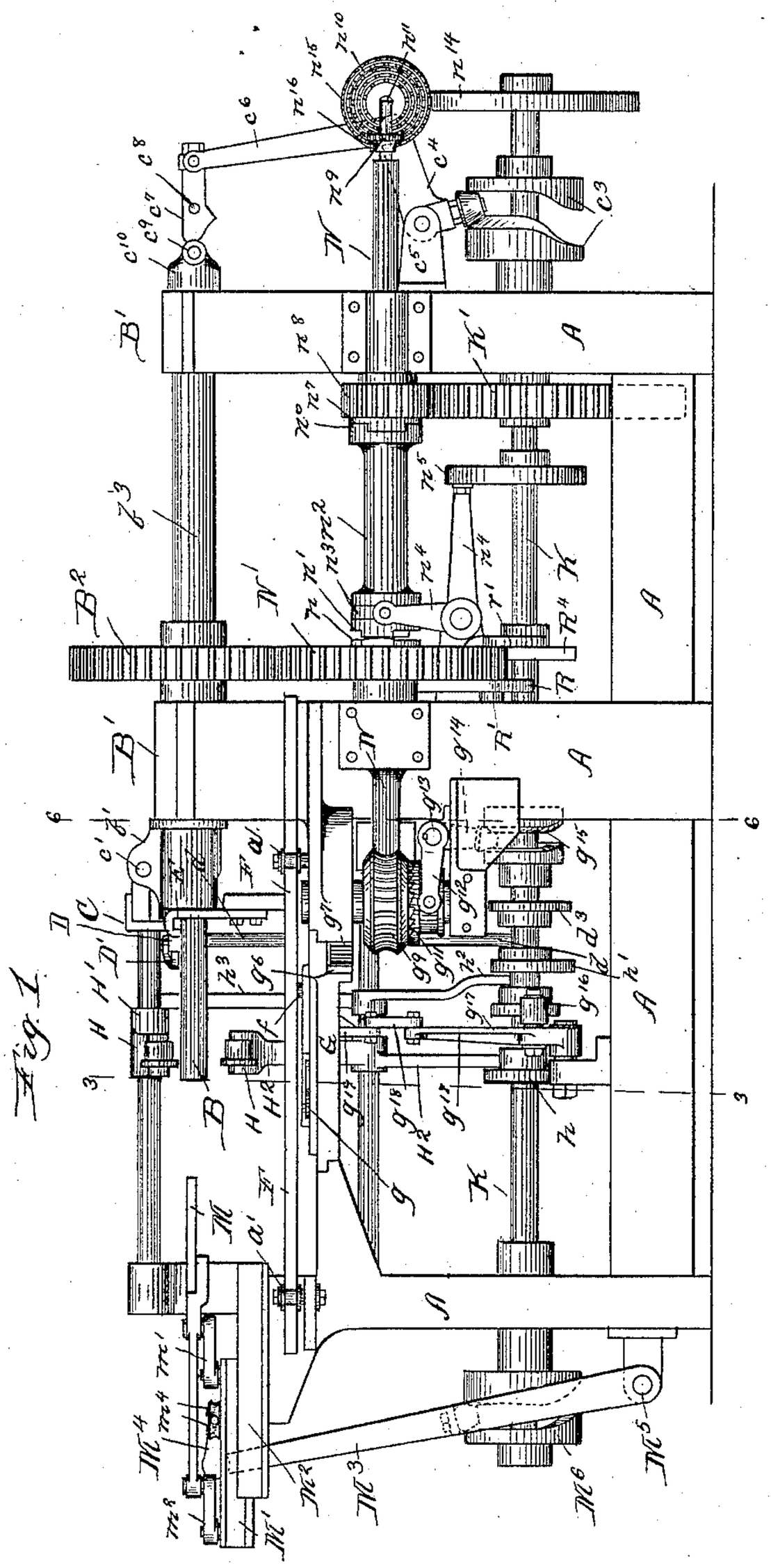
(No Model.) 5 Sheets—Sheet 1.

H. D. MILLETT.

SPRING COILING MACHINE.

No. 468,573. Patented Feb. 9, 1892.



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(No Model.) 5 Sheets—Sheet 2.

H. D. MILLETT.

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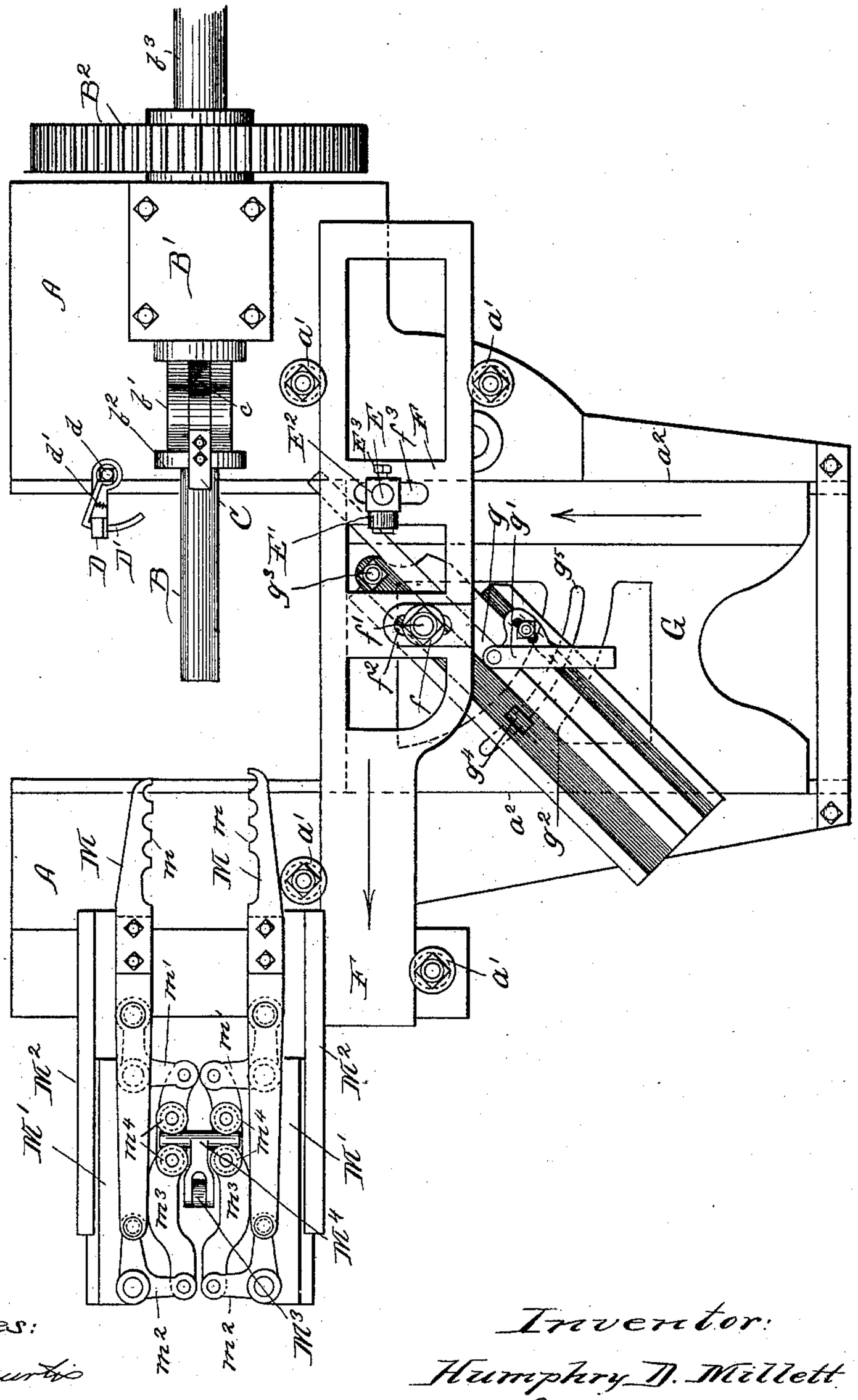

Fig. 2.

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(No Model.) 5 Sheets—Sheet 3.

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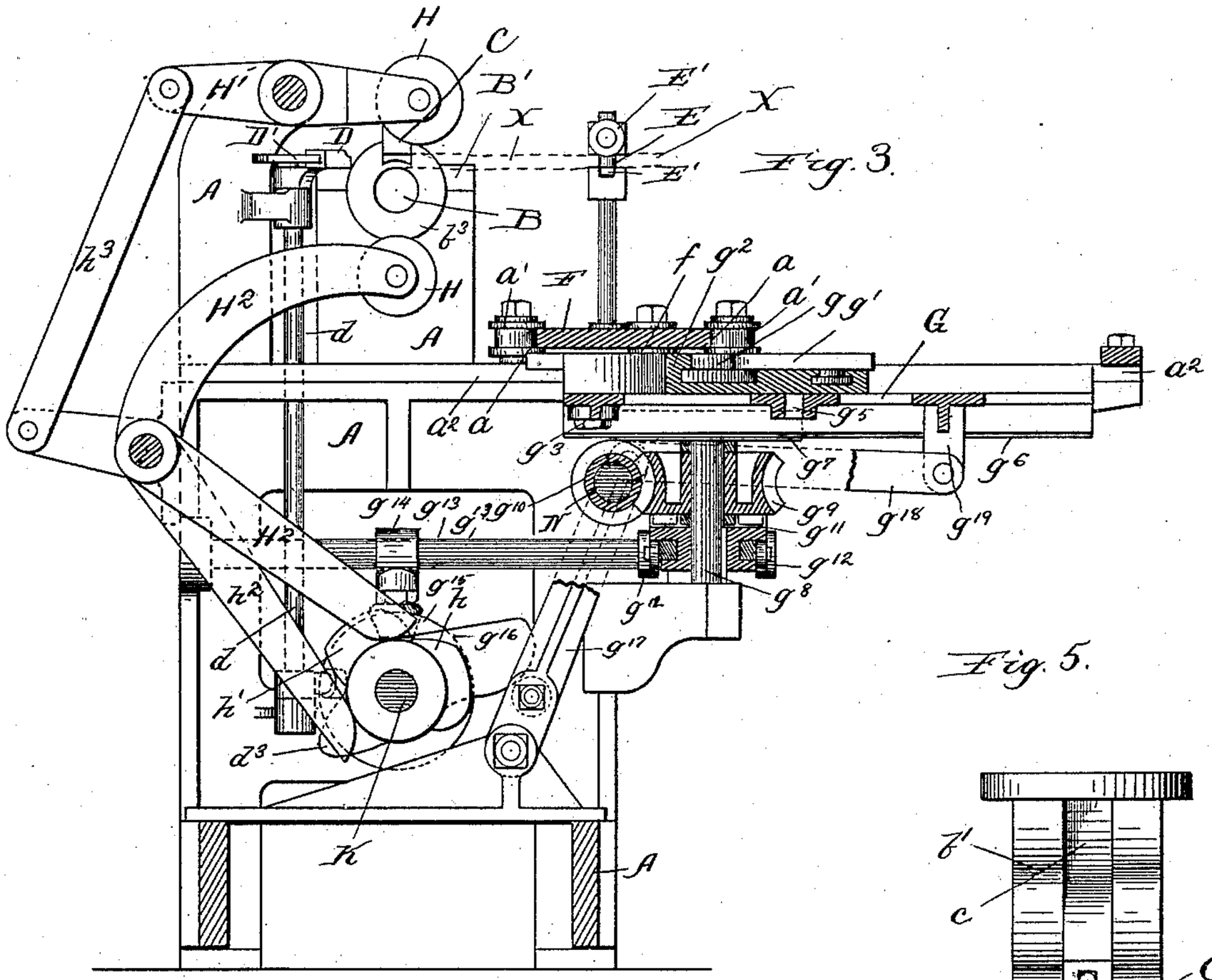


Fig. 3.

Fig. 5.

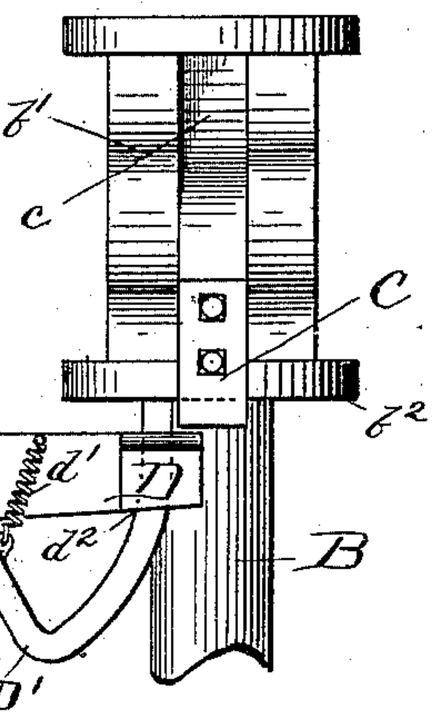
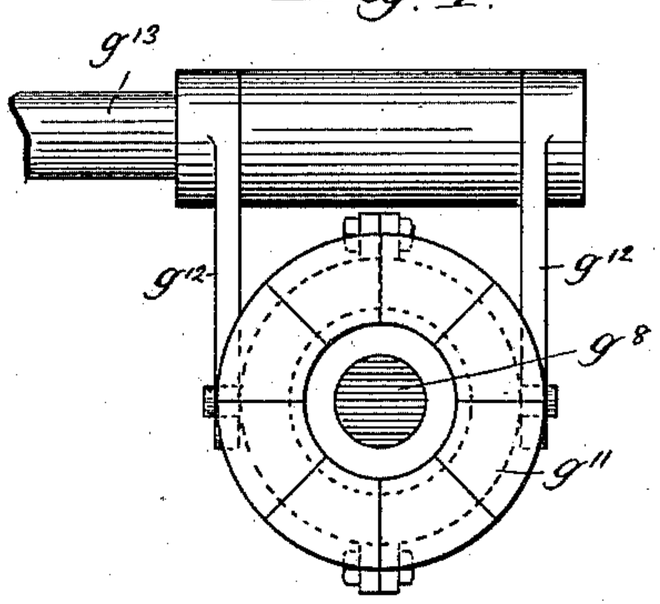


Fig. 4.



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SPRING COILING MACHINE.

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Fig. 6.

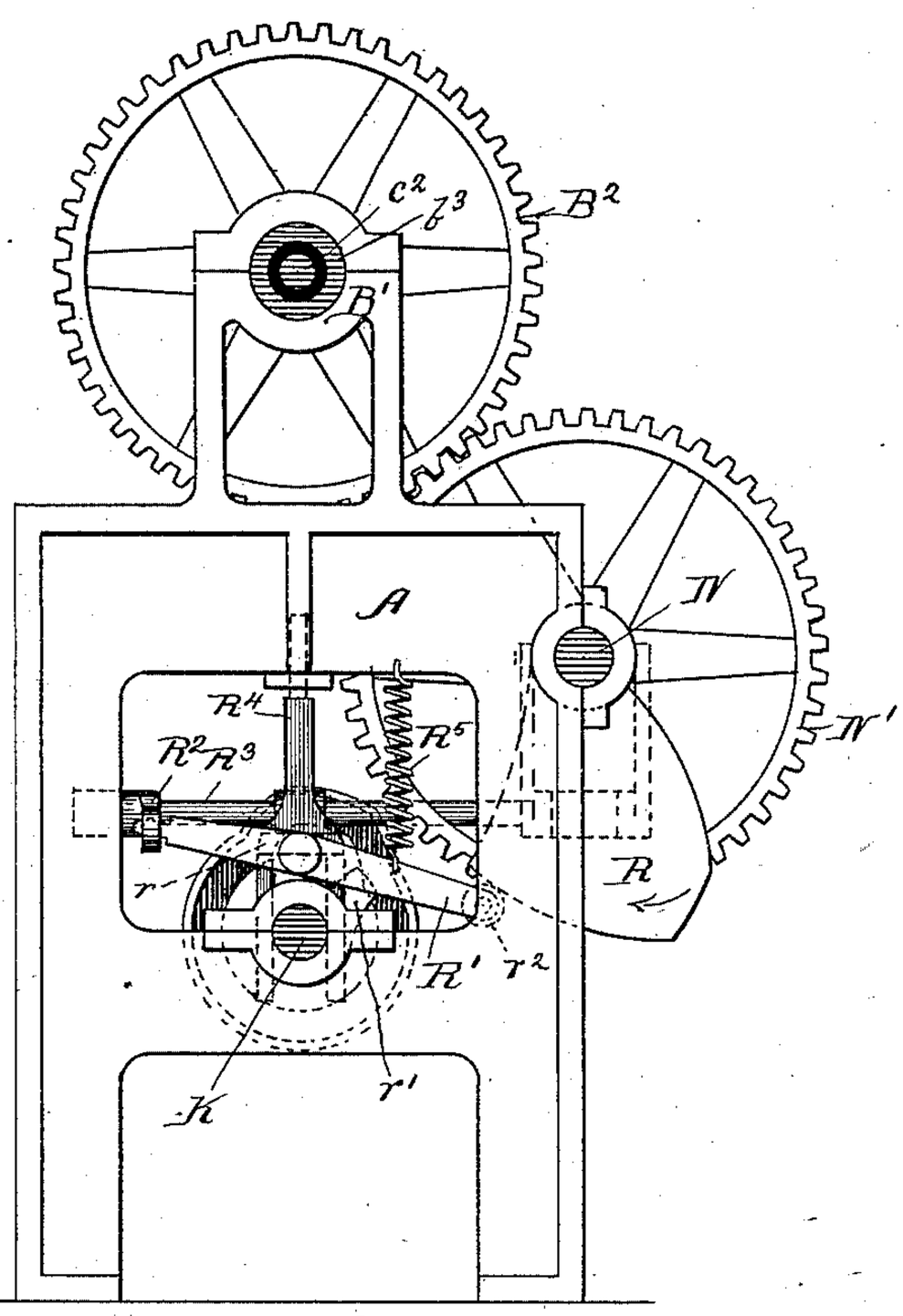
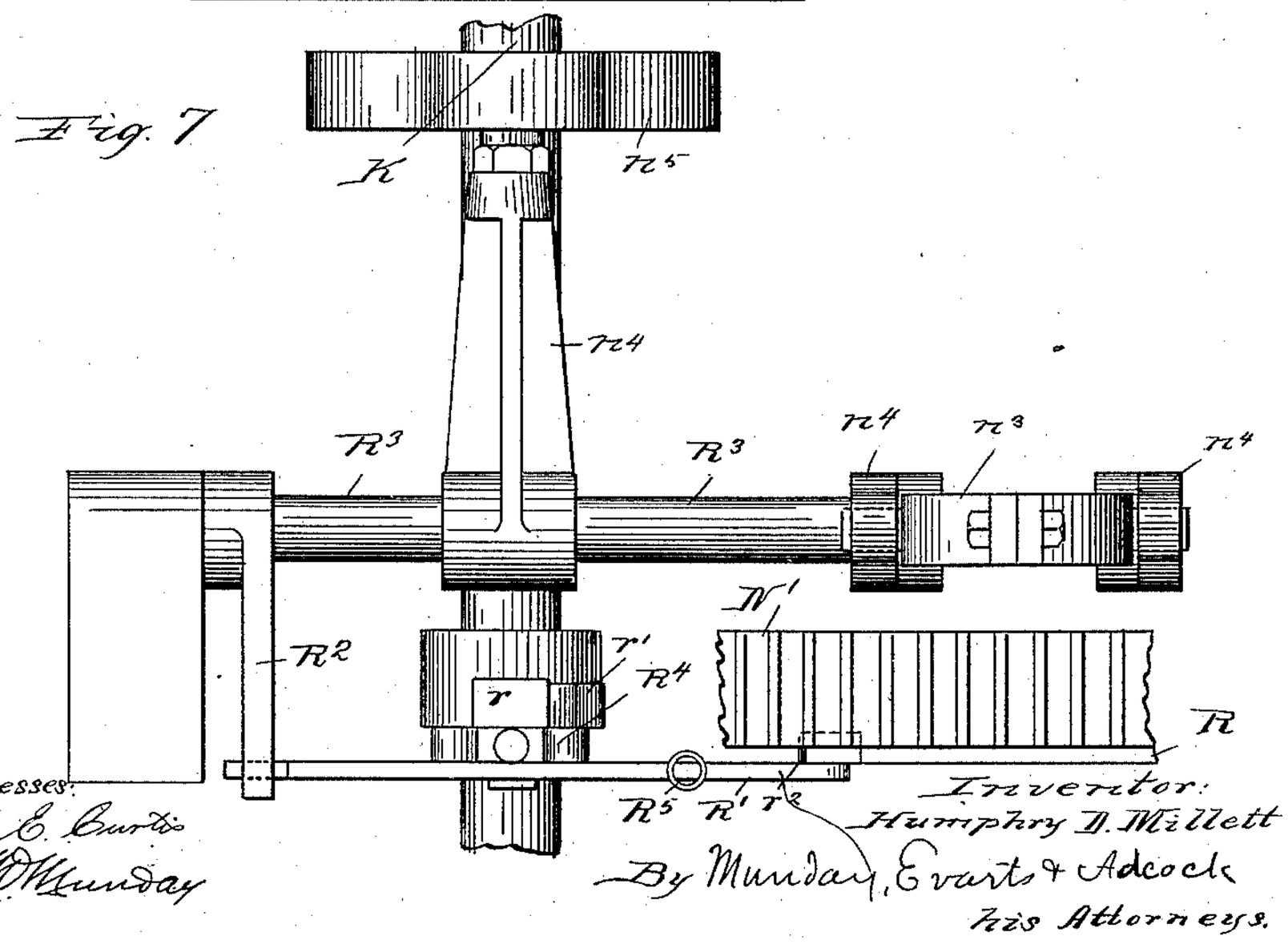


Fig. 7



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(No Model.) 5 Sheets—Sheet 5.

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SPRING COILING MACHINE.

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Fig. 8

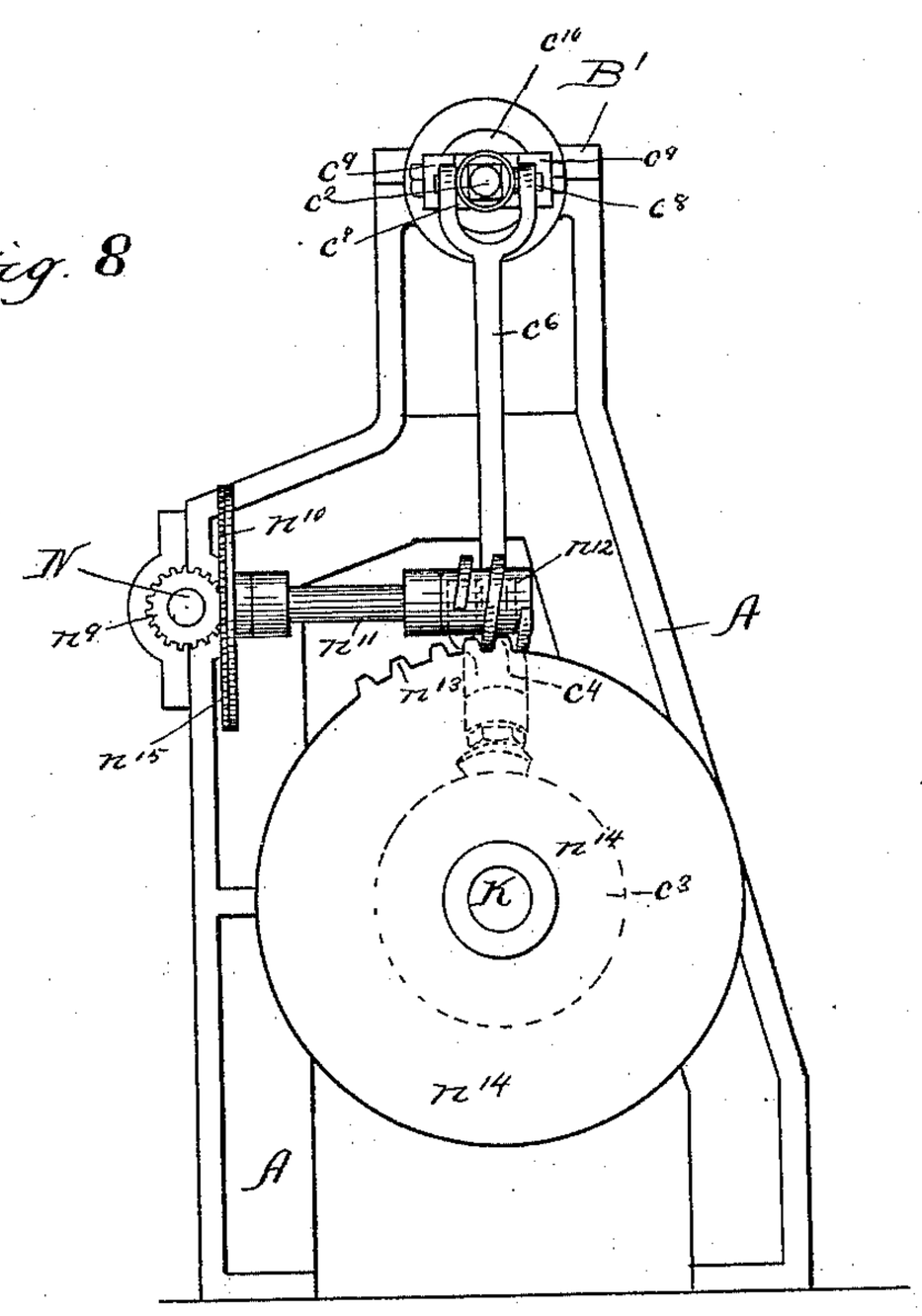


Fig. 9.

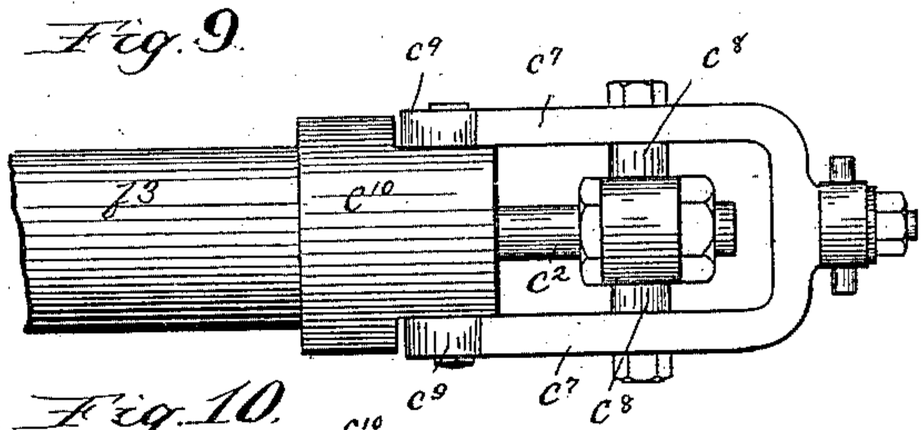
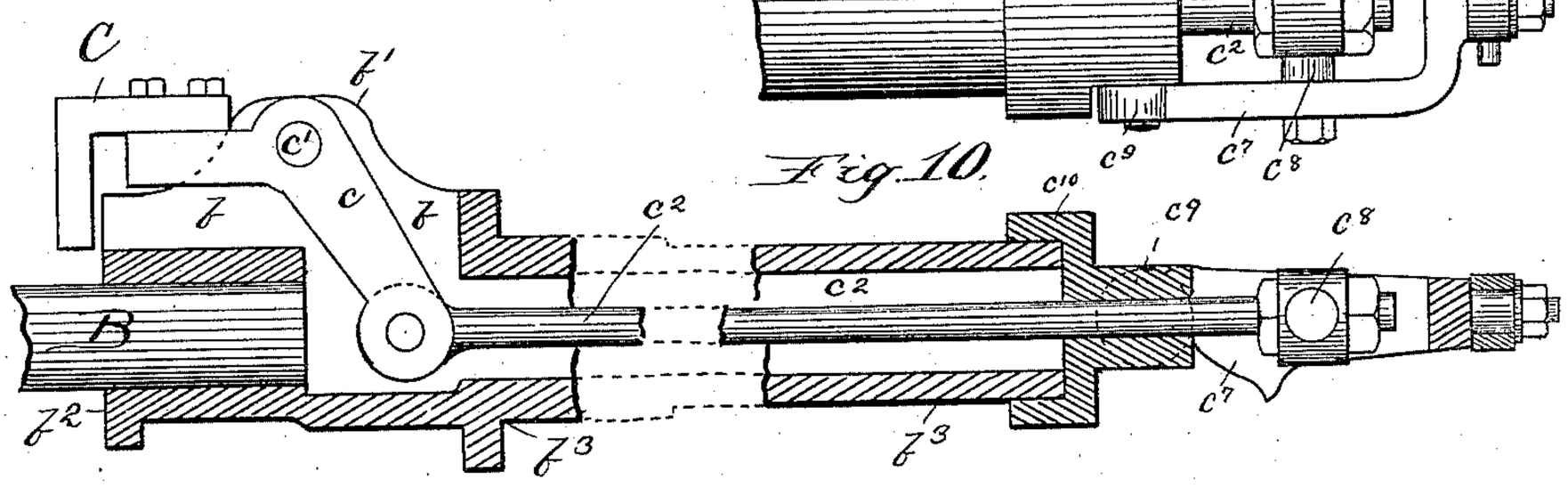


Fig. 10.



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UNITED STATES PATENT OFFICE.

HUMPHRY D. MILLETT, OF MAYWOOD, ASSIGNOR TO CHARLES H. FERRY, OF CHICAGO, ILLINOIS.

SPRING-COILING MACHINE.

SPECIFICATION forming part of Letters Patent No. 468,573, dated February 9, 1892.

Application filed May 4, 1891. Serial No. 391,513. (No model.)

To all whom it may concern:

Be it known that I, HUMPHRY D. MILLETT, a citizen of the United States, residing in Maywood, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Spring-Coiling Machines, of which the following is a specification.

My invention relates to improvements in machines for coiling heated bars of metal around a mandrel to form coil-springs.

My improved spring-coiling machine is specially designed for coiling the bars used in the manufacture of car-springs. After the hot bar is coiled around the forming-mandrel the contraction of the metal by cooling and the scale which is formed tend to cause the coil-spring to stick to the mandrel around which it is formed, and it has heretofore been a difficult and somewhat slow operation to remove the spring from the mandrel.. Heretofore this has usually been done by a workman with a hammer or other instrument striking blows against the spring to loosen and remove it. As the coils of the spring are usually still at a red heat and the metal soft or easily bent, the coils of the spring are frequently bent out of shape or distorted in the act of removing, so that it is necessary to straighten the coils up by hand. Heretofore, also, the spring-coiling machine has usually left the extreme end of the bar projecting out tangentially, and it has been customary to coil or bend this projecting end into shape by hand after the spring has been removed from the mandrel of the coiling-machine.

The object of my invention is to provide a spring-coiling machine for operating upon hot bars which will be of a simple, efficient, and durable construction, which will operate to remove the coil-spring from the mandrel automatically and expeditiously and without disturbing the relative position of the coils or distorting the shape of the spring, and whereby the whole bar may be coiled without leaving any uncoiled or projecting end, and whereby, also, the coils may be formed at any desired pitch, and whereby, too, the first and last coils of the spring may be formed at right angles to the axis of the mandrel, so that the spring will have square ends or bases and rest properly upon its support.

My invention consists in the combination, with a revolving mandrel around which the hot bar is coiled, of a clamping-jaw mounted upon and revolving with the mandrel for clamping the end of the bar to the mandrel, a movable support for holding the free or stationary end of the bar as it is coiled, and mechanism for stopping the revolving mandrel at a certain point, so that the end of the bar may be inserted between the clamping-jaw and the mandrel at the beginning of the operation.

It also consists, in combination with the revolving mandrel around which the bar is coiled, of a pair of opposing rollers arranged on opposite sides of the mandrel for supporting the free end of the mandrel and coiling down upon the mandrel the final end of the bar or spring, which otherwise would be left projecting tangentially.

It also consists, in combination with the coiling-mandrel, of a pair of extractor-jaws for removing the spring from the mandrel, having teeth or projections adapted to fit between the coils of the spring, so as to keep the separate coils in place in respect to each other during the operation of removing the spring from the mandrel.

It further consists, in combination with the revolving mandrel around which the hot bar is coiled, of a support for the free end of the bar and adjustable mechanism for moving this support, so that the pitch of the spring may be adjusted at will, and springs having coils of different pitch formed upon the same machine.

It further consists in the combination of the revolving mandrel, the support for the free end of the bar, and mechanism whereby the movement of this support is caused to begin after the first coil or a portion thereof has been formed and to cease prior to the formation of the last coil, so that the first and last coils of the spring may be formed parallel to each other while the intermediate coils are spiral, and in mechanism whereby the relative points of stopping and starting the movement of this support may be adjusted or varied, as required, to produce springs of different sizes or forms upon the same machine.

It further consists in the novel devices and

novel combinations of parts and devices herein shown and described, and more particularly pointed out in the claims.

In the accompanying drawings, which form a part of this specification and in which similar letters of reference indicate like parts, Figure 1 is a side elevation of a spring-coiling machine embodying my invention. Fig. 2 is a partial plan view. Fig. 3 is a vertical cross-section taken on line 3 3 of Fig. 1. Fig. 4 is a detail view of a clutch, hereinafter described. Fig. 5 is a detail view of a movable device for pushing the first end of the spring-bar into position and of the clamping-jaw of the mandrel to insure the proper clamping of the end of the bar to the mandrel. Fig. 6 is a cross-section on line 6 6 of Fig. 1. Fig. 7 is a detail plan view showing the mechanism for stopping the mandrel at a certain point. Fig. 8 is a detail end view of the machine, showing the mechanism for communicating motion to the cam-shaft. Figs. 9 and 10 are detail views showing the mechanism for operating the clamping-jaw, by which the end of the bar is clamped to the revolving mandrel.

In the drawings, A represents the frame of the machine.

B is the revolving mandrel around which the bar X is coiled to form the spring. The mandrel B is journaled in suitable bearings B′ on the frame of the machine.

C is the movable clamping-jaw, by which the end of the bar is clamped to the mandrel during the coiling operation. This jaw C is carried by and revolves with the mandrel and has an operating-lever *c*, which works in a slot *b* in the hollow portion of the mandrel B. The lever *c* is pivoted at *c′* to the projection or lug *b′* formed upon the mandrel B. The mandrel B is also furnished with a shoulder b^2 adjacent to the clamping-jaw C. This shoulder or collar b^2 serves as a guide to position the end of the bar on the mandrel at the beginning of the coiling operation and as a guide for the first coil of the spring, which is or should be formed at right angles to the axis of the mandrel. The shoulder b^2 and the hollow portion b^3 of the mandrel may preferably be formed in a separate piece from the solid portion of the mandrel around which the spring is coiled. The clamp C, or its lever *c*, is opened and closed through a connecting rod or link c^2, which extends out through the hollow portion b^3 of the mandrel.

D is a movable device or pusher by which the end of the bar is pushed snugly against the shoulder b^3 of the mandrel and under the clamping-jaw C, and D′ is a movable stop against which the end of the bar X projects, and by which the position of the bar longitudinally is regulated in respect to the clamping-jaw and mandrel. The pusher D and stop D′ are both made movable, so that they may be swung or moved out of the way of the spring as it is coiled around the mandrel. They may be mounted movably in any suitable manner and moved in and out of position by any suitable mechanism. I prefer, however, to mount them on a pivot or shaft *d*. The arm D may be secured rigidly to the rotatable pivot or shaft *d*, and the stop D′ mounted loosely on the pivot *d* and connected by a spring *d′* with the arm D, so that the movement of the arm D will also move the stop device D′. The stop D′ may preferably extend through an opening or notch d^2 in the pusher D. By thus providing a spring or yielding connection between the pusher D and stop D′ the projecting stop D′ will not prevent or interfere with the proper movement of the pusher D in pushing the bar X into place against the shoulder b^2 of the mandrel.

E is the movable support or guide by which the free end of the bar X is held and guided during the coiling operation and by which this free end of the bar is moved longitudinally or in the direction of the mandrel to give the proper pitch to the intermediate coils of the spring, as desired. This movable support E is preferably furnished with rolls E′ E′, between which the bar X passes. The movable support E is secured to a longitudinal slide F, which moves back and forth in suitable guides *a* on the frame of the machine. To diminish the friction of the slide F its guides *a* are preferably furnished with or made in the form of friction-rollers *a′*. In order to readily adjust or vary the movement of the slide F, I communicate motion to it through a transverse slide G, which reciprocates in suitable guides a^2 on the frame of the machine, and which is provided with an adjustable inclined bar or guide *g*, which impinges against a projection or friction-roller *f* on the longitudinal slide F, and thus communicates to the slide F and support E a greater or less movement, according to the particular inclination of the adjustable guide *g*. The adjustable guide or bar *g* has a pivoted part *g′*, which may be fixed in position on the guide-holder g^2 parallel to the direction of motion of the slide G, so that when the roller *f* strikes against this parallel portion of the guide-bar the further movement of the slide F will cease, though the slide G may continue to move. This is for the purpose of forming the last coil of the spring without any pitch or at right angles to the axis of the coiling-mandrel. The guide-holder g^2 is pivoted at g^3 to the slide G and is fixed in position at any desired angle by a clamp screw or bolt g^4, which passes through a slot g^5 in the slide G. The roller *f* is adjustably fixed to the slide F by a pivot-bolt *f′*, which passes through a slot f^2 in the slide F. The guide or support E for the spring-bar is also adjustably fixed to the slide F by means of the slot f^3, and the guide-rollers on the support E may likewise be adjusted up or down by means of the sliding blocks E^2 and set-screws E^3.

H H are a pair of movable rollers mounted upon opposite sides of the mandrel B to support the free end of the mandrel and to wind or curve down the final end of spring-bar X

as the coiling-mandrel revolves. These movable rollers H H may preferably be supported or mounted upon the arms of movable levers H′ H², which are actuated by cams *h h′* on the cam-shaft K. The lever H² is operated directly by its cam *h*, and the lever H′ is operated indirectly by its cam through the intermediate lever h^2 and connecting-link h^3. The spring, after it is coiled upon the mandrel, is automatically removed therefrom by means of a pair of opening and closing extracting-jaws M M, having projecting teeth or notches *m* to fit between the coils of the spring, so as to hold the separate coils in position during the operation of removing the spring from the mandrel. These extractor-jaws M M are preferably mounted upon and carried by a slide M′, which reciprocates in suitable guides M² on the frame of the machine. The extractor-jaws M are movably connected to the slide M′, and preferably in such way that they may have a straight or parallel opening and closing movement in respect to each other. To effect this I prefer to operate each jaw M by a pair of bent levers m' m^2, so that the means or devices employed for communicating motion to the slide M′ may also serve to open and close the jaws M M at the proper time. To effect this I connect the pairs of levers m' m^2 together by a pivoted link m^3, and connect the operating-lever M³ with these pivoted links by means of a T-shaped connecting-link M⁴. The links m^3 are furnished with friction-rollers m^4 to receive between them the branches of the T-link M⁴. The operating-lever M³ is pivoted at M⁵ to the frame of the machine and is actuated by a cam M⁶ on the cam-shaft K. Motion is communicated to the revolving mandrel B from the driving-shaft N by means of a gear B² keyed to the mandrel and a loose gear N′ on the driving-shaft N which has a clutch-face *n*, and is at proper intervals clutched to the driving-shaft by a clutch *n′* thereon actuated by the clutch-sleeve n^2 through the connecting-collar n^3, bent lever n^4, and cam n^5 on the cam-shaft K. Motion is communicated from the driving-shaft N to the cam-shaft K, while the mandrel is not being revolved, by means of a clutch-face n^6 on the sleeve n^2, which engages a corresponding clutch n^7 on the face of a loose gear n^8 on the driving shaft, which meshes with a gear K′ on the cam-shaft K, and a slow motion is communicated from the driving-shaft to the cam-shaft while the mandrel is being revolved, by means of a spur-gear n^9 on the driving-shaft N, which meshes with a flat or disk faced gear n^{10} on a counter-shaft n^{11}, which is furnished with a worm n^{12}, which meshes with teeth n^{13} of a partial or mutilated gear n^{14} on the cam-shaft K. In order to adjust or vary the length of time that the mandrel is revolved for the coiling of each spring, and thus the number of coils or the length of the spring, the flat-faced or disk gear n^{10} is furnished with a number of rows of teeth n^{15}, and the gear n^9 is made adjustable on the driving-shaft by means of a set-screw n^{16}, so that the worm-shaft n^{12} may revolve at a greater or less speed.

In order to stop the revolution of the mandrel B at a fixed point, so that the clamping-jaw C will be in proper position relative to the guide or support E, through which the spring-bar X is fed to the mandrel, I provide a device or mechanism for arresting the motion of the mandrel and overcoming its momentum and that of its connecting-gearing after it is unclutched from the driving-shaft. This motion-arresting device may be of any suitable construction known to those skilled in the art. That which I prefer to employ consists in providing the driving-gear N′ with a cam or wedge R, which impinges against a pivoted lever R′, pivoted to an arm R² on the pivot or rock-shaft R³, to which the two arms of the clutch-operating lever n^4 are connected. This lever R′ carries a sliding block R⁴, which reciprocates in suitable guides on the frame of the machine and has a projection *r* adapted to engage a cam or projection *r′* on the cam-shaft K. As long as the clutch *n′* is engaged with the clutch *n* on the face of the mandrel-driving gear N′ the cam R on the gear N′ will simply cause the lever R′ to slide the block R⁴ loosely up and down, a spring R⁵ returning the block and lever to position, but the moment the clutch *n n′* is disengaged the rock-shaft R³ is rocked, throwing up the arm R², and the cam or projection *r′* is brought under the lip *r* on the block R⁴, so that the two pivotal points of the lever R′ become fixed, and as the cam or wedge R engages the roller r^2 on the end of the lever R′, the motion of the gear N′ and of the mandrel connected therewith will be arrested, the momentum of the parts being overcome by the wedging action of the cam against the lever R′.

The shaft *d*, by which the pusher D and stop D′ are operated, is actuated by a cam d^3 on the cam-shaft K.

The transverse slide G, through which motion is communicated to the movable support E, is operated from the driving-shaft by means of a rack g^6 on said slide, which meshes with a pinion g^7 on an upright shaft g^8, which carries a worm-gear g^9, that meshes with a worm g^{10} on the driving-shaft. The worm-gear g^9 is clutched to its shaft by means of a clutch g^{11}, which is operated by an arm g^{12} on a rock-shaft g^{13}, having an arm g^{14}, which engages a cam g^{15} on the cam-shaft K. The slide G is retracted by means of a cam g^{16}, which engages a pivoted arm or lever g^{17}, the upper end of which is connected by a link g^{18} with a bracket or lug g^{19}, secured to the slide G. The clamping-jaw C or its operating-rod c^2 is actuated by a cam c^3 on the cam-shaft K through a lever c^4, pivoted to the bracket c^5, and which is connected by a link c^6 with a cam-faced link c^7, pivoted at c^8 to the rod c^2, and the cam-face of which impinges against a roller c^9, journaled on the collar c^{10} on the end of the mandrel-sleeve b^3.

In operation the end of the spring-bar X is fed through the guide or support E, so that its end projects against the stop D′. The swinging movement of the pusher B then crowds or pushes the end of the bar against the shoulder b^2 of the mandrel and under the clamping-jaw C. The clamping-jaw C then closes upon the end of the bar and the coiling-mandrel begins to revolve until one coil or one partial coil is formed around the mandrel. At this time the guide-bar *g* on the transverse slide G comes in contact with the roller *f* on the longitudinal slide F, and causes this slide to move slowly forward, producing the required pitch in the intermediate coils of the spring. When the intermediate coils have been formed, the longitudinal slide F will have moved forward until the roller *f* will strike the straight or parallel portion *g′* of the guide-bar *g*. As the mandrel continues to revolve, the final coil of the spring will thus be wound parallel to the first coil or at right angles to the axis of the mandrel. During the final portion of the coiling operation the rollers H H are closed upon the spring, thus flattening or curving down upon the mandrel the projecting end of the bar. In the meantime the extractor-jaws advance into position to close upon this spring, and when the coiling is finished and the rollers H H opened or removed the extractor-jaws by the receding movement of the slide M′ remove the finished spring from the mandrel.

I claim—

1. In a spring-coiling machine, the combination, with the revolving mandrel, of an opening and closing jaw mounted thereon, and a support or guide for holding the free end of the bar, substantially as specified.

2. In a spring-coiling machine, the combination, with the revolving mandrel, of a movable clamping-jaw for clamping the end of the bar to the revolving mandrel, and a stop for the end of the bar to project against as it is fed between the clamping-jaw and mandrel, substantially as specified.

3. In a spring-coiling machine, the combination, with a revolving mandrel, of a clamping-jaw and a device for pushing the end of the bar into position under the clamping-jaw, substantially as specified.

4. The combination, with a revolving mandrel, of a clamping-jaw, a movable device for pushing the end of the bar under the jaw, and a movable stop for the end of the bar to project against, substantially as specified.

5. The combination, with a revolving mandrel, of a movable clamping-jaw C, a pusher D, and a stop D′, having a spring or yielding connection with said pusher D and projecting through the same, substantially as specified.

6. In a spring-coiling machine, the combination, with the revolving mandrel, of a pair of movable rollers for rolling down the final end of the spring-bar and supporting the mandrel, substantially as specified.

7. In a spring-coiling machine, the combination, with the revolving mandrel, of a movable roller for coiling or bending the final end of the spring down upon the mandrel, substantially as specified.

8. In a spring-coiling machine, the combination, with a revolving mandrel, of a pair of opposing rollers H.H and cams and levers for operating the same, substantially as specified.

9. In a spring-coiling machine, the combination, with a revolving mandrel, of a roller for pressing down the final end of the spring, means for withdrawing the roller from the mandrel after the spring is coiled, and means for extracting the spring from the mandrel, substantially as specified.

10. The combination, in a spring-coiling machine, of a revolving mandrel around which the spring is coiled, and an extractor device consisting of a pair of opening and closing jaws furnished with teeth or projections to fit between the coils of the springs, substantially as specified.

11. In a spring-coiling machine, the combination, with a revolving mandrel, of a pair of spring-extractor jaws having teeth or projections adapted to fit between the coils of the spring, a reciprocating slide upon which said jaws are mounted, a lever for reciprocating said slide, and mechanism connecting said lever with said opening and closing jaws, so that the forward movement of the slide will open the jaws and the withdrawing movement of the slide close the jaws, substantially as specified.

12. In a spring-coiling machine, the combination, with the mandrel, of a driving-shaft and a cam-shaft, a clutch and gearing for connecting the mandrel with the driving-shaft, a clutch and gearing connecting the driving-shaft with the cam-shaft when the mandrel is disconnected or unclutched, and a worm and gearing connecting the driving-shaft with the cam-shaft when the mandrel is also in gear with the driving-shaft, substantially as specified.

13. In a spring-coiling machine, the combination, with the mandrel, of a driving-shaft and a cam-shaft, a clutch and gearing for connecting the mandrel with the driving-shaft, a clutch and gearing connecting the driving-shaft with the cam-shaft when the mandrel is disconnected or unclutched, and a worm and gearing connecting the driving-shaft with the cam-shaft when the mandrel is also in gear with the driving-shaft, said latter gearing being furnished with means for increasing or decreasing the relative speed of the cam-shaft in respect to the mandrel, substantially as specified.

14. The combination, with the revolving mandrel, of a movable support for the free end of the spring mounted upon a longitudinal slide, and a transverse slide for communicating motion thereto, having an adjustably inclined bar or guide engaging a projection or roller on the longitudinal slide, whereby the movement of the longitudinal slide and the

consequent pitch of the spring may be adjusted or varied, substantially as specified.

15. In a spring-coiling machine, the combination, with the revolving mandrel, of a movable support for the free end of the spring and adjustable mechanism for communicating motion to said support, substantially as specified.

16. In a spring-coiling machine, the combination, with a revolving mandrel around which the spring is coiled, of a clamping-jaw for clamping the end of the bar to the revolving mandrel, a movable support for holding the bar as it is coiled around the mandrel, and mechanism for stopping the revolving mandrel at a certain point, so that the bar may be inserted between the jaw and the mandrel at the beginning of the operation, substantially as specified.

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