No. 716,681. Patented Dec. 23, 1902.

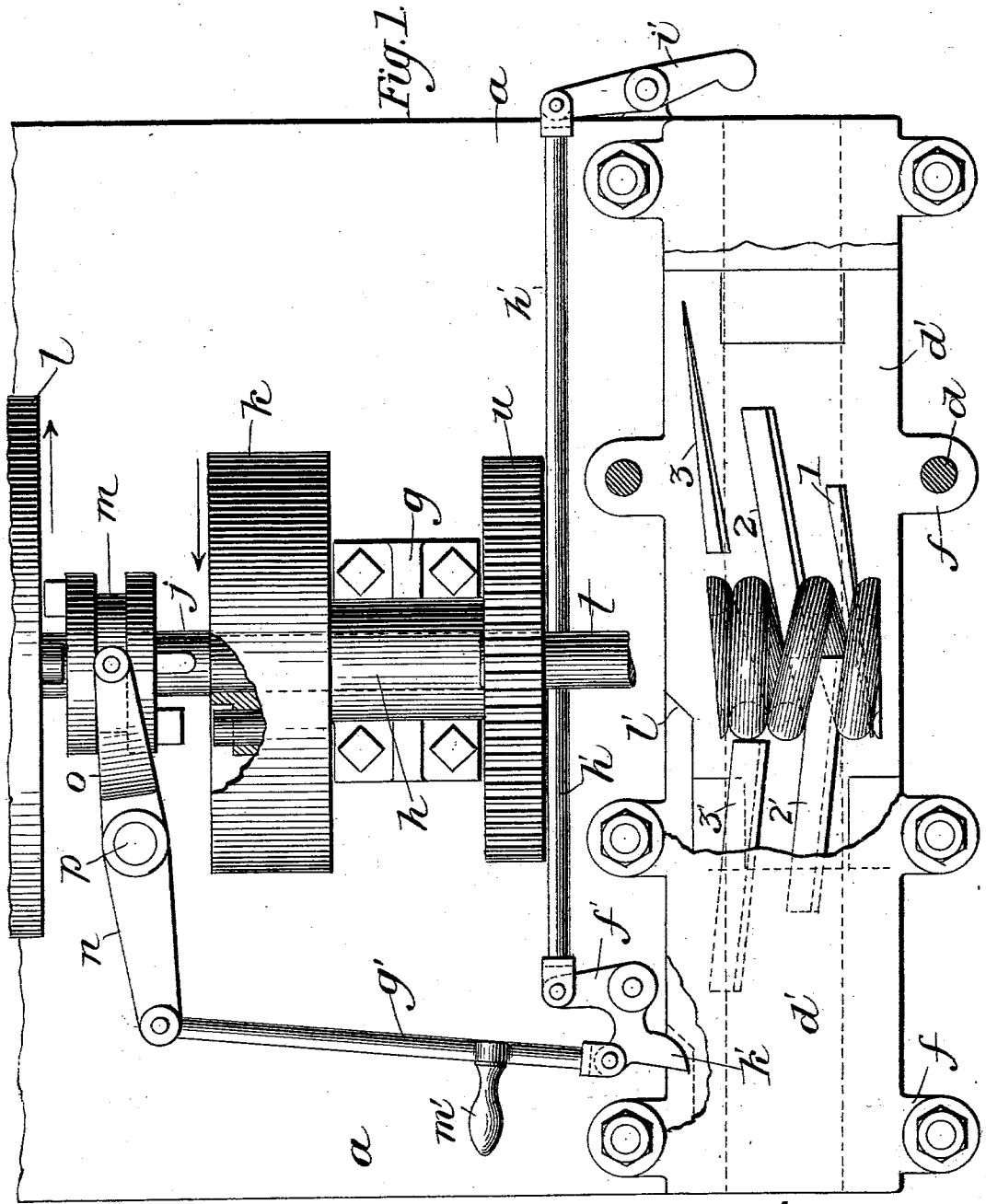
F. H. DANIELS & C. S. MARSHALL.

MANUFACTURE OF SPRINGS.

(Application filed May 6, 1902.)

(No Model.) 4 Sheets—Sheet 1.

Fig. 1.



Witnesses:
E. M. Olmsted
Chas. J. O'Neill

Inventors.
F. H. Daniels &
C. S. Marshall, by
Pennie Goodsborough
Atty's

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

No. 716,681. Patented Dec. 23, 1902.

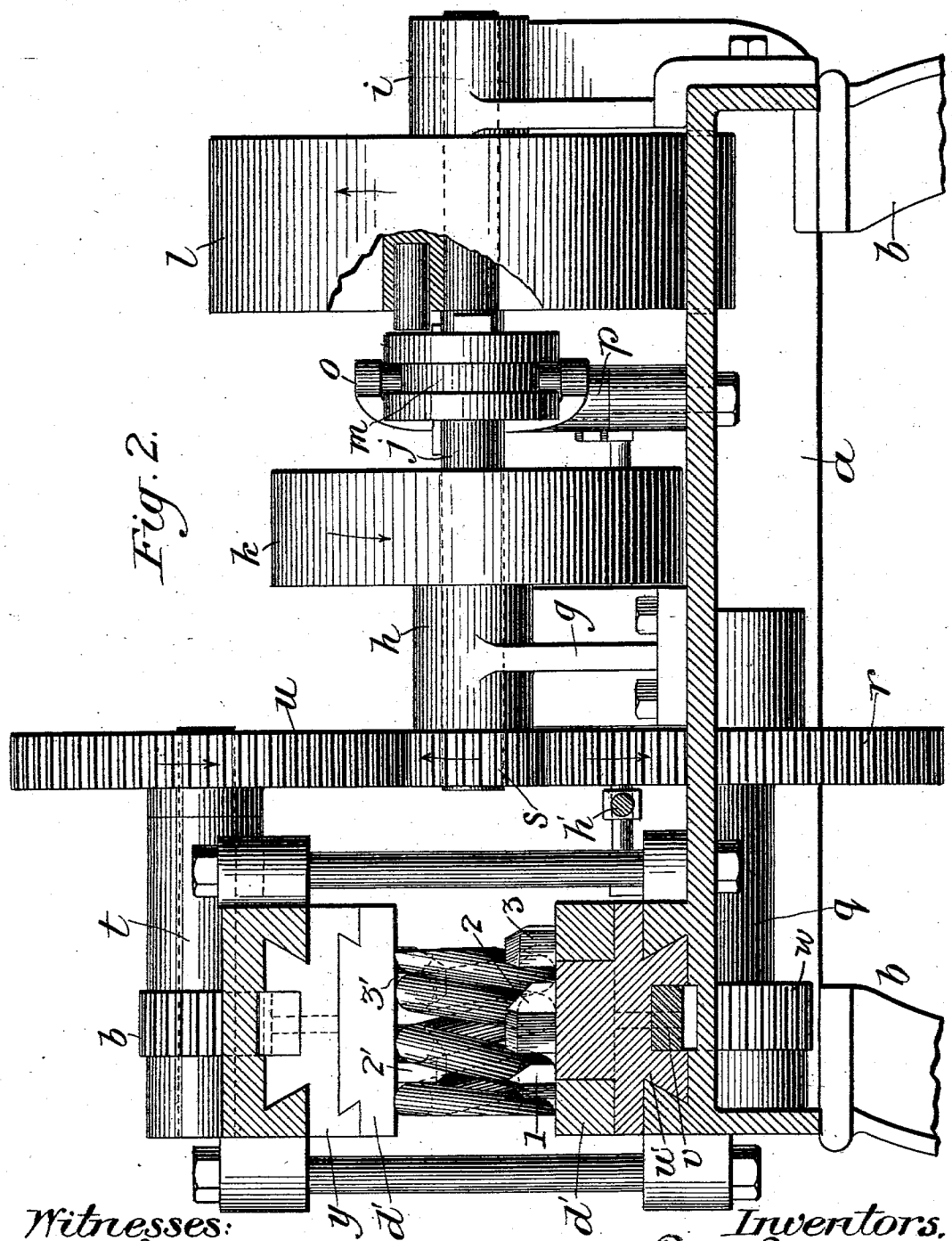
F. H. DANIELS & C. S. MARSHALL.

MANUFACTURE OF SPRINGS.

(Application filed May 6, 1902.)

(No Model.) 4 Sheets—Sheet 2.

Fig. 2.



Witnesses:
E. M. Olmsted
Chas. J. O'Neill

Inventors.
F. H. Daniels &
C. S. Marshall, by
Daniel Goldsborough.
Atty's.

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

No. 716,681. Patented Dec. 23, 1902.

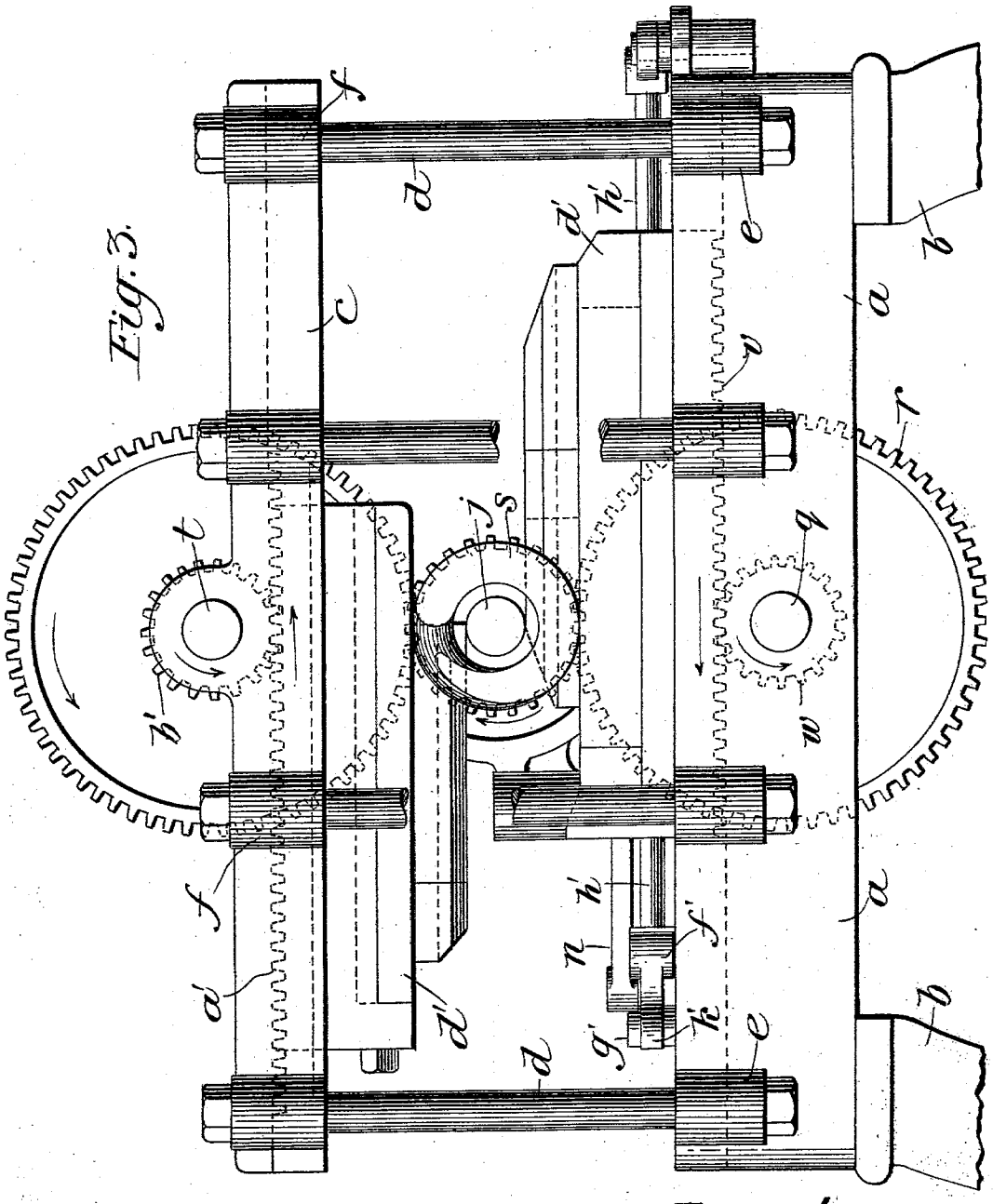
F. H. DANIELS & C. S. MARSHALL.

MANUFACTURE OF SPRINGS.

(Application filed May 6, 1902.)

(No Model.) 4 Sheets—Sheet 3.

Fig. 3.



Witnesses:
E. M. Olmsted
Chas. J. O'Neill

Inventors.
F. H. Daniels &
C. S. Marshall by
Pennie & Goldsborough,
atty's

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

No. 716,681. Patented Dec. 23, 1902.

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

MANUFACTURE OF SPRINGS.

(Application filed May 6, 1902.)

(No Model.) 4 Sheets—Sheet 4.

Fig. 4.

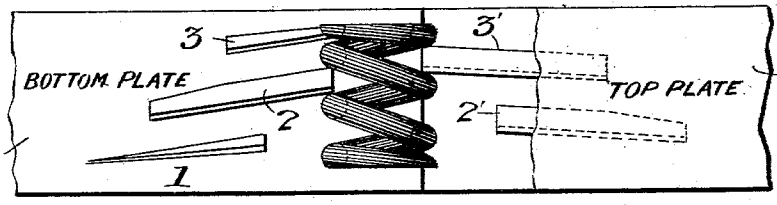


Fig. 5.

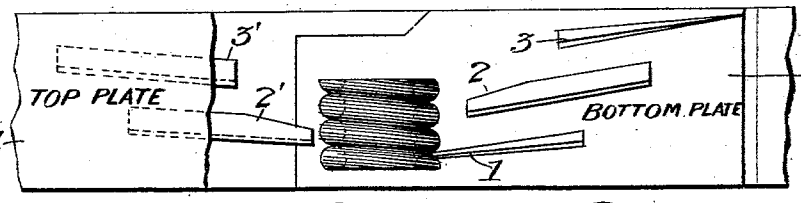


Fig. 6.

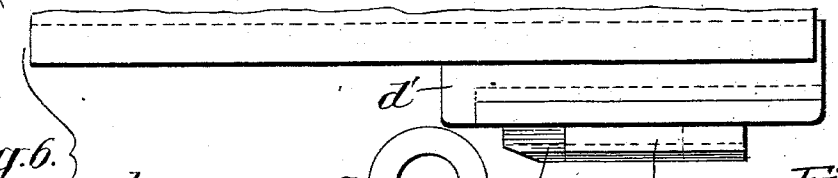
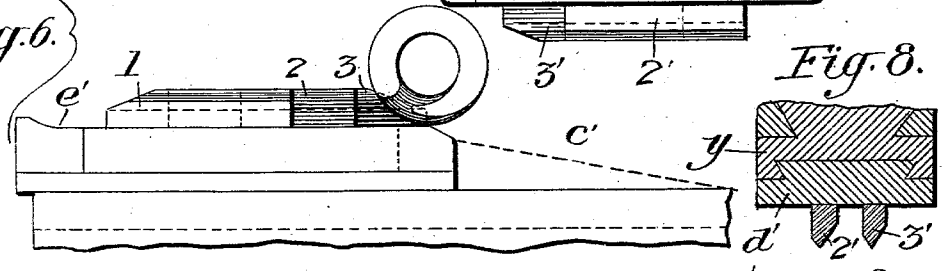


Fig. 8.



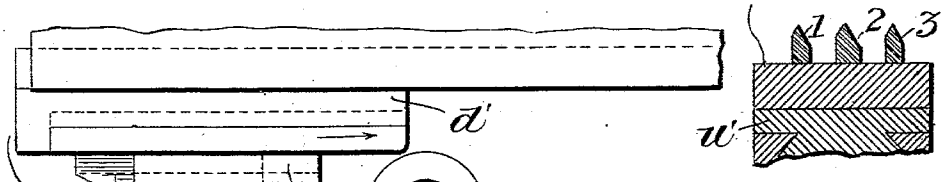
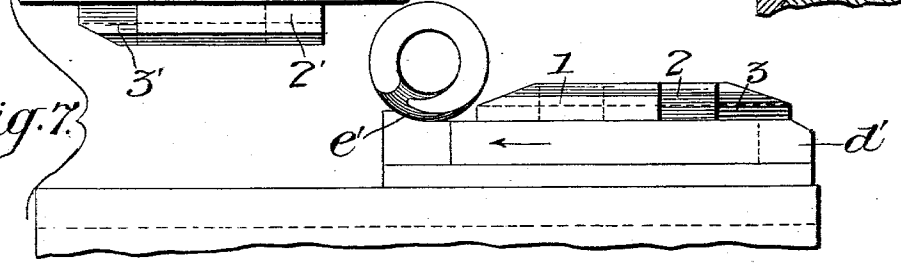


Fig. 7.



Witnesses:
E. M. Olmsted
Chas. J. O'Neill

Inventors.
F. H. Daniels &
C. S. Marshall, by
Pennie & Goldsborough Attys

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

UNITED STATES PATENT OFFICE.

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

MANUFACTURE OF SPRINGS.

SPECIFICATION forming part of Letters Patent No. 716,681, dated December 23, 1902.

Application filed May 6, 1902. Serial No. 106,201. (No model.)

To all whom it may concern:

Be it known that we, FRED H. DANIELS and CLINTON S. MARSHALL, citizens of the United States, residing at Worcester, in the county of Worcester and 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.

The present invention has been designed with a view to provide a machine for carrying out one step in the method of manufacturing spiral springs illustrated, described, and claimed in our application filed February 10, 1902, Serial No. 93,446.

The springs contemplated are open-coil compression-springs, particularly of the heavier type—such, for example, as springs for cars, vehicles, and similar purposes. According to the method described in our application above referred to, these springs are wound in the first instance in long lengths, with their coils close together, in which state they have no elasticity of compression. These long lengths are then cut up into shorter pieces appropriate for the finished springs required, and these shorter pieces are afterward subjected while hot to the action of the machine forming the subject of the present application for the purpose of separating and opening up the coils, after which the springs are ready without further treatment for the usual hardening, tempering, and japanning processes.

The machine of the present invention is illustrated in the accompanying drawings, wherein—

Figure 1 is a top plan view; Fig. 2, a vertical cross-section; Fig. 3, an end view. Fig. 4 is a plan view of the wedge-plates in the position they occupy at the completion of the operation. Fig. 5 is a similar view of the same parts at the beginning of the operation. Fig. 6 is an end view of the plates in the position of Fig. 4. Fig. 7 is an end view of the plates in the position of Fig. 5, and Fig. 8 is a cross-section of the plates and wedges.

The machine illustrated herein is designed to take a spiral spring with closed coils which have been wound in the manner above described and whose ends have been squared up at a right angle to the axis of the coils and to separate and open up the coils sufficiently to give them a permanent set without disturbing the alinement of the squared end, so that at the end of the operation the spring will be an open spiral spring adapted for compression.

The machine comprises two oppositely-moving plates, one overlying the other and both carrying wedge-shaped projections. The close-wound springs are placed between the plates when they are at opposite ends of the machines, and on the plates being moved in opposite directions the springs are caused to roll, and the wedges enter between and separate the coils. This operation is preferably performed on the springs while hot, and the coils after being thus opened up are treated in the usual way, as before described.

Referring to the drawings, *a* denotes the bed-plate of the machine, which is mounted on suitably-elevated supports *b*. At some distance above the bed *a* there is a head-plate *c*, that is supported on pillars *d*, composed of rods that are bolted to ears *e* on the side of the bed-plate and to similar ears *f* on the head-plate.

From a point near the center of the bed *a* there rises a standard *g*, carrying at its upper end a bearing *h*, which is on a level with and in line with a similar bearing *i* on the end of the bed *a*. In these bearings the main shaft *j* of the machine is journaled. The shaft *j* carries two band-wheels *k* and *l*, running loosely thereon in opposite directions, and between these wheels there is fixed to the shaft a sliding clutch *m*, that is adapted to be shifted so as to lock the shaft to either wheel. The clutch is controlled by a lever *n* on the upper end of a rock-shaft *p'*. The lever has a yoke *o* at its end, that has pins running in a groove in the clutch. The rock-shaft is preferably tubular and is secured to the bed-plate by a tie-rod passing up through it.

Under the bed *a* of the machine there is journaled a counter-shaft *q*, that has a gear-wheel *r*, by means of which it is driven from a gear-wheel *s* on the shaft *j*, and another counter-shaft *t* is journaled on the upper side

of the head-plate *c* and driven from the same gear *s* by a large gear *u*. The counter-shafts are thus driven in opposite directions by the main drive-shaft *j*, and these shafts operate the plates carrying the wedge-shaped projections, which will now be described.

The bed-plate *a* is provided with ways in which slides a dovetailed plate *u'*, having a rack *v* on its under side, that gears into a pinion *w*, fast on the front end of the counter-shaft *q*. The head-plate *c* above the bed is provided with similar ways, and a rack-plate *y*, in all respects like that of the bed-plate, slides in these ways and has a gear-rack *a'* on its upper side, that meshes with a pinion *b'* on the front end of the overhead counter-shaft *t*. Each of the rack-plates has removably attached to it a plate *d'*, carrying a number of wedge-shaped dies or flanges projecting from its surface and extending in the direction of its movement. The wedge-shaped flanges on the two plates are formed as illustrated in the drawings and are preferably arranged at a slight inclination to the length of the plates corresponding to the pitch of the the spring's coils. The arrangement of the flanges is best shown in Fig. 1, where it will be seen that they are also set such distance apart as corresponds with the thickness of the wire or rod out of which the springs are being made and that they are also arranged in graduated order so far as the movement of their plates is concerned—that is to say, instead of being abreast of one another, so as to come into action simultaneously, one is arranged somewhat behind the other, so that they overlap one another and come into action consecutively. In the accompanying drawings three of these flanges are shown on each plate; but any preferred number may be employed, depending upon the length of the spring to be made. The outer side ones are tapered, as shown in Fig. 1, constituting elongated wedges of gradually-increasing thickness. It is not necessary that the intermediate ones be tapered in this way; but they are all preferably tapered also in cross-section, as shown in Fig. 8.

Referring to Figs. 4 and 5 for a more particular description of these flanges, those on the lower plate are denoted 1, 2, and 3. There are only two on the upper plate, and they are designated 2' and 3'. The flanges are positioned on the plates at opposite inclinations, as shown in the figure, and their length will depend upon the diameter of the spring to be made. The thickness of the flanges depends, as before stated, on the size of wire or rod out of which the springs are made, and the graduated arrangement lengthwise the plates is also governed by the diameter of the spring.

A spring with its coils closed tightly together being placed in the machine at the point indicated in Figs. 2, 3, 5, and 7 and the plates being started in the direction of the arrows in Fig. 7, none of the wedges come into operation until the spring has made about one-eighth of a revolution. The wedge 1 then enters and, as the rolling continues, immediately begins to separate the end coil. After the front end of wedge 1 has passed the center line of the spring wedge 2' on the upper plate and wedge 2 on the lower plate begin almost simultaneously to enter the space between the convolutions immediately in front of wedge 1 in the direction of its relative motion. This space is already beginning to be opened up by the action of wedge 1. The plates continuing to move in opposite directions and rolling the spring over without moving it bodily, the wedge 3' on the top plate begins to enter the opened space immediately after the front ends of the wedges 2 and 2' pass the center line of the spring. The wedge 3 on the lower plate is tapered in the reverse direction to that of the wedge 1 at the opposite edge of the plate, and this wedge 3 is the last to enter between the coils, which it does immediately after the wedge 3' on the upper plate passes the center line. The wedge 3 is of course the last to leave the spring, and when its tapered end comes out from between the coils the spring has just made one complete revolution. During this revolution all the wedges have entered in the order above described, and they leave the coil in the reverse order—that is to say, the wedge 1, which was the first to enter, passes out from between the coils shortly after the butt-end of the wedge 3 has passed the center line of the spring. All three of the wedges on the bottom plate are therefore for a short period in action simultaneously on the spring. The lower wedge 2 and the upper wedge 2' move out of action simultaneously, and they cease to operate shortly after the wedge 1 leaves the spring. The two upper wedges 2' and 3' also act simultaneously on the spring for a short portion of its revolution. After the wedge 3 has passed out from between the coil at the end of the spring opposite to that where the wedge 1 entered the opening-up operation is then complete and the spring simply rolls down an incline *c'*, Fig. 6, to the hardening bath or wherever else it may be desired to deliver it.

The position of the parts when the machine is started is shown in Fig. 7, where the left-hand end of the lower wedge-plate is shown provided with a rounded depression *e'*, forming a seat for the spring. The distance between the two plates *d' d'* is governed, of course, by the diameter of the spring and is accurately adjusted so as to exert just sufficient friction on the spring to cause it to roll as the plates move, and the speed of the two plates being the same the spring rolls over and over without changing its position bodily.

When the opening-up operation is completed, the plates occupy the position shown in Fig. 6 and must be returned to their starting position before another spring can be treated. This reverse movement is effected

by means of the clutch-shipping arrangement shown in Fig. 1, though of course any automatic shipper that would answer the purpose could be used.

On referring to the first figure, it will be seen that the lever n is connected by a rod g' to one arm of a bell-crank f', that is pivoted on the bed a near the edge of the lower wedge-plate at one side of the machine. The other arm of the bell-crank is connected by a rod h' with a short lever i', that is pivoted at the opposite side of the machine and has its front end so located as to be struck by the end of the lower wedge-plate when at one extreme of its movement. The bell-crank f' has an arm k', that is also located so as to be struck by the opposite end of the lower wedge-plate, which is provided with a shoulder l' for the purpose.

It will be obvious from the illustration and description of this arrangement that the clutch m will be automatically disconnected from one of the drive-wheels k or l at the completion of each movement of the wedge-carrying plates. The reverse movement may also be effected by hand, and for this purpose a handle m' is formed on the rod g'.

Such being the construction and operation of the machine, it is to be noted that the coils of the spring are opened up without disturbing the alinement of the squared ends and that the operation is completed during one revolution of the spring, the length of the wedges and the movement of the plates being of course properly proportioned to the circumference of the spring. As here shown the spring has four coils, and the flattened ends overlap each other slightly. When the spring is put into the machine, the ends should be located as shown in Fig. 7, and as there is some little revolution of the spring before the foremost one of the wedges begins to act the tapered point of the squared end is not separated from the adjacent coil, but is left in contact with it for a short distance, so as to keep the squared seat at a right angle to the axis of the spring.

The invention is not limited to any of the details of construction here shown, and especially may the gearing for operating the plates, the connection of the plates with the machine, and the arrangement for reversing the motion, be varied, as desired.

What we claim, and desire to secure, is—

1. In a machine for separating and opening up the coils of spiral springs, the combination of wedges for insertion between the coils, and means for rotating the spring and causing the wedges to separate the coils.

2. In a machine for separating and opening up the coils of spiral springs, the combination of opposing sets of rectilinearly-moving wedges for insertion between the coils, and means for moving the wedges in opposite directions with the spring between, and thereby rotating the spring and causing the wedges to separate the coils.

3. In a machine for separating and opening up the coils of spiral springs, the combination of a pair of oppositely-disposed plates located at such distance apart as to receive the springs between them, each plate being provided on its face with a series of wedges arranged lengthwise the plate at an angle to its line of movement, with intervening spaces between individuals of the series, and means for moving the plates in opposite directions.

4. In a machine for separating and opening up the coils of spiral springs, the combination of a pair of oppositely-disposed plates located at such distance apart as to receive the springs between them, each plate being provided on its face with wedges arranged lengthwise the plate, with intervening spaces between them, said wedges being set at an angle to the line of movement of the plate, and having their ends overlapping, and means for moving the plates in opposite directions with the spring between.

5. In a machine for separating and opening up the coils of spiral springs, the combination of a pair of endwise-moving plates located at such distance apart as to receive the springs between them, series of wedges on the adjacent faces of each plate, and means for moving the plates in opposite directions to roll the springs between them, the individual wedges of each series being located transversely across the plate with intervening spaces between, and being located longitudinally of the plate, one in advance of the other and with their ends overlapping.

6. In a machine for separating and opening up the coils of spiral springs, the combination of a pair of endwise-moving wedge-carrying plates arranged one over the other and provided with toothed racks, counter-shafts having pinions engaging the racks, a drive-shaft having a pinion on one end meshing with gears on the counter-shafts so as to move the plates in opposite directions, oppositely-rotating drivers loose on the drive-shaft, a clutch to connect either driver to the shaft, and a shipper mechanism operated by one of the wedge-carrying plates when it reaches the end of its movement.

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

FRED H. DANIELS.
CLINTON S. MARSHALL.

Witnesses:
WILLIAM H. MORSE,
JAMES W. SMITH.