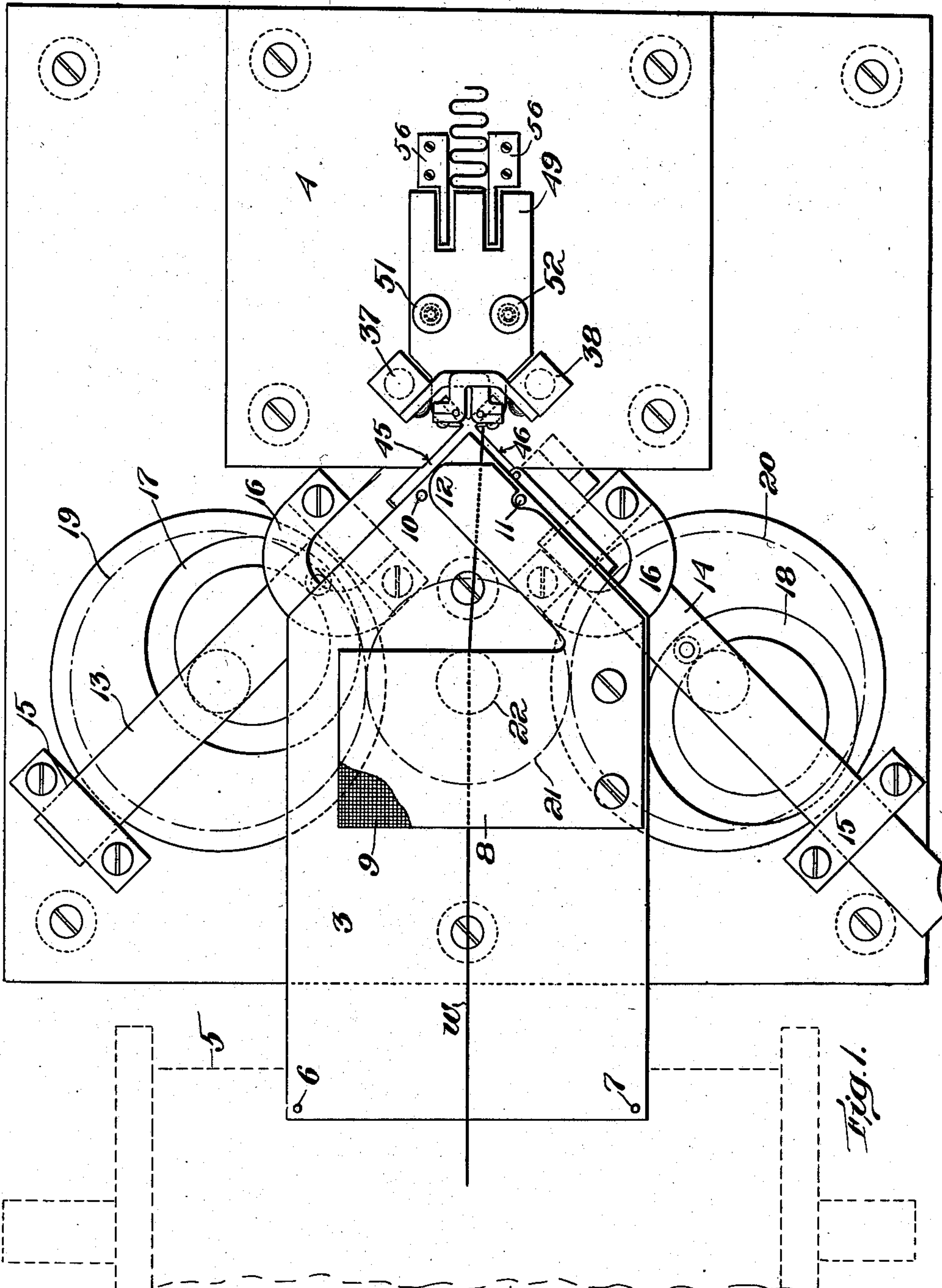
MACHINE FOR CRIMPING ELECTRIC RESISTANCE WIRES.

APPLICATION FILED DEC. 8, 1906.

905,130.

Patented Dec. 1, 1908.

3 SHEETS—SHEET 1.



Witnesses:

Edward Maxwell.  
C. J. Smerdon.

Inventor:

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by Geo. H. Maxwell,  
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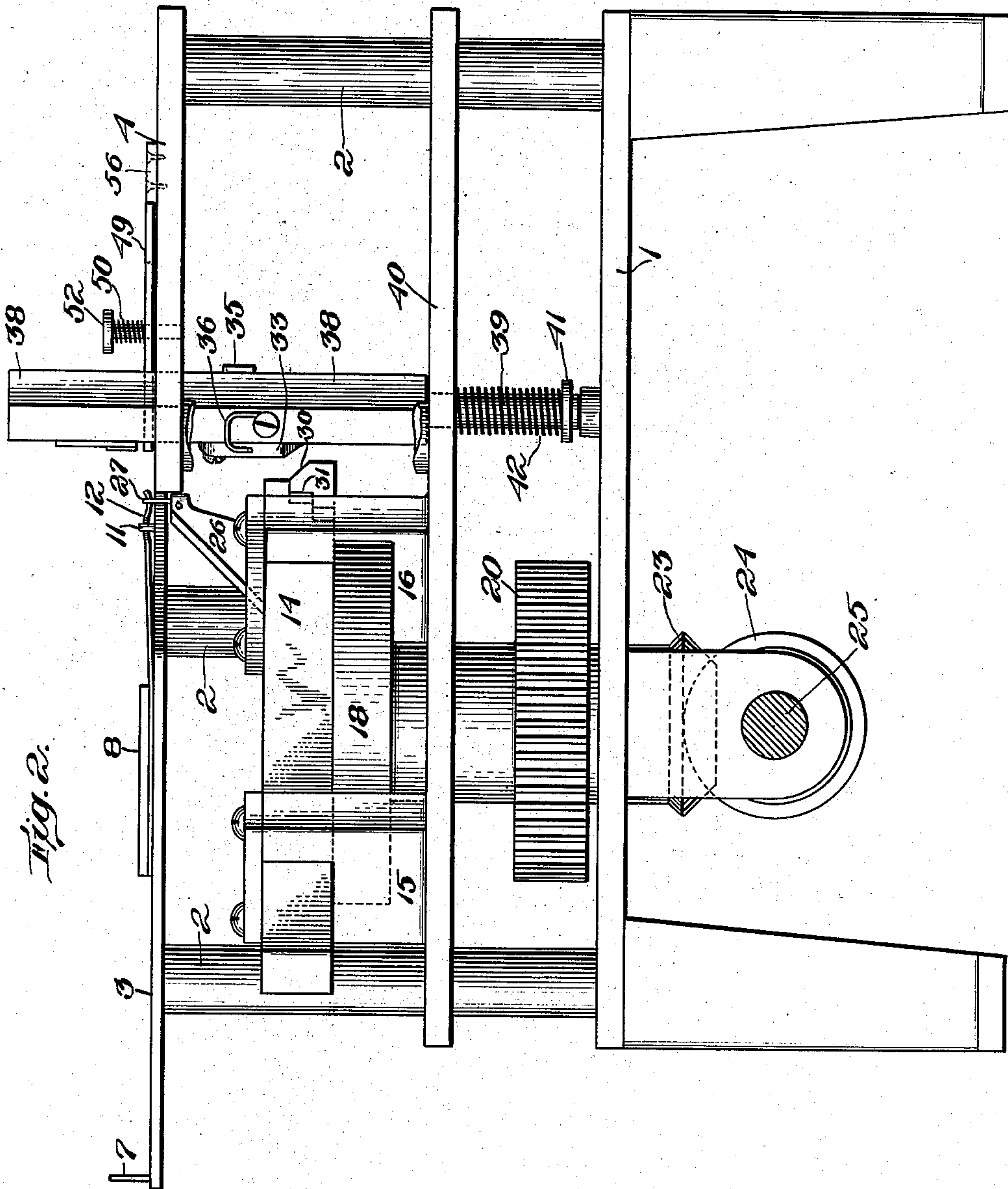
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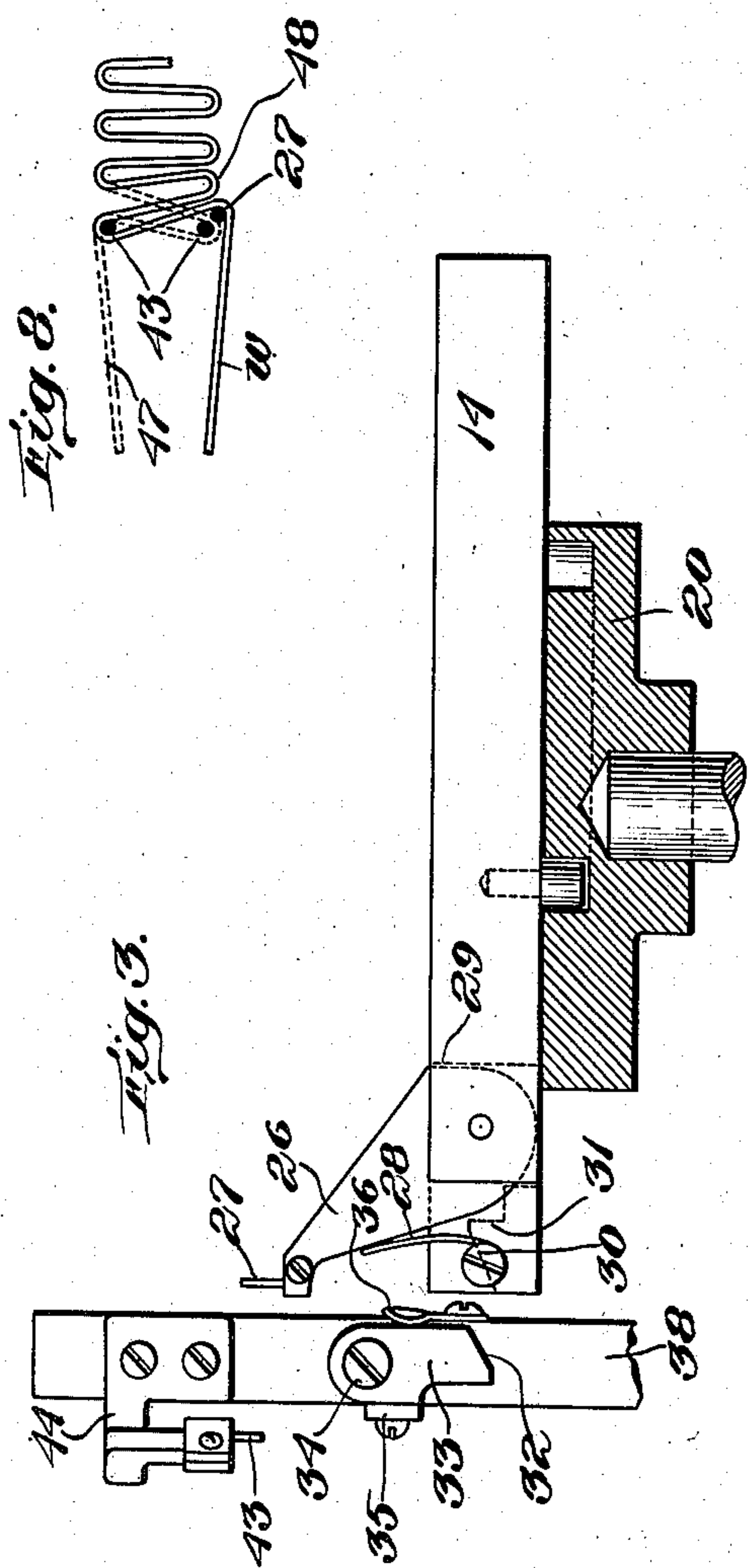


Fig. 3.

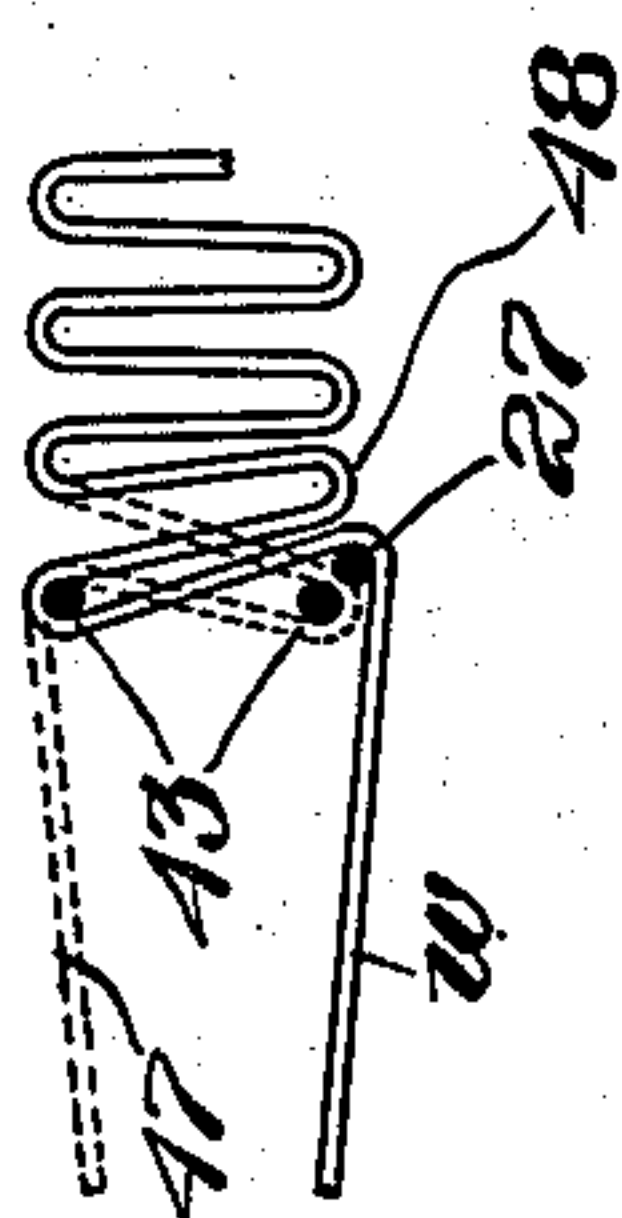


Fig. 8.

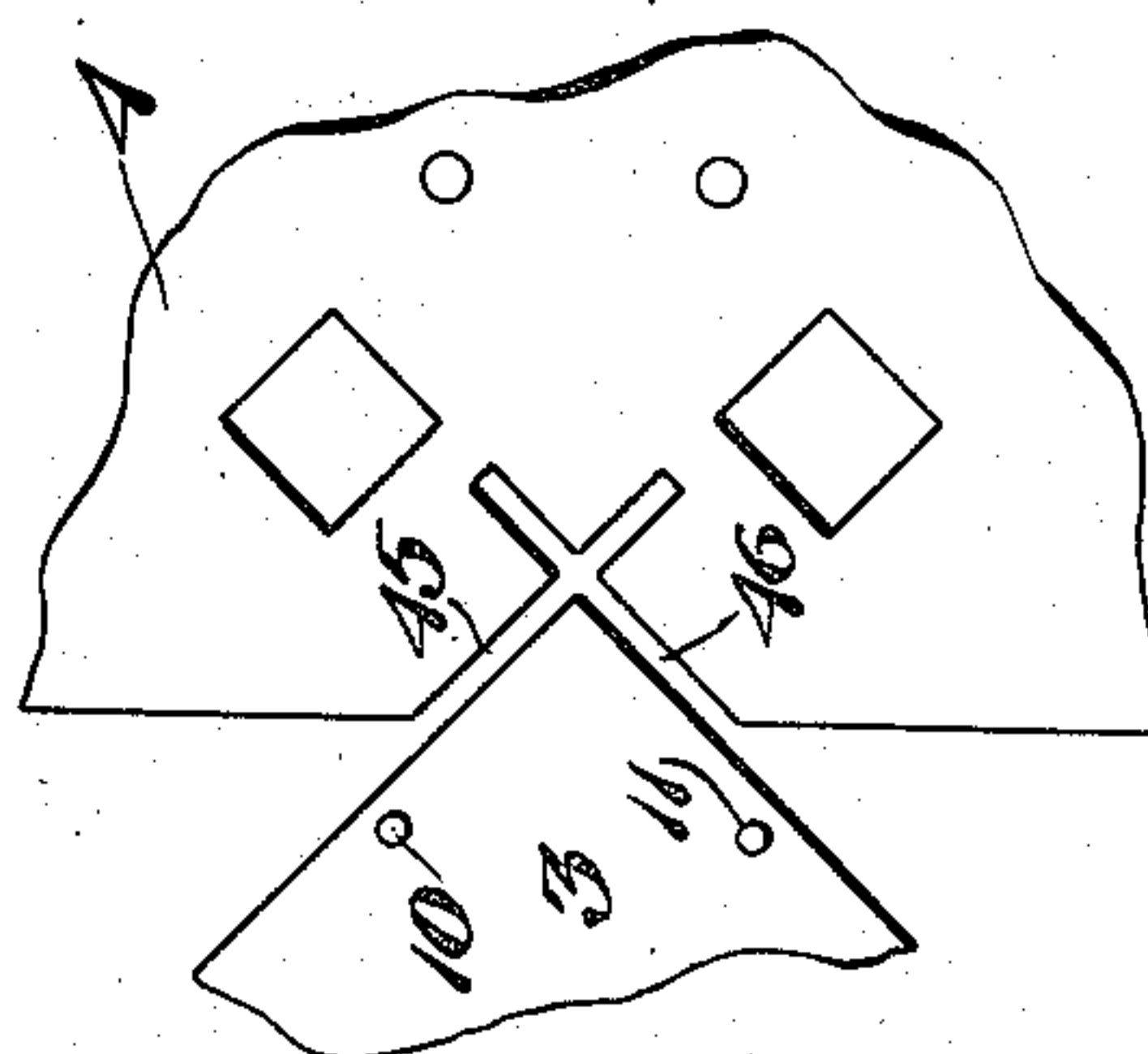


Fig. 4.

Fig. 6.



Fig. 7.

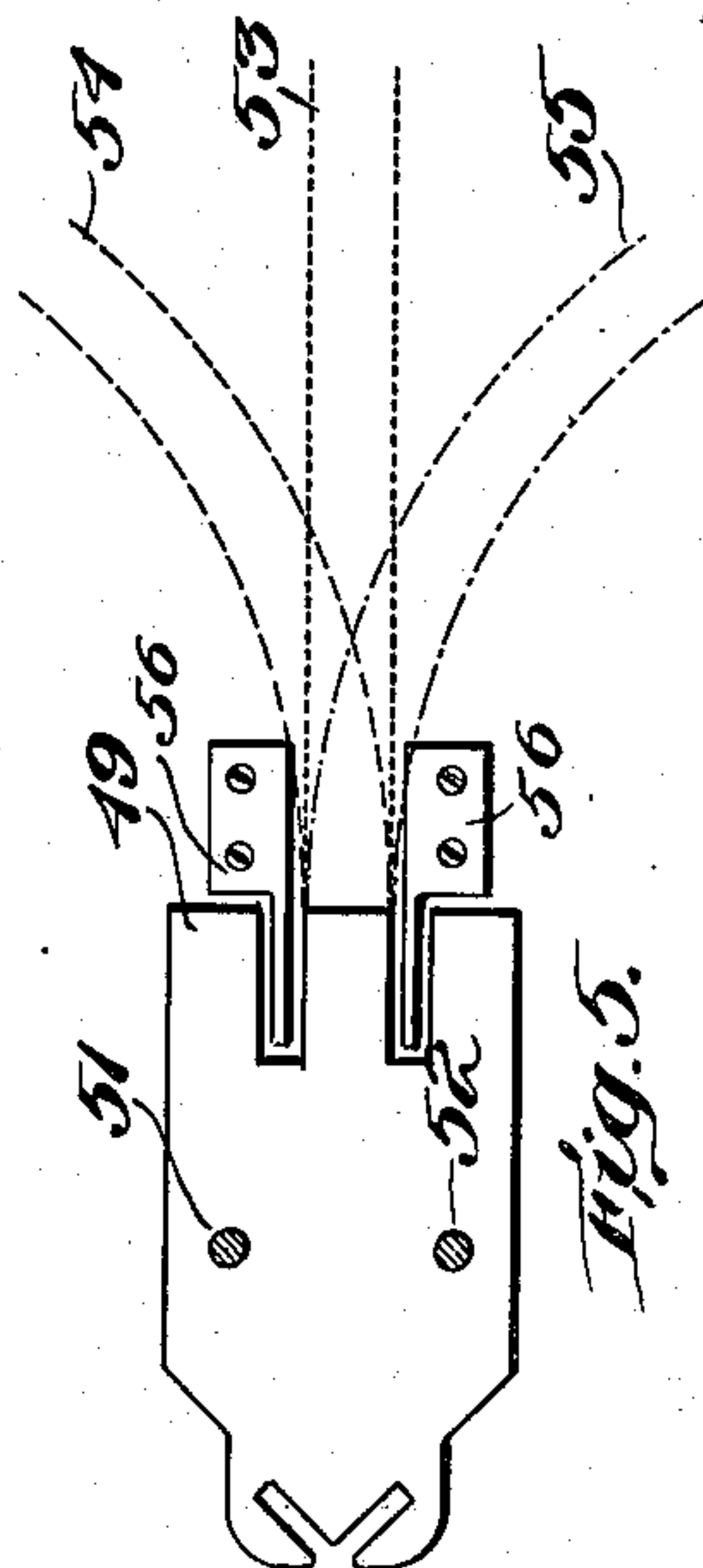


Fig. 5.

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# UNITED STATES PATENT OFFICE.

JAMES I. AYER, OF CAMBRIDGE, MASSACHUSETTS, ASSIGNOR TO SIMPLEX ELECTRIC HEATING COMPANY, OF BOSTON, MASSACHUSETTS, A CORPORATION OF MASSACHUSETTS.

## MACHINE FOR CRIMPING ELECTRIC RESISTANCE-WIRES.

No. 905,130.

Specification of Letters Patent.

Patented Dec. 1, 1908.

Application filed December 6, 1906. Serial No. 346,616.

*To all whom it may concern:*

Be it known that I, JAMES I. AYER, a citizen of the United States, residing at Cambridge, in the county of Middlesex and State of Massachusetts, have invented an Improvement in Machines for Crimping Electric Resistance-Wires, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

My invention is a machine for crimping wire for use as resistance for electric apparatus, the object thereof being to crimp the wire rapidly and with extreme accuracy, feeding the wire without kinks to the crimping mechanism and delivering the crimped product in a flat straight ribbon without tendency to curl or coil.

The use of electricity in small articles for domestic and mercantile arts has been rapidly increasing in recent years so that I find it practicable to standardize many of the various parts, and the present machine aims to effect the convenient and economical manufacture of the resistance wire for all such kinds of apparatus, whereby I am enabled to manufacture the crimped resistance wire not only with extreme speed and economy, but in such lengths of wire for a given length of crimped product as will afford the desired number of ohms per foot, for instance, of finished product, and will turn out said finished product perfectly flat and straight, so that it can be wound and handled conveniently for the market without tendency to twist and tangle as has been the case heretofore with hand-made resistance wire of this character.

The constructional details of my invention will be pointed out at length in the course of the following description, reference being had to the accompanying drawings, in which I have shown one of the various contemplated embodiments of my invention.

In the drawings, Figure 1 is a top plan view of my machine; Fig. 2 is a side elevation thereof; Fig. 3 shows in side elevation a portion of the crimping mechanism, parts being broken away and sectioned for clearness; Fig. 4 is a fragmentary view of a cooperating bed portion of the crimping mechanism; Fig. 5 is a plan view of a portion of the tension device; Figs. 6 and 7 show the

finished product; and Fig. 8 is a plan view, partly diagrammatic, illustrating the manner of forming the crimps.

On a suitable frame 1 supported by posts 2 I mount bed plates 3, 4 for receiving the wire *w* from any suitable source as a spool 5, said wire being retained on the plate 3 by pins 6, 7, and guided beneath a tension spring or plate 8 provided with a friction pad 9 on its under surface to the crimping pins 10, 11 of the crimping mechanism and preferably beneath an overhanging retainer 12. Beneath the bed plate opposite slides or reciprocating carriers 13, 14 are mounted to reciprocate alternately in an oblique line toward the crimping region, being guided and actuated by any suitable means, guides 15, 16 being shown for the purpose, and the actuating means being shown as comprising eccentric path cams 17, 18 driven by gears 19, 20 meshing with an intermediate drive gear 21 whose shaft 22 is provided with a beveled gear 23 in mesh with a gear 24 on a power shaft 25.

It will be understood that the various details which I have herein preferably shown are subordinate to the main features of my invention as pointed out originally.

The respective slides carry similar mechanism for engaging the wire and pushing it laterally to make a loop, each comprising a pivoted pin-carrier 26, a wire-engaging pin 27, normally held in upward position by a spring 28, which holds the pin carrier in fixed upward position against a stop 29 on the slide carrier 13, or 14, as the case may be. On its outer side each slide carrier has a beveled projection 30 and notch 31 to engage the bevel 32 of a lifter 33 shown as pivoted at 34 and prevented from swinging to the left, Fig. 3, by a stop 35, but free to swing to the right against a spring 36. As already stated, there are two sets of these mechanisms, the lifters being secured to plungers 37, 38, normally held downward by springs 39 bearing at their upper ends against a transverse plate 40 and at their lower ends against a collar 41 on the reduced bottom ends 42 of the plunger. The plungers carry at their upper ends holding pins 43 on arms 44 secured rigidly to said plungers, one of said arms being arched as clearly shown in Fig. 3 so as to permit the requisite up-and-down movement of said two plungers and arms



independently without interfering with each other. The mechanisms carried by the plungers are arranged to face each other so as to cooperate with the alternately reciprocating slide carriers 13, 14, said slide carriers being so arranged that the pins 27 thereof normally project above the bed plates 3, 4. To permit said pins to project thus in their reciprocation I slot the bed plates as indicated at 45, 46, see Figs. 1 and 4. Thus when, for instance, the pin 27 of the slide carrier 14 moves forward, it engages the wire *w*, then in the position shown in dotted lines at 47 Fig. 8, and pushes it forward to the position shown in full lines. As it is moving the same forward, however, its incline 30 engages the lifter 33 of the plunger 38 and thereby raises the holding pin 43 thereof out of the path of said forwardly moving crimping pin 27, thereby permitting the wire loop 48 which had been held by said pin 43 as shown in dotted lines to be moved out of the way to its full line position Fig. 8 by the forwardly moving crimping pin 27, which continues to move forward until it has passed beyond the normal position of the holding pin 43, thereby carrying the wire *w* as clearly shown in Fig. 8. Just at this moment the notch 31 of the slide carrier 14 has passed beyond the lifter 33 so that the plunger 38 is pulled down by its spring 39 thereby restoring the pin 43 to its original lowered position in the path of the wire. Thereupon the slide carrier 14 starts to move backwards and immediately the pin carrier 26 is compelled to swing downwardly against its spring 28 because of the engagement of its pin 27 with the lowered pin 43, the result being that the wire *w* is left in engagement with the pin 43 while the pin 27 which carried it there is permitted to retreat. Just as said pin 27 and the slide carrier 14 have retreated out of the path of the slot 45, the opposite slide carrier 13 moves forward and repeats exactly the same operation which we have just explained excepting that it shifts the wire *w* from the full line position Fig. 8 to the dotted line position, and the holding pin of the plunger 37 and the crimping pin of the slide carrier 13 perform the same crimping and holding operation which we have just explained in connection with the formation of the opposite loop. In this manner the loops are successively and alternately formed and released, being pushed one by one forwardly beneath a tension plate 49, which constitutes a further very important feature of my invention. This plate is held yieldingly with great delicacy by little springs 50 surrounding thumb-screws or tension pins 51, 52, by means of which the frictional pressure of the plate 49 on the loops formed by the crimping mechanism may be adjusted with extreme delicacy. I have found that by this

means I may not only accurately guide the crimped wire in a perfectly straight line and maintain it flat and perfect in shape and even in its loop formation, but I can graduate the spacing of the loops precisely as required, so that, for example, the loops may be close together, as shown in Fig. 6, or spaced farther apart as shown in Fig. 7. The delicate adjustment provided enables me to bring the ribbonlike loops into accurate central or straight position as shown at 53, a very slight excess of pressure of the tension pin 51 causing the ribbon to curve as indicated at 54 and a very slight excess of pressure of the tension pin 52 causing the ribbon to curve as indicated at 55. Preferably guides 56 are also provided to retain the ribbon.

It will readily be understood by those practical in this art that it is of decided value and importance to be able to deliver the crimped wire perfectly straight so that it may be wound and handled without inconvenience and with a minimum liability of becoming tangled. It is also of particular advantage to be able to deliver the crimps spaced apart at any distance desired, as thereby I vary the length of wire in a given length of loops and hence for instance I can manufacture the ribbon accurately and rapidly with any number of loops from say 60 loops per foot to 160 loops per foot finished product. For instance a heater to be used with 100 volt current requires 50 ohms whereas the same heater for a 110-volt current requires 55 ohms, and yet in both instances the length of resistance ribbon must be the same. My machine turns out the ribbon with exactly the number of loops to provide the 50 ohms or the 55 ohms as desired.

I have already set forth to quite an extent the operation of the machine, and will therefore simply summarize the same at this point briefly as follows: As the power shaft rotates its beveled gear 24 engages the gear 23 and through the intermediate pinion 21 simultaneously rotates the cams 17, 18, whose path cams, being oppositely set, cause the slide carriers 13, 14 to reciprocate alternately forward, the slide carrier 13 being shown in Fig. 1 as at the end of its forward movement and the slide carrier 14 at the end of its backward movement ready to reverse their relative position. In their forward movements said slide carriers by reason of the engagement of their pins 27 with the wire *w* pull the latter forward from the spool or other source of supply 5, said wire being maintained straight and without any possibility of kinking, it being pulled over the edge of the plate 3 and beneath the spring pad 9. The wire shifts bodily back and forth between the pins 10, 11 as it is pushed toward one side and then toward



the other side by being successively engaged by the alternately moving pins 27. Each pin as it moves forward carries the wire for a new loop, its carrier meanwhile raising the holding pin of the previously formed loop at that side of the ribbon out of the path of the crimping pin, and as the latter carries the wire forward far enough to form a loop, the holding pin is automatically dropped into holding position, whereupon the crimping pin automatically retreats, leaving the wire in engagement with the holding pin. The wire is thus held immovably while the opposite slide carrier and its crimping pin move forward and repeat the operation in connection with the opposite holding pin, thereby forming a loop at the opposite side of the ribbon. Each time a loop is about to be formed the preceding loop at the same side is automatically pushed forward and this forward pushing of the loops in rapid succession alternately at one side and the other coöperates with the tension plate 49 to form the ribbon with the desired closeness of loops. It will be observed that I form the loops with round ends, this form of crimping being preferable as it is desirable to avoid all sharp angles in electric conductors.

In many respects I regard my invention as broadly novel, and therefore I wish it understood that I am not restricted to the constructional details of the machine. In fact I have already pointed out that a wide variety of embodiments of the machine are within my contemplation for carrying out the broad features of crimping the wire and varying the length of the wire for a given length of ribbon and for varying the number of loops to the foot and for maintaining the wire without kinks and for delivering the ribbon in a straight, flat form, etc.

Having described my invention, what I claim as new and desire to secure by Letters Patent is,

1. A wire crimping machine, comprising means for delivering the straight wire to be crimped, crimping means for crimping said straight wire alternately into oppositely extending loops, and means for varying the length of wire in a given length of loops.

2. A wire crimping machine, comprising means for delivering the straight wire to be crimped, crimping means for crimping said straight wire alternately into oppositely extending loops, and means for varying the number of loops in a given length of loops.

3. A wire crimping machine, comprising wire delivering mechanism, including means to maintain the wire straight to the crimping point, longitudinally reciprocating means to crimp said straight wire laterally in one direction, coöperating longitudinally reciprocating means movable angularly to said other

crimping means to crimp the wire laterally in an opposite direction, and operating mechanism for alternately reciprocating said two crimping means across each other's path.

4. A wire crimping machine, comprising two loop forming mechanisms constructed and arranged to lay the loops alternately in opposite directions and including opposite reciprocating members, opposite pins for holding said loops, and means actuated by said reciprocating members for automatically releasing said pins from said loops, as the wire is crimped, to permit the forward feeding of the crimped wire.

5. A wire crimping machine, comprising two loop forming devices constructed and arranged to lay the loops alternately in opposite directions, opposite pins for holding said loops, actuating means for said two devices, and means actuated by said loop forming devices, for removing one of said pins from its loop as the next similarly extending loop is being formed.

6. A wire crimping machine, comprising two loop forming devices constructed and arranged to lay the loops alternately in opposite directions, actuating means for said two devices, opposite pins for holding said loops, means actuated by said loop forming devices, for removing one of said pins from its loop as the next similarly extending loop is being formed, and then permitting said pin to engage said next partially formed loop.

7. A wire crimping machine, comprising two loop forming devices constructed and arranged to lay the loops alternately in opposite directions, opposite pins for holding said loops, automatically yielding means permitting the disengagement of said pins from said loops, and means actuated by said loop forming devices, for removing one of said pins from its loop as the next similarly extending loop is being formed.

8. A wire crimping machine, comprising two loop forming devices constructed and arranged to lay the loops alternately in opposite directions, opposite pins for holding said loops, automatically yielding means permitting the disengagement of said pins from said loops, means actuated by said loop forming devices, for removing one of said pins from its loop as the next similarly extending loop is being formed, and then permitting said pin to engage said next partially formed loop.

9. A wire crimping machine, comprising wire delivering mechanism and wire crimping mechanism including a holding part and a wire-bending part, said holding part having a pin and said wire-bending part having a reciprocating member provided at its wire engaging end with a tripping pin constructed and arranged to move said holding pin



from the path of the wire and then permit the holding pin to drop into holding position behind the wire.

10. A wire crimping machine, comprising  
5 opposite vertically movable members, a holding pin actuated by each member, opposite horizontally movable members, a crimping pin actuated by each horizontally movable member, means operated by the horizontal  
10 movement of said members for moving said vertically movable members, and operating means for the aforesaid parts constructed and arranged to operate said horizontally  
15 movable members alternately to move the crimping pin to crimp the wire and the holding pin to engage the wire when crimped.

11. In a wire crimping machine, a vertically yielding loop holding means, a transversely movable member, a crimping device  
20 yieldingly carried by said member, and

means for tripping said crimping device when it has crimped the wire and moved the same into position to be held by said holding means.

12. In a wire crimping machine, wire 25 crimping mechanism for bending a resistance wire into operative resistance form, delivery means therefor, including means for maintaining the formed product perfectly  
30 straight, and pressure varying means for controlling the degree of compactness of the formed product.

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

JAS. I. AYER.

Witnesses:

ELIZABETH M. CONLIN,  
DORA A. PROCTOR.