No. 791,753. PATENTED JUNE 6, 1905.

F. H. DANIELS & C. S. MARSHALL.

MANUFACTURE OF SPRINGS.

APPLICATION FILED NOV. 27, 1903.

2 SHEETS—SHEET 1.

Fig. 1.

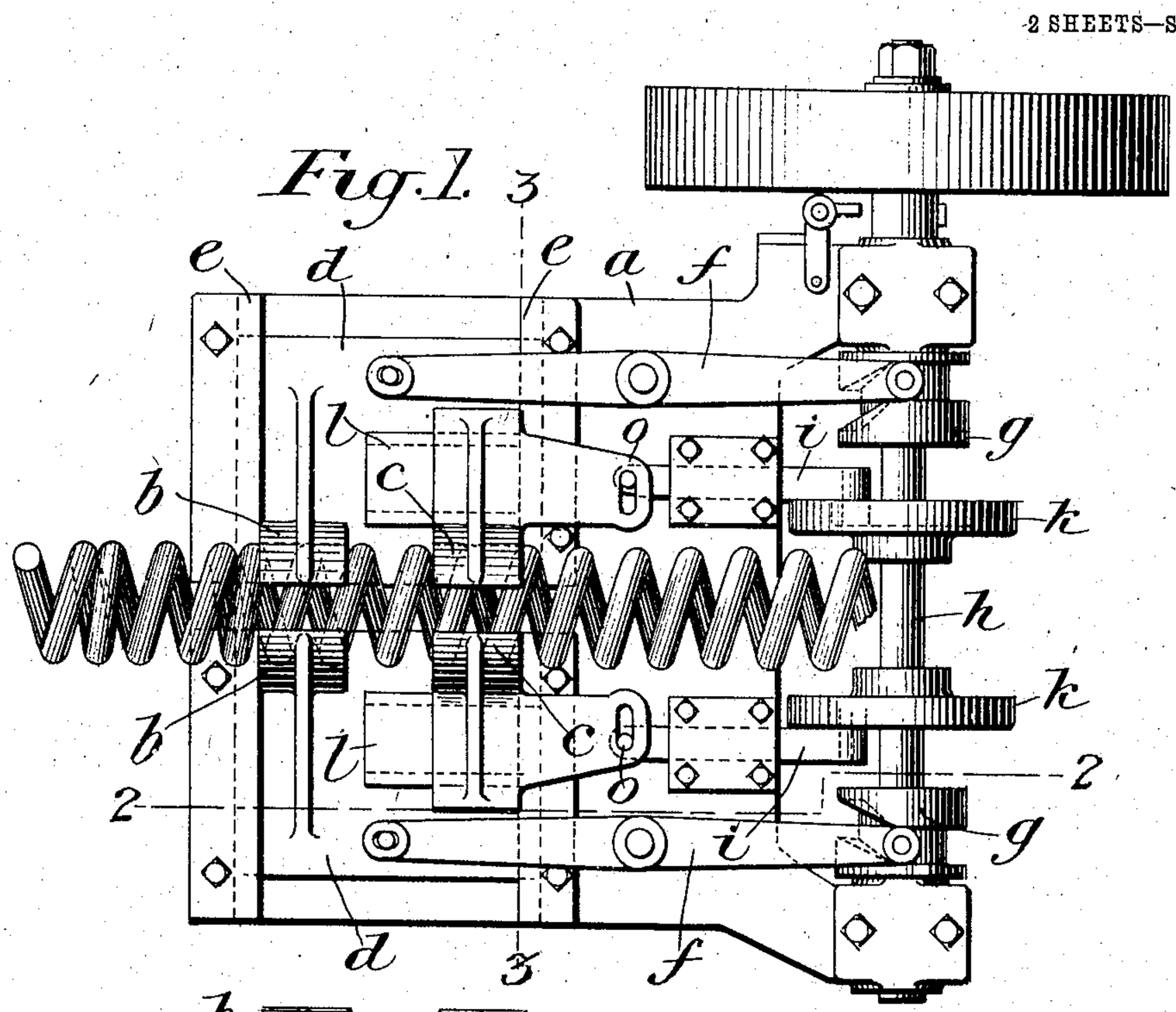
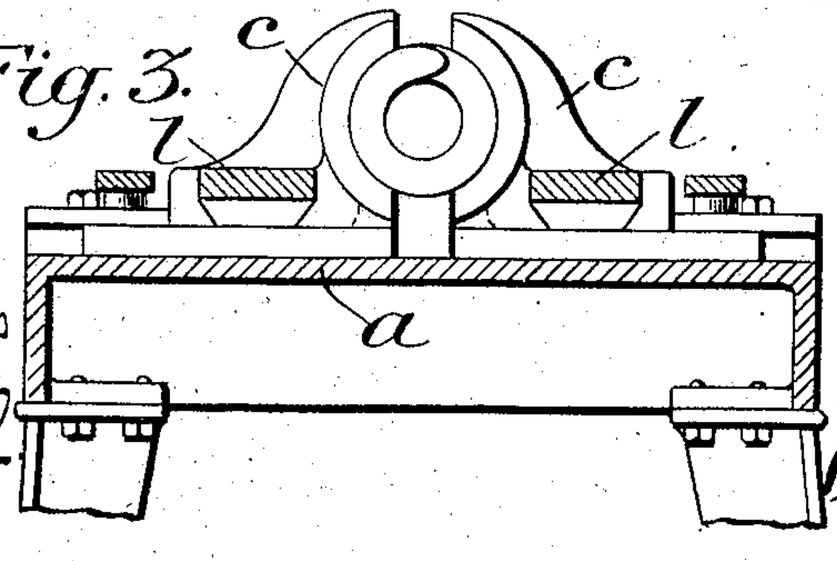


Fig. 2.

Fig. 3.



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2 SHEETS—SHEET 2.

Fig. 4.

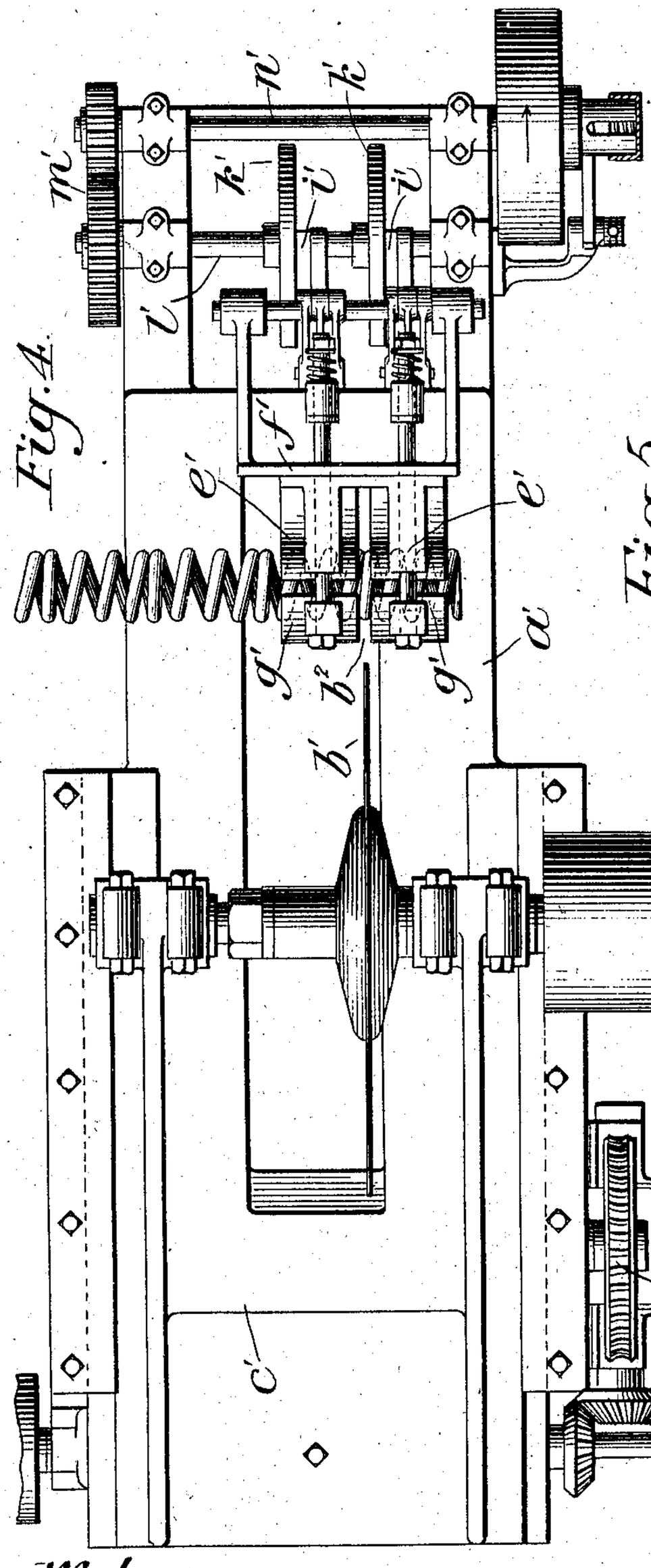
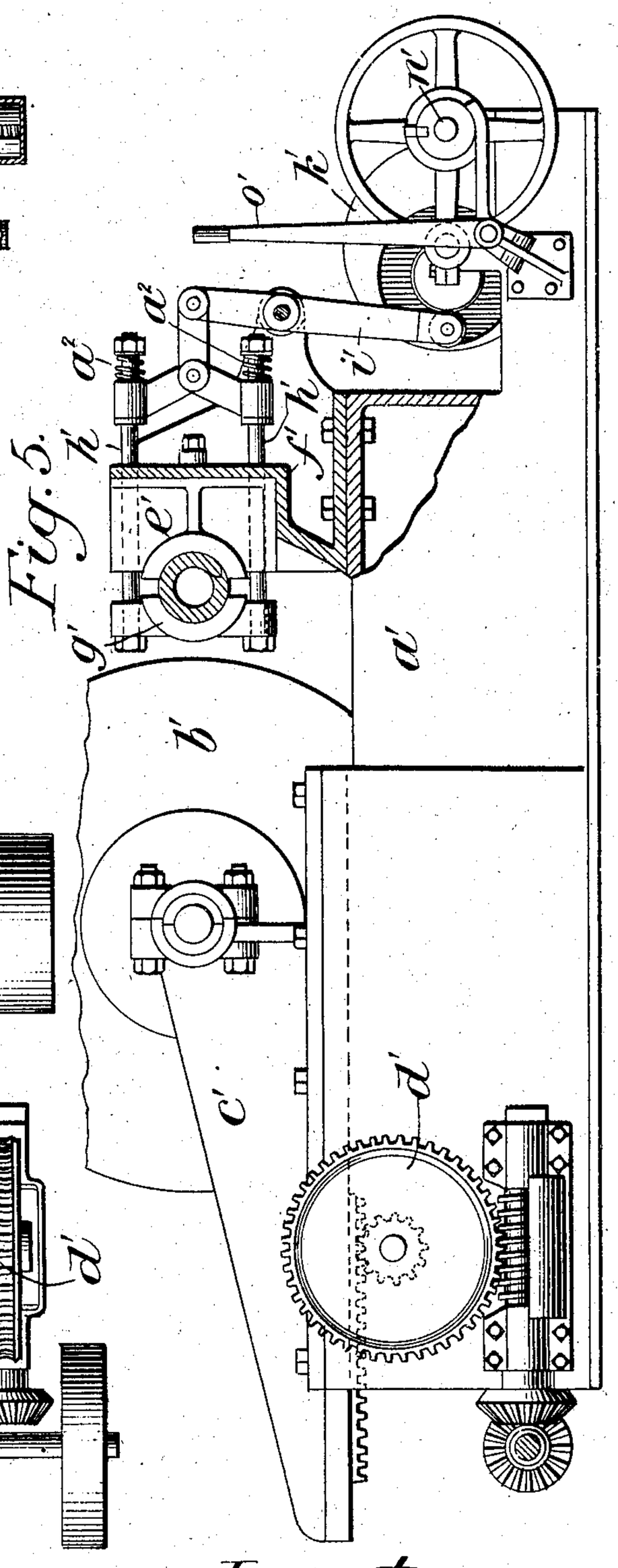


Fig. 5.



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UNITED STATES PATENT OFFICE.

FRED H. DANIELS AND CLINTON S. MARSHALL, OF WORCESTER, MASSACHUSETTS.

MANUFACTURE OF SPRINGS.

SPECIFICATION forming part of Letters Patent No. 791,753, dated June 6, 1905.

Application filed November 27, 1903. Serial No. 182,797.

To all whom it may concern:

Be it known that we, FRED H. DANIELS and CLINTON S. MARSHALL, citizens of the United States, residing in Worcester, county of Worcester, State of Massachusetts, have invented certain new and useful Improvements in the Manufacture of Springs; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

In the patent granted to us jointly with Johan O. E. Trotz on the 23d day of December, 1902, No. 716,679, we have illustrated, described, and claimed a method of making spiral coiled springs, consisting in winding a rod or wire with open convolutions of uniform pitch for a predetermined distance, continuing the winding for one or more turns with the pitch diminished, so as to close the convolutions, restoring the original open pitch of the convolutions without discontinuing the winding, and finally severing the coil by cutting clear across it in a plane at right angles to its axis at the point or points where the convolutions are closed.

The present invention is an improvement upon that of the above patent, particularly in respect of the manner of closing the convolutions and the time when the severing of the coil takes place.

Instead of closing the convolutions at intervals during the winding operation we now complete the winding before any closure of the convolutions takes place. We then pinch or compress the coil at certain points, so as to close the convolutions only where it is desired to sever the coil, and we then cut across the coil in a plane perpendicular to its axis at the points where these closures occur.

The accompanying drawings illustrate suitable machines for carrying out this method.

In the drawings, Figure 1 is a plan view of a machine for closing the convolutions of the coil at desired points. Fig. 2 is a longitudinal section of the same machine on the line 2 2 of Fig. 1. Fig. 3 is a cross-section on the line 3 3, Fig. 1. Fig. 4 is a plan of a sawing-machine for severing the coil at the points where the convolutions are closed; and Fig. 5 is a side elevation of the same, partly in section.

The coil is wound with open convolutions of uniform pitch upon any suitable coiling-machine, of which many constructions are known in the art. The coiling-machine illustrated and described in the above-mentioned patent would be suitable for this purpose with the devices for intermittently closing the coils thrown out of operation, so that the winding would proceed from one end of the coil to the other without interruption in the pitch of its convolutions.

Having wound the coil in the manner described, adjacent convolutions are closed together at whatever points it is desired to sever the coil by means of the compressing-machine shown in Fig. 1, where the bed *a* is shown provided with clamps *b b* and *c c*, each being formed in sections, as best shown in Figs. 1 and 3, so as to open to receive the coil and close to clamp it firmly. The sections of the clamps are mounted upon plates *d d*, that slide in ways on the bed-plate and are held thereto by strips *e e*, and the plates *d d* are moved toward and from each other, so as to open and close the clamps, by means of levers *f f*, which are pivoted on the bed *a* and are connected at one end with the plates and are operated simultaneously in opposite directions by means of oppositely-grooved cams *g g* on the main shaft *h* of the machine.

The clamps have cylindrical inner surfaces corresponding in diameter to the outer periphery of the coil and are of a length substantially equal to the length of the completed springs which it is desired to form. The two sections of the clamp *b b* are fixed with respect to the length of the coil; but the sections of the clamp *c c* are movable toward and from the other clamp, so that when the coil is inclosed by the two clamps the clamp *c* may be moved toward the clamp *b*, and the convolutions of the coil intervening between the two clamps will be closed together, as clearly illustrated in Fig. 1. The sections of the movable clamp *c c* are mounted upon slides *l l*, that are transversely secured to the plates *d*

d, and the clamp is moved as a whole on these slides by means of bars *i i*, which are connected to the sections of the clamp at one end and have antifriction-rollers at their other ends, which work in the grooves of cam-disks *k* on the shaft *h*, so as to slide bars *i i* in their keepers on the bed of the machine and move the clamp *c c* toward and from the fixed clamp *b b*. The connections between the sections of the clamp *c c* and their operating-bars *i i* should be such as to permit the sections of the clamp to move apart with the corresponding sections of the fixed clamp. A convenient arrangement for this purpose is shown at *o o* in Fig. 1, where it will be seen that each section of the clamp has a transverse slot into which a pin from the corresponding operating-bar projects, so that the clamp-sections are free to move sidewise relative to the operating-bars and are also at all times movable toward and from the fixed clamp by the bars.

The machine may obviously be designed to make any number of closures in the convolutions of a coil, and the distance between each closure will be the length of the completed springs that are to be made out of the coil. In Fig. 1 the closures are rather close together, and the springs are therefore comparatively short; but it will be understood that longer springs may be made by arranging the closures to come farther apart. The coil having been treated in the manner above described presents substantially the appearance shown in Fig. 4 and is then transferred to the cutting-machine illustrated in the fourth and fifth figures, where *a'* is the bed of the cutting-machine, *b'* is the saw, and *c'* a sliding carrier upon which the saw is mounted and by means of which it is fed forward during the cutting operation by a gear-train *d'*, with which the carrier is provided. At the opposite end of the machine there is provided a clamp to hold the coil during the cutting operation. This clamp is composed of fixed semicylindrical sections *e' e'*, that are secured to a bracket *f'*, erected on the bed of the machine, and movable sections *g' g'*, that are similar in construction to the fixed sections and are carried by rods *h' h'*, sliding in bearings in the bracket *f'*, to which the fixed sections are secured. The sections *g' g'* of the clamp are arranged to be moved toward and from the fixed sections, so as to open the clamp to receive the coil and close upon it to hold it during the cutting operation, and this movement of the sections *g' g'* is effected by pivoted levers *i' i'*, that are connected at their upper ends to the rods *h' h'* and are oscillated by grooved cam-disks *k' k'* on a shaft *l'*, which is connected by gearing *m'* to the main shaft *n'* of the machine and which the operator may control by a lever *o'*. The connection between the rods *h' h'* and the upper end of the levers *i' i'* preferably has springs *a*² *a*² included therein, so that the coil may be gripped in the clamp by a yielding pressure.

As will be seen in Fig. 4, the clamp for the coil is cylindrical and is arranged parallel to the shaft of the saw, so that the axis of the coil during the cutting operation will be perpendicular to the plane of the saw. The saw passes into a slit *b*² in the coil-holding clamp, and the coil is adjusted in the clamp so that one of the convolutions at the point where the coil is closed will come opposite the slit. When, therefore, the saw is fed forward, the coil is severed in a plane which is perpendicular to its axis and forms the same sort of a cut and surface that is contemplated in the patent above referred to.

As the invention herein consists wholly in the method, it is not to be understood as limited to the employment of the particular compressing and cutting machines herein illustrated, these machines being included herein merely for the purpose of illustrating the practical carrying out of the method.

The coil should be taken from the coiling-machine and put in the compressor while hot, and the best results are obtained also by sawing it while hot; but the invention is not limited to treating the coil at any particular temperature.

Having thus described our invention, what we claim is—

In the art of making spiral coiled springs, the herein-described improvement, consisting in winding a length of rod or wire into an open coil, clamping the coil at predetermined points so as to prevent certain of the convolutions from closing, squeezing or pinching the coil endwise to close the unclamped convolutions, and then severing the coil by cutting clear across it in a plane perpendicular to its axis at the points where its convolutions were closed.

In testimony whereof we affix our signatures in presence of two witnesses.

FRED H. DANIELS.
C. S. MARSHALL.

Witnesses:
A. F. BACKLIN,
T. M. LATHAM.