

No. 756,823.

PATENTED APR. 12, 1904.

C. E. BOOTH.  
WIRE SPRING MACHINE.  
APPLICATION FILED AUG. 13, 1903.

NO MODEL.

5 SHEETS—SHEET 1.

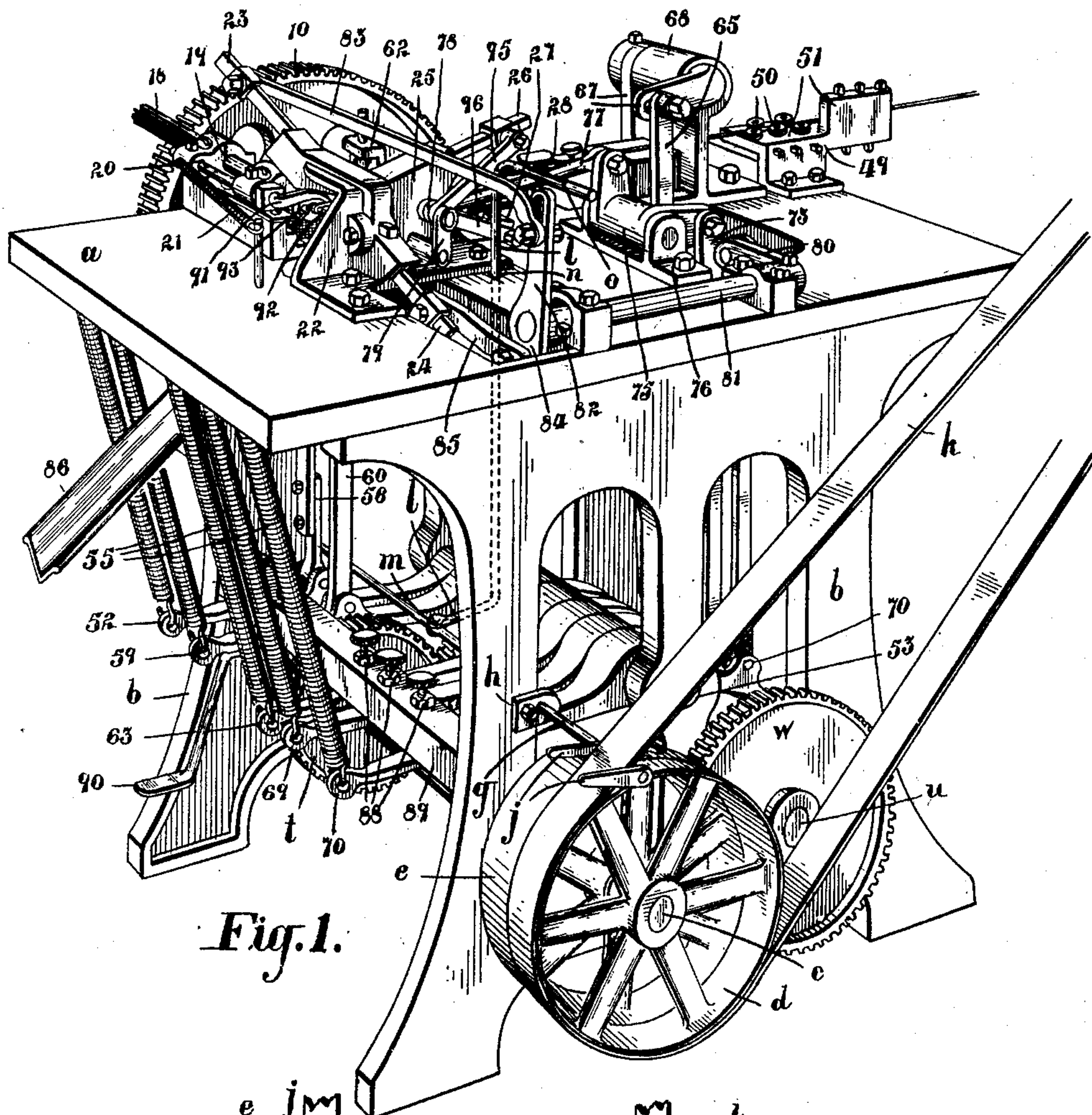


Fig. 1.

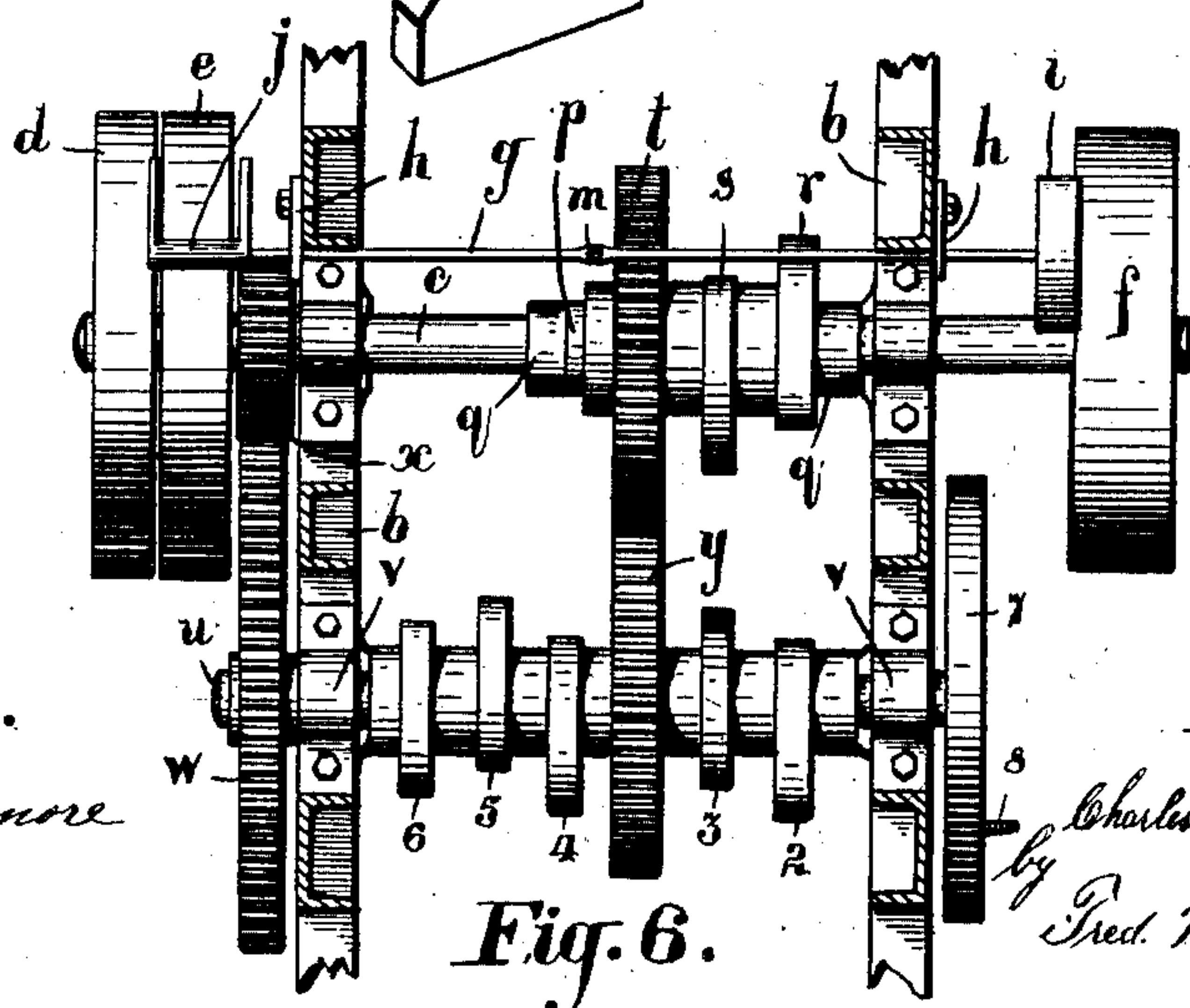


Fig. 6.

Witnesses.

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R. J. Trotter

Inventor.

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by Fred. A. Tetherstonhaugh  
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5 SHEETS—SHEET 2.

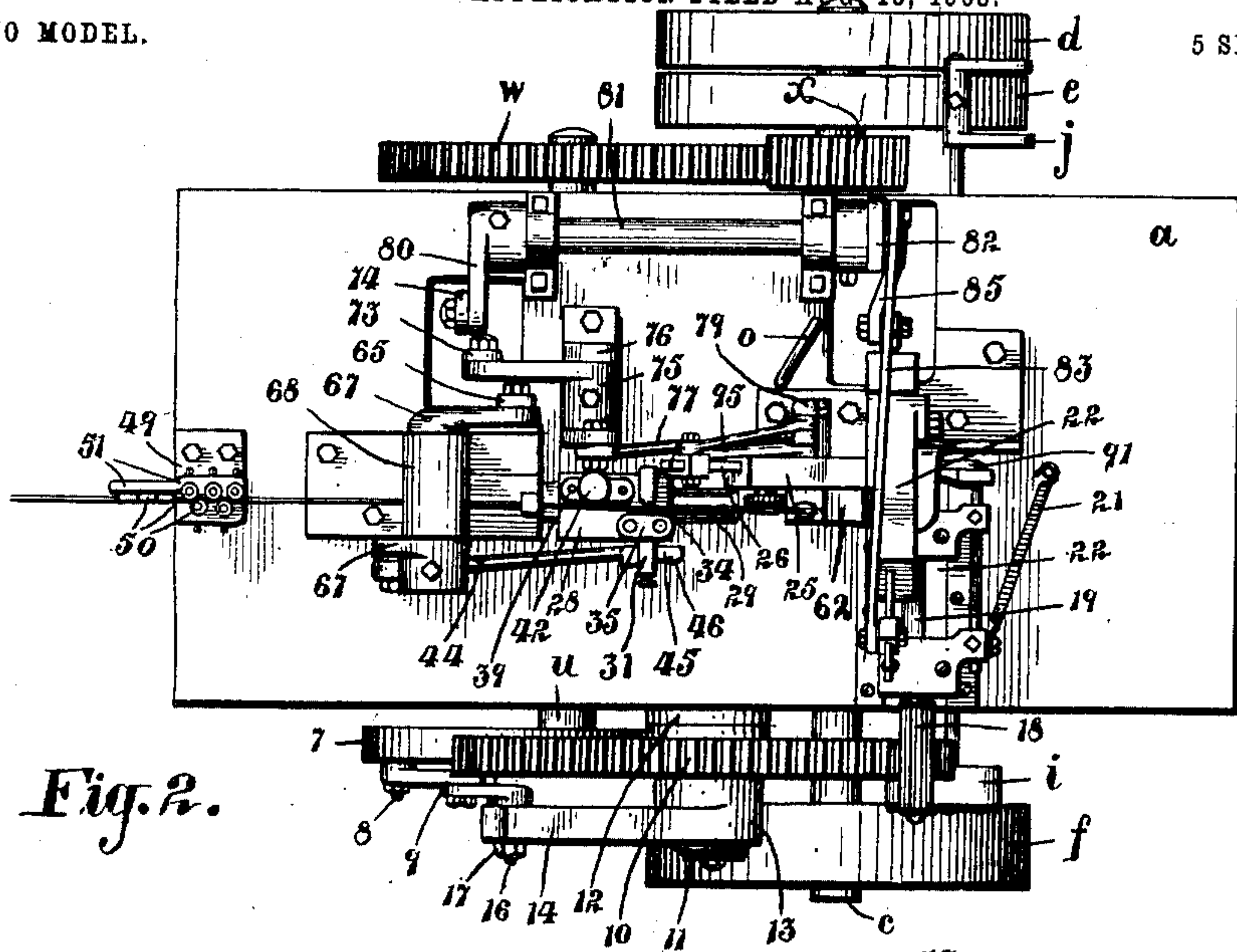


Fig. 2.

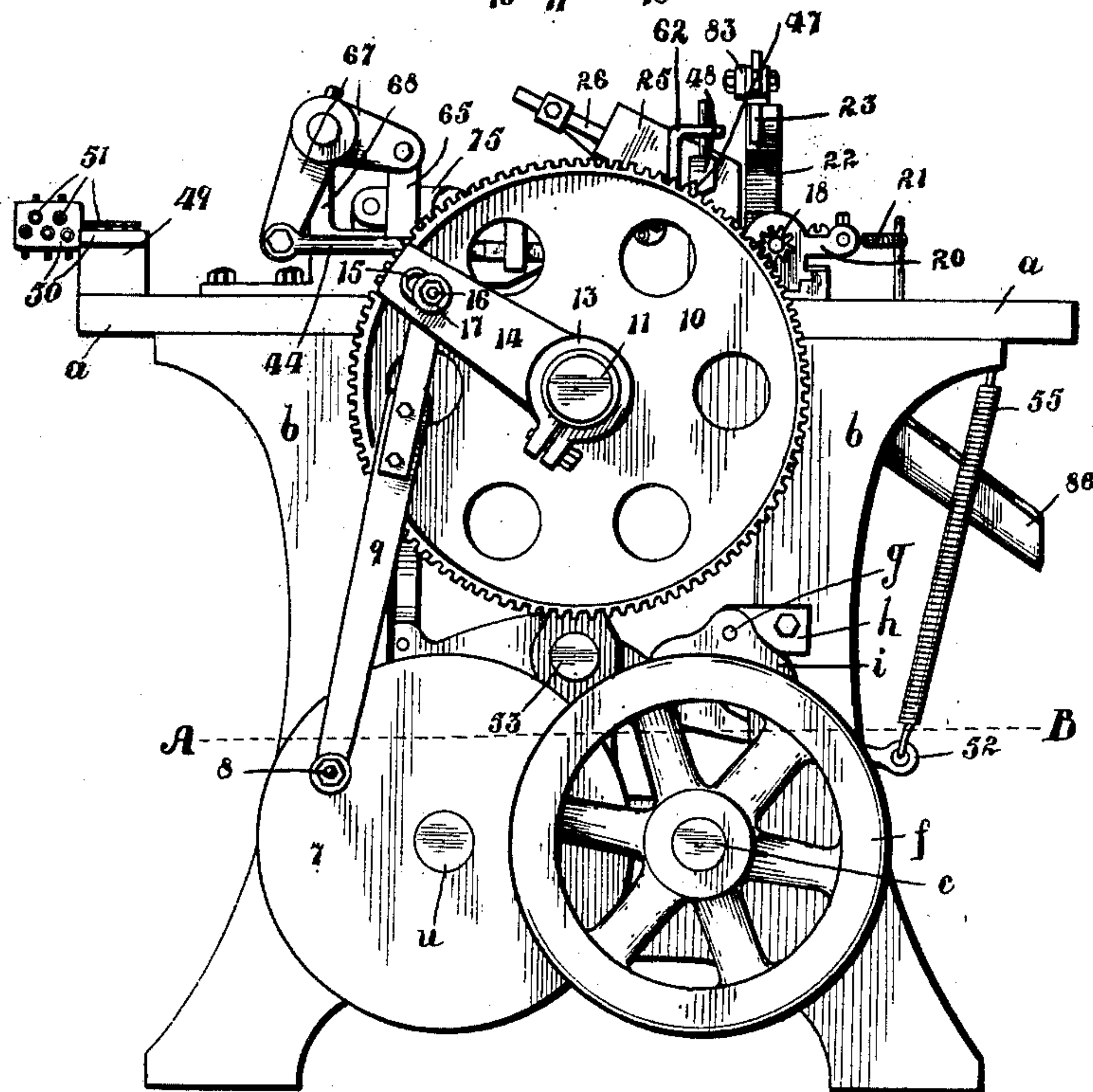


Fig. 3.

Witnesses.

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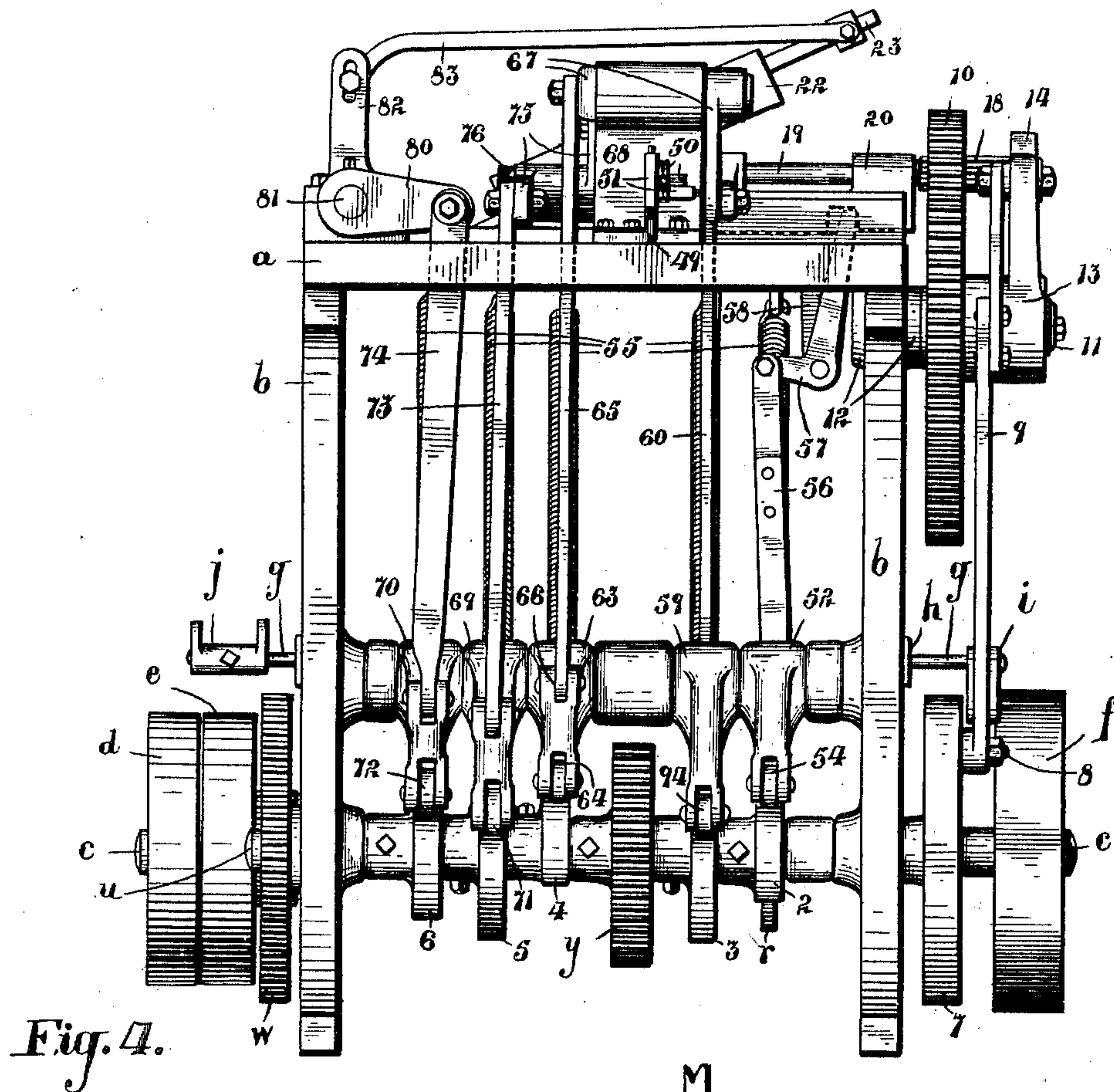


Fig. 4.

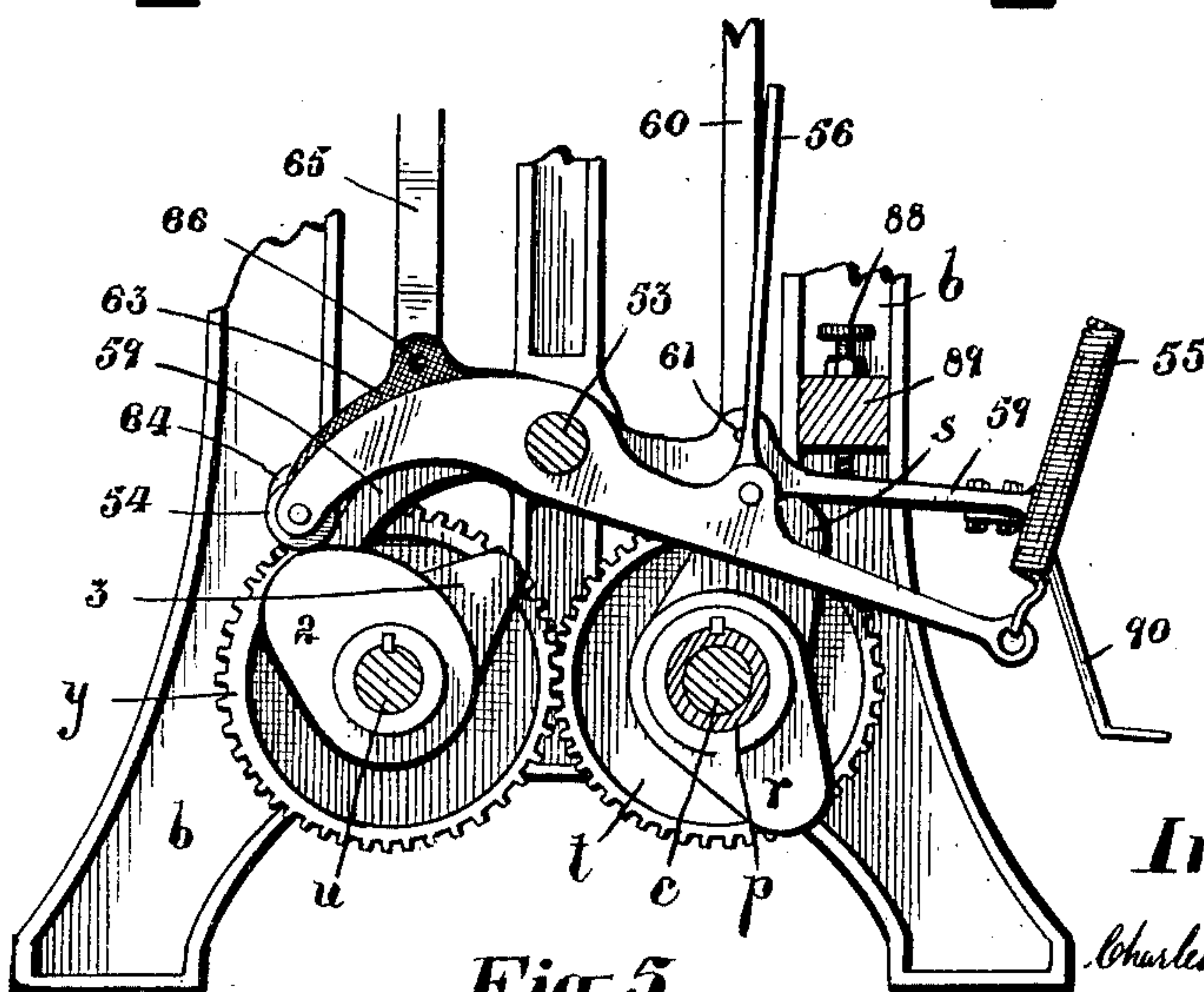


Fig. 5.

Witnesses.

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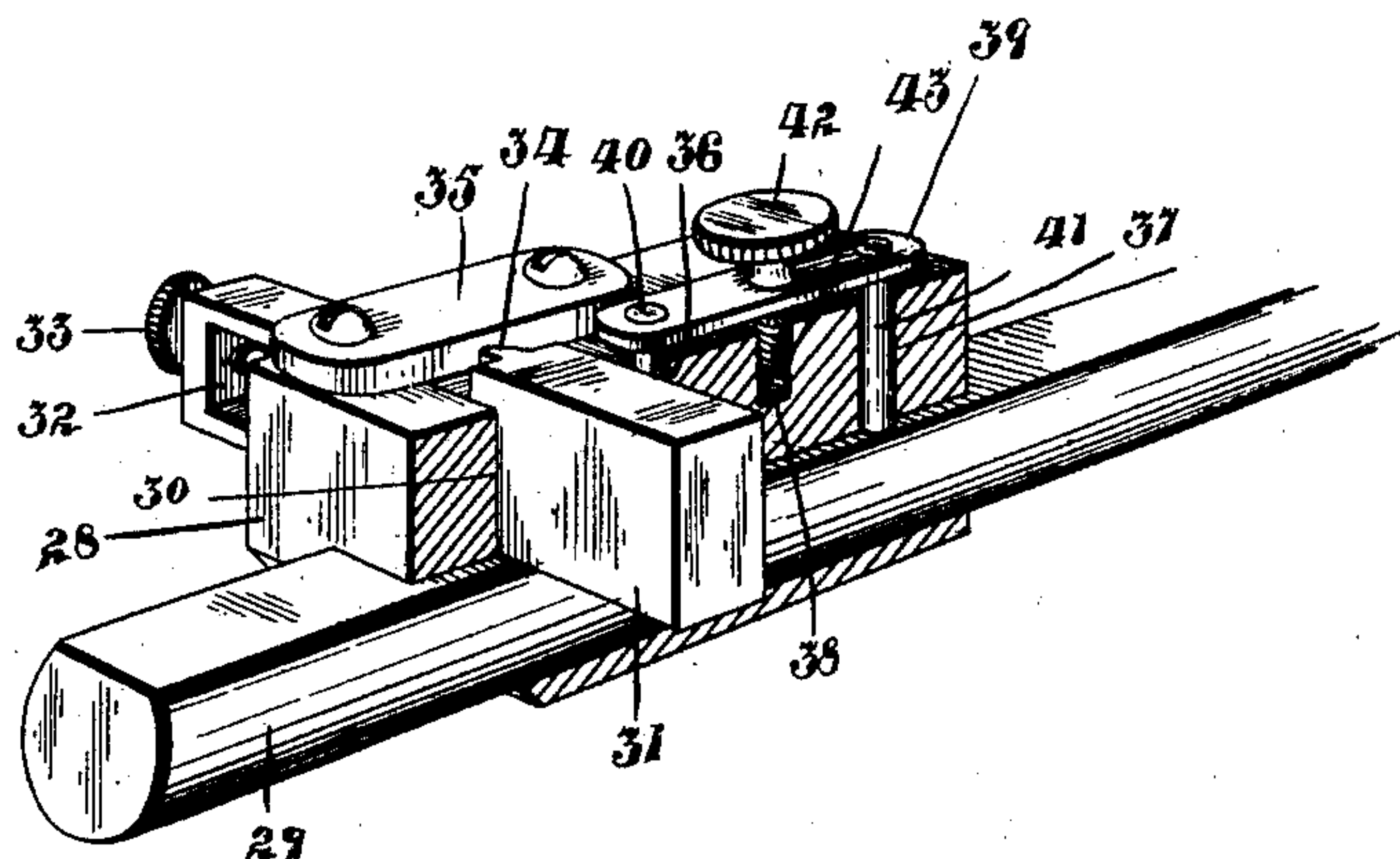
C. E. BOOTH.

## WIRE SPRING MACHINE.

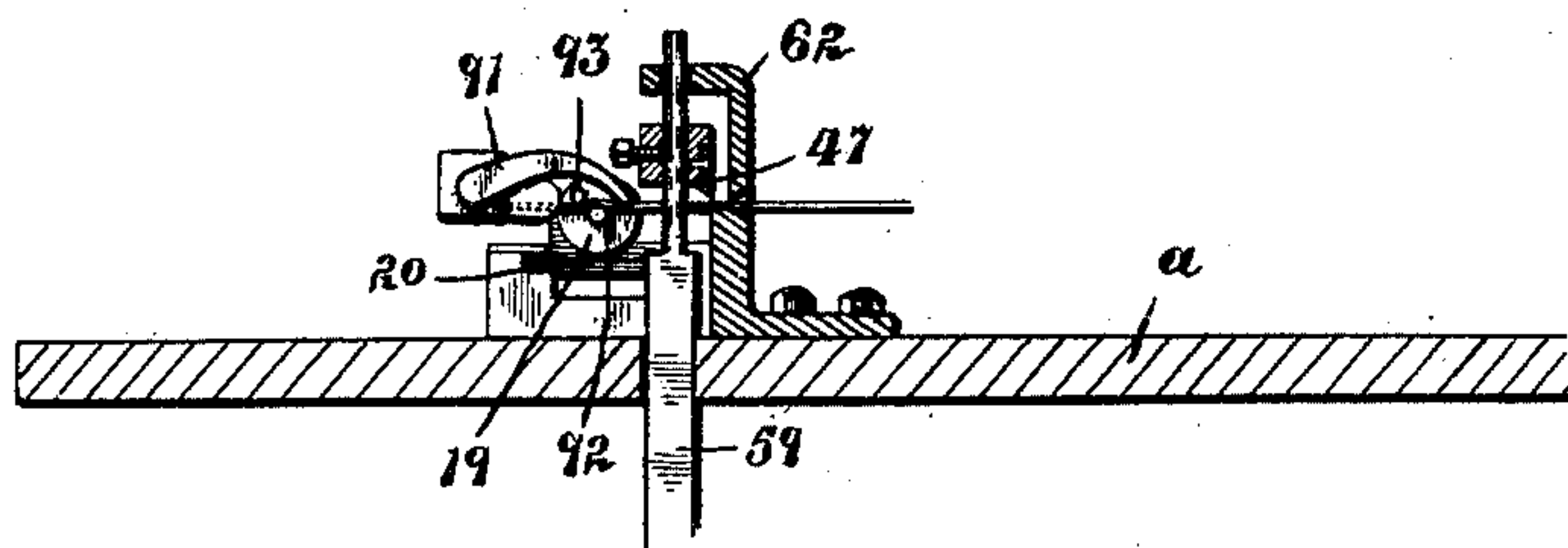
APPLICATION FILED AUG. 13, 1903.

NO MODEL.

5 SHEETS—SHEET 4.



*Fig. 7.*



*Fig. 8.*

**Witnesses**

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5 SHEETS—SHEET 5.

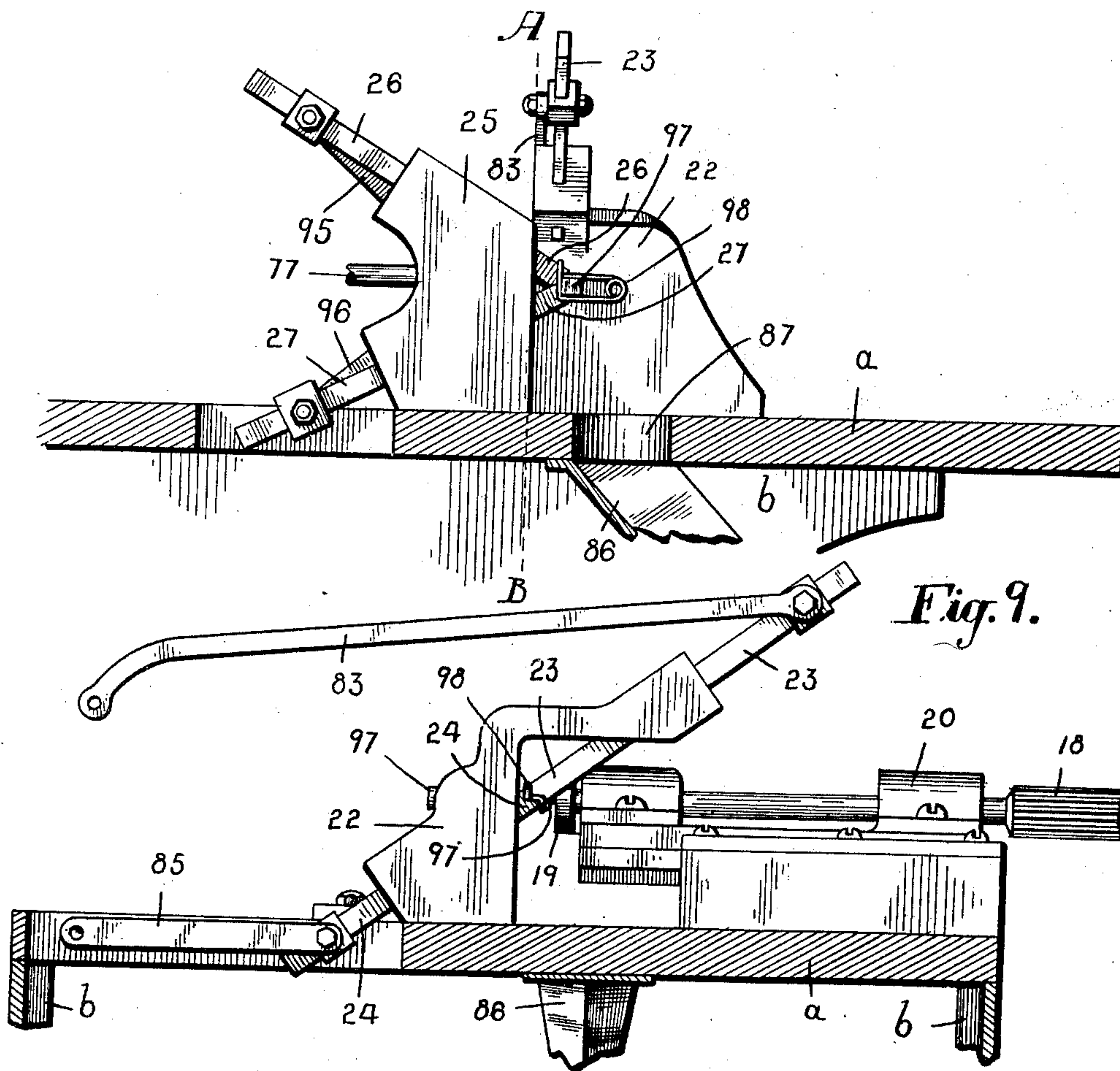


Fig. 9.

Fig. 10.

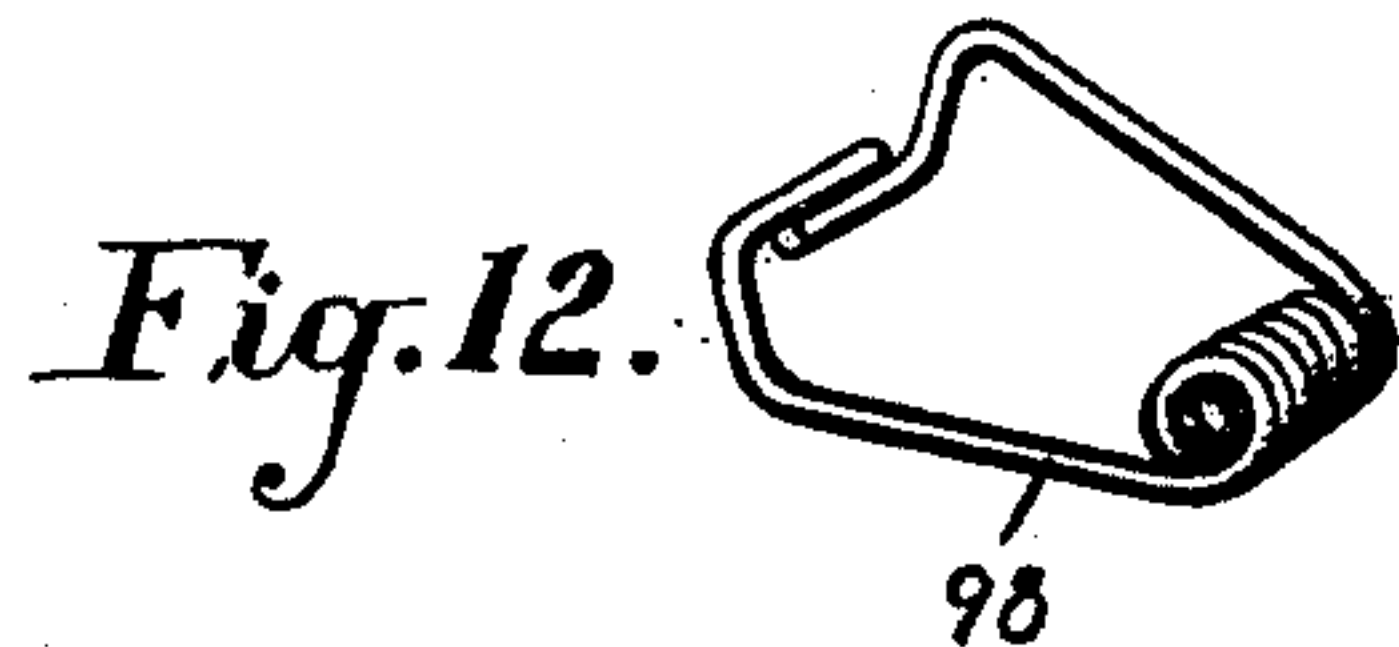


Fig. 12.

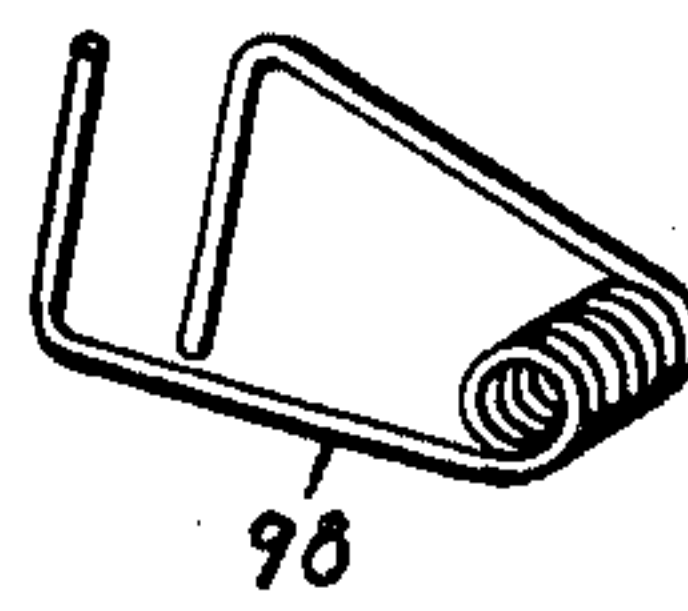


Fig. 11.

Witnesses.

*John Blackmore*  
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# UNITED STATES PATENT OFFICE.

CHARLES EDWIN BOOTH, OF MONTPELIER, VERMONT, ASSIGNOR TO  
UNITED STATES CLOTHES PIN COMPANY, OF MONTPELIER, VER-  
MONT, A CORPORATION OF VERMONT.

## WIRE-SPRING MACHINE.

SPECIFICATION forming part of Letters Patent No. 756,823, dated April 12, 1904.

Application filed August 13, 1903. Serial No. 169,402. (No model.)

*To all whom it may concern:*

Be it known that I, CHARLES EDWIN BOOTH, a citizen of the United States of America, residing at Montpelier, in the State of Vermont, have invented certain new and useful Improvements in Wire-Spring Machines, of which the following is a specification.

My invention relates to improvements in wire-spring machines; and the object of the invention is to devise an arrangement of parts in a machine of this class which shall be automatic throughout in its operation and whereby the springs made shall be uniform; and it consists, essentially, of a feed-carriage on the table of the machine automatically operated, a plurality of cams mounted on rotating shafts beneath the said table, a plurality of levers having suitable connection to the said cams at their lower ends and at their upper ends to the various operating mechanism on the upper surface of the table, brake mechanism, and means for operating the spindle, the various parts being constructed and arranged in detail, as hereinafter more particularly described.

Figure 1 is a perspective view of my machine. Fig. 2 is a plan view looking from above. Fig. 3 is a side elevation showing the means for operating the coiling-spindle. Fig. 4 is an end elevation of the machine, showing the operating-levers and their connections to the cams. Fig. 5 is a detail showing the operating-cams for insuring the return of the levers to their normal positions. Fig. 6 is a plan view of the shafting through A B in Fig. 3. Fig. 7 is an enlarged sectional perspective view of the feed-carriage. Fig. 8 is an enlarged sectional detail of the shearing-knife, showing its connection to the operating-lever. Fig. 9 is a longitudinal sectional view through the table, showing the operation of the first acting dies. Fig. 10 is a cross-sectional view through the table at A B in Fig. 9, showing the operation of the finishing-dies. Fig. 11 is a detail view of the article immediately af-

ter the action of the first dies. Fig. 12 is a detail view of the finished article.

Like characters of reference indicate corresponding parts in each figure.

*a* is the table of the machine, supported on the standards *b*. 50

*c* is a shaft journaled in suitable bearings in the standards *b* and having at one end the fixed and idle pulleys *d* and *e* outside one of the said standards and at the other end the fly-wheel *f*. 55

*g* is a rod sliding in suitable brackets *h* from the standards *b* and extending beyond the latter at each side.

*i* is a brake-shoe on one end of the rod *g* and designed to break the speed of the fly-wheel *f*. 60

*j* represents fingers fixedly attached and extending laterally from the rod at its other end and designed to control the position of the driving-belt *k*. 65

*l* is a rod pivotally attached to the rod *g* at *m* and projecting laterally therefrom and elbowed and extending upwardly through the table *a* at *n* and having at its top end a lever *o*, by means of which the said rod *l* may be turned to change the position of the rod *g*, and consequently the position of the belt-shifting fingers *j* and the brake-shoe *i*. In this manner the belt may be shifted to the idle pulley and the brake applied to the driving-wheel simultaneously. 75

*p* is a shaft encircling the driven shaft *c* for a portion of the length of the latter and turning thereon.

*q* represents collars retaining the encircling shaft *p* in one position longitudinally on the shaft *c*. 80

*r* and *s* are cams fixedly secured on the shaft *p* and operating in turn, as more fully described hereinafter. 85

*t* is a gear-wheel turning with the shaft *p*.

*u* is a shaft journaled in bearings *v* in the standards in a parallel plane with the shaft *c*.



*w* is a gear-wheel fixedly secured on the shaft *u* outside the standards and meshing with the gear-wheel *x*, fixedly secured on the driven shaft *c*. This gear causes the shaft *u* to rotate at the required speed.

*y* is a gear-wheel fixedly secured on the shaft *u* and meshing with the gear-wheel *t*, causing the shaft *p* to rotate at an even speed with the shaft *u*.

2, 3, 4, 5, and 6 are cams fixedly secured to the shaft *u* and operating certain parts of the mechanism, which will be hereinafter more fully described.

7 is a revolving disk fixedly secured at the other end of the shaft *u* outside the standards.

8 is a pin projecting through the face of the disk 7.

9 is a connecting-rod pivotally held on the pin 8 at one end.

10 is a gear-wheel fixedly attached to the shaft 11, which is suitably journaled in a bearing 12, projecting from the standards of the machine immediately beneath the table *a*.

13 is a collar encircling the shaft 11 and securely bolted thereto and having the projecting arm 14, with the slot 15 at the outer end thereof.

The connecting-rod 9 has a pin 16 at its outer end which extends through the slot 15 in the arm 14, being adjustably secured therein by the nut 17.

It will be seen that any movement of the arm 14, extending from the collar 13, which is securely bolted to the shaft 11, will cause the said shaft 11 to turn, and consequently the gear 10.

The revolving of the disk 7 imparts to the gear *y* a reciprocatory motion through the connecting-rod 9, as at each full revolution the gear will travel a certain distance and be returned.

18 is a pinion meshing with the gear 10 and fixedly secured on the coiling-spindle shaft 19, located in the carriage 20. The pinion 18 has a wider tooth-face than the gear 10 in order that the carriage 20 may be permitted a limited movement.

The carriage 20 is steadied by the spring 21, but is made to travel reciprocally on the table *a*, as will be explained in the following.

25 is a die-case, and 26 and 27 are dies sliding therein and meeting at an angle of about thirty to forty degrees over the die-block 97 to bend the projecting ends of the wires of the spring 98 after shearing and directly following the coiling of the spring before the same leaves the spindle, the spring 98 being left in the shape as shown in Fig. 9.

22 is a die-case, and 23 and 24 are dies coming together from opposite directions at the edge of the die-block 97 and catching the previously-bent ends of the spring 98 and folding them inwardly along the edge of the said die-block 97. The die-block 97 is adjustably ar-

ranged from the die-case 22 and projects therefrom immediately at the end of the travel of the carriage 20 opposite the coiling-spindle when the carriage is at its extreme inward position.

28 is a feed-carriage traveling on the bar 29, which is flattened on its upper surface.

The feed-carriage 28 has a lateral slot 30 over the bar 29. The grip-bar 31 is inserted in said slot and is provided with a slot 32 through one end, having a set-screw 33 through the end of the bar and leading into the said slot. At the other end the grip-bar has a raised portion with a tip 34, pointed inwardly and designed to abut at intervals a cross-bar 35, bridging the slot 30.

36 and 37 are orifices through the carriage 28 to the flat surface of the bar 29, and 38 is a threaded hole centrally situated between the said orifices.

39 is a plate having the pins 40 and 41 securely fixed thereto at each end and extending downwardly.

42 is a thumb-screw loosely turning in the center of the plate 39 and having a threaded pintle 43, designed to enter the correspondingly-threaded hole 38. It will be seen by this arrangement that the pins 40 and 41 on being inserted in the orifices 36 and 37 can be forced downwardly by means of the thumb-screw 42 to produce the necessary amount of friction for the carriage 28 on the flat surface of the bar 29.

44 is a rod having the wedge-shaped end 45, provided with a hook 46, inserted through the slot 32 in the bar 31 and designed to affect the position of the said bar through the wedge-shaped end 45. The friction produced by the pressure of the pins 40 and 41 on the flat upper surface of the bar 29 will insure the wedge-shaped end 45 closing the pointed tip 34 on the wire against the cross-bar 35 previous to the carriage starting. In the event of the wires being different sizes the set-screw 33 will regulate the requisite size of the slot for the operation of the wedge-shaped end 45.

47 is a shearing-knife arranged in the block 48 and is of known construction in this class of machine.

49 is a wire-straightener having the small grooved wheels 50 set in position on the plates 51, so that the wire on passing through will be straightened out to pass into the carriage 28.

52 is a rocker-arm rocking on the shaft 53, having a roller 54 at one end thereof and one of the coil-springs 55 at the other end, the latter being attached to the under surface of the table *a*.

56 is a lever pivotally attached at its lower end to the rocker-arm 52 and at its upper end pivotally attached to the bell-crank 57, which is pivoted to a bracket 58 from the table *a*. The other arm of the bell-crank 57 projects through the table *a* beneath the carriage 20



into a recess in the under side of the said carriage, so that any movement of the said bell-crank imparted through the movement of the lever will affect the position of the said carriage, and the movement of the said lever 56 will be controlled by the cam 2—that is to say, at each revolution of the shaft carrying the cam 2 the lever 56, attached to the rocker-arm 52, will be pulled downwardly, thus turning the bell-crank on its pivot and through the upper arm of the said crank move the carriage inwardly. The cam *r* on the shaft *p* tends to bring back the rocker-arm 52 to its normal position, to which it is held by one of the springs until again affected in the revolutions of the cam 2.

59 is a rocker-arm arranged similar to the rocker-arm 52, having a roller 94 at one end and spring-held by one of the springs 55 at the other end. 60 is a lever pivotally attached to said rocker-arm at 61 and extending upwardly through the table *a* and operated by the cam 3 and returned to its normal position by the cam *s*, the operation of the said rocker-arm and lever being precisely similar to the aforesaid, with the exception that the lever extends directly through the table, having its upper end projecting through the bracket 62 and the shearing-knife 47 adjustably arranged on said upper end, and at each revolution of the cam 3 draws down the knife 47 to cut the wire. One of the coil-springs 55 is arranged in a similar manner in regard to the rocker-arm 59 as with the rocker-arm 52.

63 is a rocker-arm having the roller 64 at one end thereof and one of the coil-springs 55 at the other end. This rocker-arm is engaged in a similar fashion to the said rocker-arm by the cam 4 and raises the lever 65, pivotally attached at 66 in proximity to the roller at its lower end and at its upper end to the rocker-arm 67 above the table *a*. The said rocker-arm 67 on being turned in its bearings 68 moves the rod 44 to operate the feed-carriage 28, and consequently the grip-bar 31, through the wedge-shaped end 45, inserted in the slot 32.

69 and 70 are rocker-arms having the rollers 71 and 72 and operated by the cams 5 and 6, respectively, to raise the levers 73 and 74. The rocker-arms 69 and 70 are arranged similar to those already described.

The lever 73 turns the rocker-arm 75 in its bearings 76, projecting above the table *a*.

77 is a rod extending from the rocker-arm 75 and connected to the toggle-joint 78. The toggles 95 and 96 are connected at their outer ends to the dies 26 and 27, and it will be seen that any movement of the rod 77 through the rocker-arm 75 will affect the position of the toggles, and consequently the position of the dies sliding in the die-case 25.

The toggle-joint 78 is pivotally supported from the die-case by the link 79.

The lever 73 extends up through the table 65 and is pivotally connected to an arm 80, ex-

tending from the shaft 81. The arm 80 extends from the shaft substantially in alignment with the table *a*.

82 is an arm extending upwardly from the shaft 81 and having a slot in its upper end in which is inserted a bolt designed to adjustably hold the rod 83 in the said slot. The other end of the rod 83 is pivotally attached to a die 23, sliding in the die-case 22.

84 is a downward projection below the shaft 81 from the arm 82.

85 is a connecting-rod pivotally attached to the downward projection 84 and to the die 24, sliding in the die-case 22.

It will thus be seen that on the upward movement of the lever 73 the upwardly-extending arm 82 is thrown over to pull on the rod 83, and consequently the die 23. Simultaneously the downward projection 84 is thrown in the reversed direction, and consequently pushes the die 23 upwardly to meet the die 24 coming toward it. The dies in both die-cases come together over a suitable die-block.

86 is a chute from the orifice 87 in the table, into which the springs after completion drop.

88 represents adjusting-screws through the cross-bar 89, designed to regulate the distance of travel of the five levers operated by the rocker-arms and cams.

90 is a pedal attached to the spring-held end of the rocker-arm 59 in order that the knife 47 may be brought down to cut the wire either previous to the operation or during the operation of the machine.

91 is a pressure-bar in the coiling-spindle carriage.

92 is a coiling-spindle, and 93 is a projection designed to catch the wire on the face of the head of the coiling-spindle shaft 19.

Having described the various parts involved in my invention in detail, I shall now more particularly explain the operation thereof.

The belt from the drive-wheel or counter-shaft passes over the fixed pulley *d* through the fingers *j*, comprising the belt-shifter. The power being applied, the shaft *c* is made to rotate, which in turn causes the shaft *u* to rotate through the meshing of the gears *w* and *x*. The gear *y*, rotating with the shaft *u*, meshes with the gear *t* on the surrounding sleeve or shaft *p*. This arrangement is effected in order that substantially even speeds may be attained, respectively, by the shafts *u* and *p* and the intervals of time spaced practically even with the intervals of time in the operation of the cams 2 and 3, though not coincident. The main cam-shaft *u*, having the cams 2, 3, 4, 5, and 6, on being rotated begins to operate the various levers through the rocker-arms 52, 59, 63, 69, and 70. The wire for the manufacture of the springs is fed through the straightener 49 and threaded through the intervening projections on the table between the feed-carriage 28 and the said straightener 49 and is then led on under



the knife 47. Then by means of the pedal 90 the knife 47 is brought down to cut the wire, so that the proper length will be obtained for the starting of the machine. The machine  
 5 now being started, a reciprocatory motion is imparted to the carriage 28, as has hereinbefore been explained. The wedge-shaped end 45 of the rod 44 closes the grip at every forward motion of the carriage and loosens the  
 10 same on being returned by means of the hook 46 on the said end 45, and thus continuously carrying the wire along at the required intervals of time. The wire is carried along to the coiling-spindle across the inner face of  
 15 the head of the spindle and under the pressure-bar 91 and over the coiling-spindle 92. The projection 93 now catches the wire and coils, as customary in machines of this class. The means of operating the coiling-spindle is an  
 20 essential feature in this invention—that is to say, the operation of the gear 10 by means of the disks 7.

It is necessary in a machine of this class to have two pauses during the manufacture of  
 25 the spring, one while the wire is being fed to the spindle and the other while the dies are operating. This is accomplished in the construction shown by the momentary pause which occurs during the reciprocatory move-  
 30 ments of the gear 10—that is to say, at each time that the connecting-rod is in direct alinement with the diameter of the shaft of the disk. The pauses, though momentary, are sufficient to allow the feeding of the wire and  
 35 the operation of the dies. After the operation of the dies the return of the gear after coiling and subsequent finishing by the dies loosens the spring, and the carriage being  
 40 moved by the lever 56 the completed spring is dropped off into the chute through the orifice 87 on the table.

What I claim as my invention is—

1. In a machine of the class described, the combination with a table having a coiling de-  
 45 vice thereon and supported on suitable standards, of a feed-carriage traveling on a suitable guide, means for applying friction to the guide from the carriage, means for imparting to the said carriage a reciprocatory motion,  
 50 and means for operating the coiling device, as and for the purpose specified.

2. In a machine of the class described, the combination with a table having a coiling de-  
 55 vice thereon and supported on suitable standards, of a feed-carriage traveling on a suitable guide, adjustable means of applying friction to the guide from the carriage, means for imparting to the said carriage a reciprocatory motion, and means for operating the coiling  
 60 device, as and for the purpose specified.

3. In a machine of the class described, the combination with a table having a coiling de-  
 65 vice thereon and supported on suitable standards, of a feed-carriage traveling on a suitable guide, a cam-shaft journaled in the standards,

a cam thereon, a rocker-arm directly operated by said cam, a lever pivotally connected to the said rocker-arm, a second rocker-arm journaled in a suitable bearing on the table, and having  
 70 pivotal connection with the upper end of the lever, a rod pivotally connected to the arm at one end and suitably connected to the carriage at the other end, and means for operating the coiling device, as and for the purpose specified.

4. In a machine of the class described, the  
 75 combination with a table having a coiling device thereon and supported on suitable standards, of a feed-carriage having orifices therethrough and a threaded hole located therebetween, and traveling on a flattened guide-  
 80 rail, friction-pins depending from a plate, having a thumb-screw, and extending through the said orifices to the surface of the guide-rail, means for imparting to the said carriage a reciprocatory motion, means for gripping  
 85 the wire passing therethrough, and means for operating the coiling device, as and for the purpose specified.

5. In a machine of the class described, the  
 90 combination with a table having a coiling device thereon and supported on suitable standards, of a feed-carriage traveling on a suitable guide-rail, and having a laterally-extending slot therethrough bridged by a fixed bar, a  
 95 grip-bar slidably arranged in said slot and having an opening through one end thereof, and a raised portion at its other end with a pointed inner side, designed to move at intervals toward the bridge-bar, means for imparting to the carriage a reciprocatory motion,  
 100 and means for operating the coiling device, as and for the purpose specified.

6. In a machine of the class described, the  
 105 combination with a table having a coiling device thereon and supported on suitable standards, of a feed-carriage traveling on a suitable guide-rail, and having a laterally-extending slot therethrough bridged by a fixed bar, a  
 110 grip-bar slidably arranged in said slot and having an opening through one end thereof, and a raised portion at its other end with a pointed inner side, designed to move at intervals toward the bridge-bar, a rod having a substantially wedge-shaped and hooked end  
 115 inserted in said opening, means for imparting to the rod a reciprocatory motion, and means for operating the coiling device, as and for the purpose specified.

7. In a machine of the class described, the  
 120 combination with a table having a coiling device thereon and supported on suitable standards, of a feed-carriage traveling on a suitable guide-rail, and having a laterally-extending slot therethrough bridged by a fixed bar, a  
 125 grip-bar slidably arranged in said slot and having an opening through one end thereof, and a raised portion at its other end with a pointed inner side, designed to move at intervals toward the bridge-bar, a rod having a substantially wedge-shaped and hooked end  
 130



inserted in said opening, adjustable means for regulating the length of the opening, means for imparting to the rod a reciprocatory motion, and means for operating the coiling device, as and for the purpose specified.

8. In a machine of the class described, the combination with a table having a coiling device thereon and supported on suitable standards, of a feed-carriage traveling on a suitable guide-rail, and having a laterally-extending slot therethrough bridged by a fixed bar, adjustable friction-pins extending through the said carriage to the guide-rail, a grip-bar slidably arranged in said slot and having an opening through one end thereof, and a raised portion at its other end with a pointed inner side, designed to move at intervals toward the bridge-bar, a rod having a substantially wedge-shaped and hooked end inserted in said opening, means for imparting to the rod a reciprocatory motion, and means for operating the coiling device, as and for the purpose specified.

9. In a machine of the class described, the combination with a table having a coiling device thereon and supported on suitable standards, of a feed-carriage traveling on a suitable guide-rail, and having a laterally-extending slot therethrough bridged by a fixed bar, a grip-bar slidably arranged in said slot and having an opening through one end thereof, and a raised portion at its other end with a pointed inner side, designed to move at intervals toward the bridge-bar, a rod having a substantially wedge-shaped and hooked end inserted in said opening, a rocker-arm journaled in a bearing on the table and having pivotal connection with the rod, a lever extending downwardly from the arm, means for operating the lever, and means for operating the coiling device, as and for the purpose specified.

10. In a machine of the class described, the combination with a table having a coiling device thereon and supported on suitable standards, of a feed-carriage traveling on a suitable guide-rail, and having a laterally-extending slot therethrough bridged by a fixed bar, a grip-bar slidably arranged in said slot and having an opening through one end thereof, and a raised portion at its other end with a pointed inner side, designed to move at intervals toward the bridge-bar, a rod having a substantially wedge-shaped and hooked end inserted in said opening, a rocker-arm journaled in a bearing on the table and having pivotal connection with the rod, a lever extending downwardly from the arm, a rocker-arm beneath the table pivotally connected to the lever and spring-held, a cam-shaft journaled in the standards, a cam, means for rotating said cam-shaft, and means for operating the coiling device, as and for the purpose specified.

11. In a machine of the class described, the combination with a table having a coiling device thereon and supported on suitable standards, of a gear-wheel, a pinion operated thereby for operating the coiling device, a shaft journaled in suitable bearings, and turning said wheel, a disk, a connecting-rod from the disk to the gear-wheel and reciprocally turning the latter, and means for rotating said disk, as and for the purpose specified.

12. In a machine of the class described, the combination with a table having a coiling device thereon and supported on suitable standards, of a gear-wheel, a shaft journaled in suitable bearings and turning said wheel, a pinion operated by said gear-wheel for operating the coiling device, a fixed collar encircling the outer end of the shaft and having an arm extending laterally, a driven shaft, and intervening means between said arm and said driven shaft for imparting to the former a reciprocatory motion, as and for the purpose specified.

13. In a machine of the class described, the combination with a table having a coiling device thereon and supported on suitable standards, of a gear-wheel, a shaft turning said wheel and journaled in said standards, a pinion operated by said gear-wheel for operating the coiling device, a fixed collar encircling the outer end of said shaft having an arm extending laterally and an elongated slot therethrough, a driven shaft, a disk fixedly secured on the same, and a connecting-rod between said disk and arm adjustably secured to the latter, as and for the purpose specified.

14. In a machine of the class described, in combination, a table supported on standards having suitable bearings, and having a die-case and dies slidably arranged therein; a driven cam-shaft journaled in said standards, a cam, a rocker-arm journaled thereabove having a suitable roller, a lever pivotally attached to said rocker-arm and projecting upwardly through the table, a shaft journaled in suitable bearings on the upper surface of the table, having a crank at one end thereof pivotally connected to the lever, an arm extending upwardly from the said shaft and having a projecting lower portion, and rods pivotally secured to said arms and attached to the dies, as and for the purpose specified.

15. In a machine of the class described, in combination, a table supported on standards having suitable bearings, and having a die-case and dies slidably arranged therein, a driven cam-shaft journaled in said standards, a cam, a rocker-arm journaled thereabove and having a suitable roller, a lever pivotally attached to said rocker-arm and extending upwardly through the table, a rocker-arm journaled in suitable bearings on the upper surface of the table, and pivotally connected to said lever, a toggle-joint, having the toggles



thereof attached to the said dies, and a connecting-rod from the upper rocker-arm to the joint, as and for the purpose specified.

16. In a machine of the class described, in  
5 combination, a table supported on standards,  
and having a shearing-knife journaled in suitable guides, a driven cam-shaft journaled in  
said standards, a cam, a rocker-arm journaled  
thereabove and having a suitable roller, a le-  
10 ver pivotally attached to said rocker-arm and

extending upwardly through the table and connected to said shearing-knife, as and for the purpose specified.

Signed at Montpelier, in the State of Vermont, in the United States of America, this 15  
6th day of August, 1903.

CHARLES EDWIN BOOTH.

Witnesses:

FRED L. LAIRD,  
JOSEPH G. BROWN.