No. 791,751. PATENTED JUNE 6, 1905.

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

MANUFACTURE OF SPRINGS.

APPLICATION FILED NOV. 27, 1903.

3 SHEETS—SHEET 1.

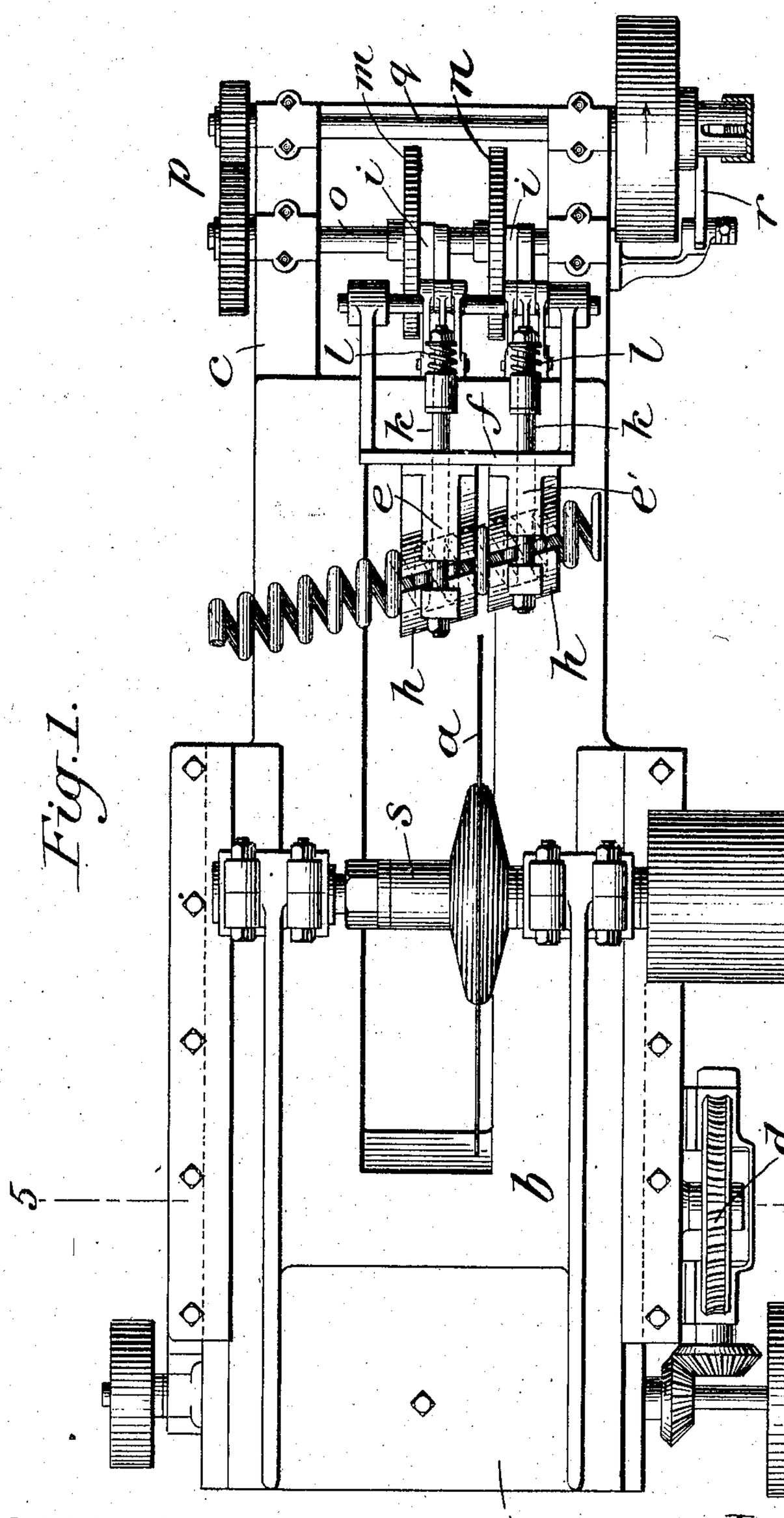


Fig. 1.

Witnesses:
W. Beall Williams.
J. E. Hutchinson Jr.

Inventors
F. H. Daniels and
C. S. Marshall
By their attys.
Munn & Goldsborough.

No. 791,751. PATENTED JUNE 6, 1905.

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

MANUFACTURE OF SPRINGS.

APPLICATION FILED NOV. 27, 1903.

3 SHEETS—SHEET 2.

Fig. 2.

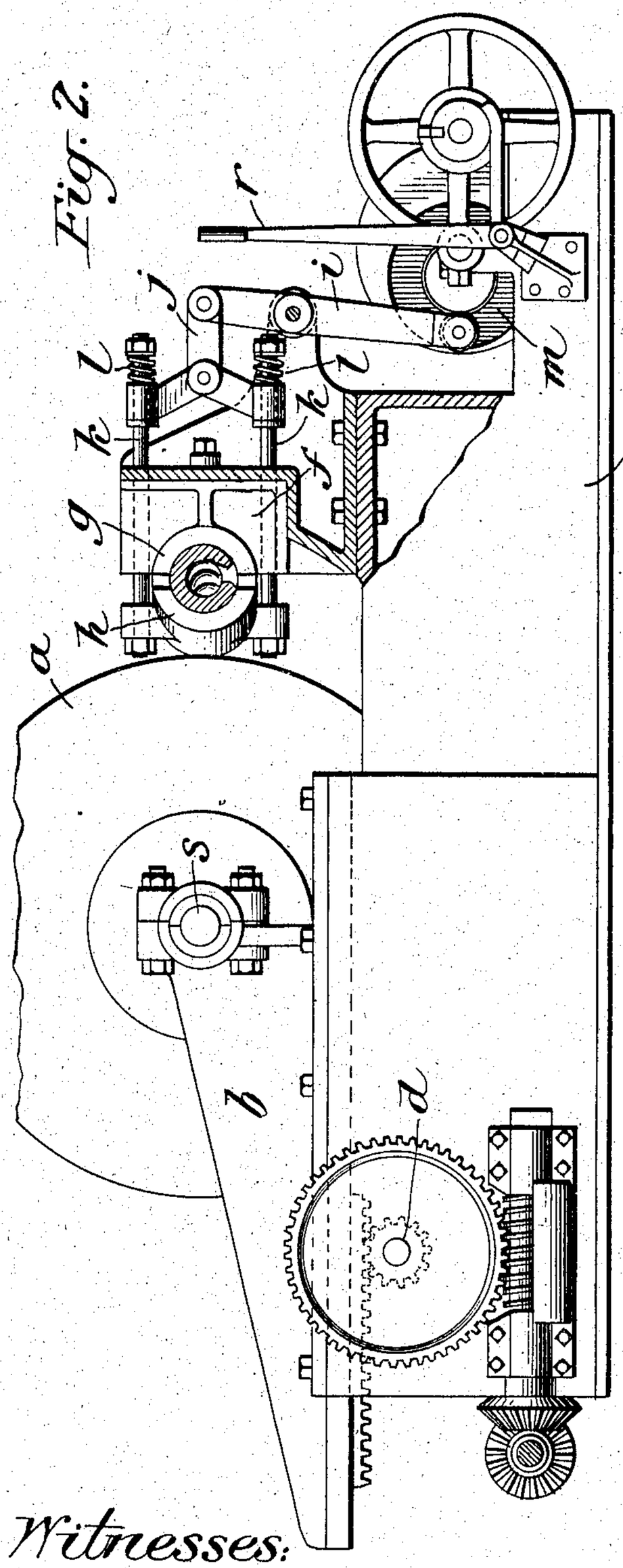
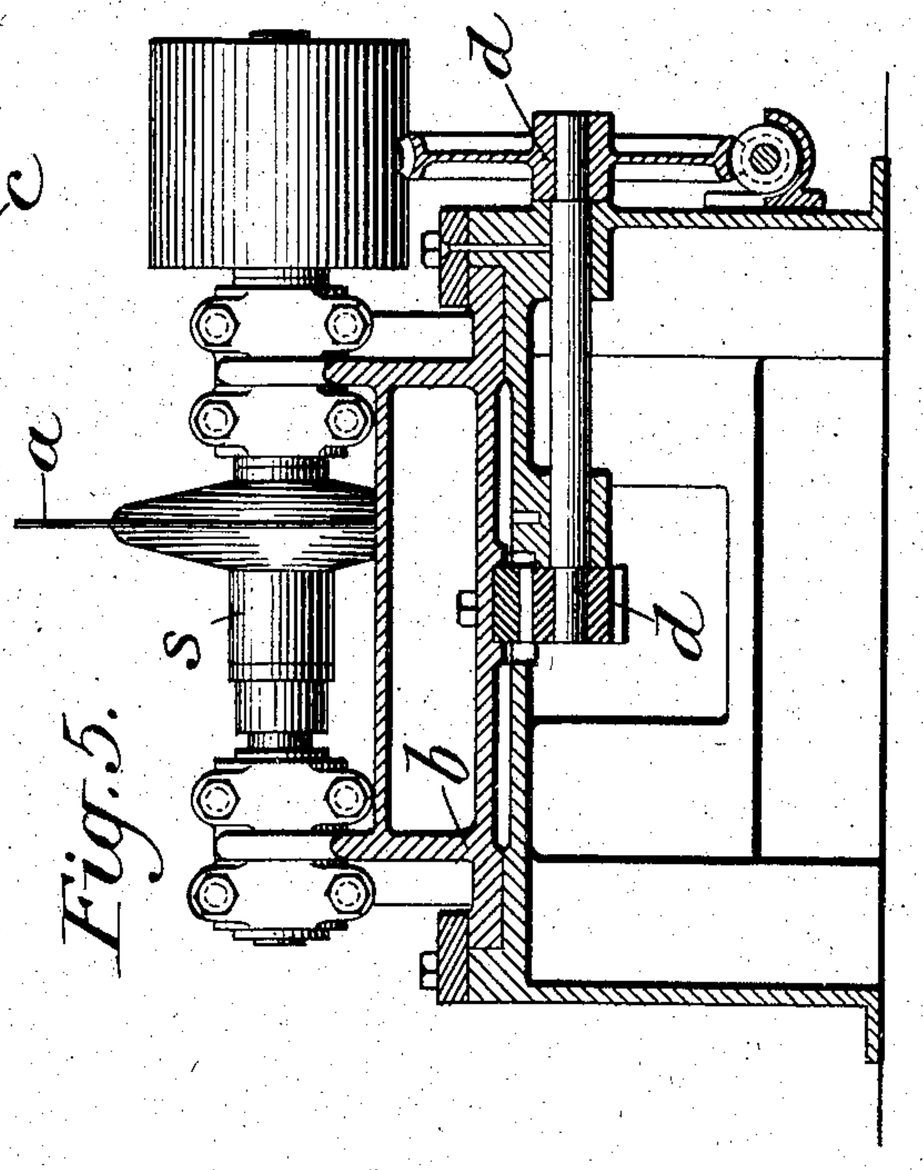


Fig. 5.



Witnesses:
W. Beall Williams.
J. E. Hutchinson Jr.

Inventors.
F. H. Daniels and
C. S. Marshall
By their attys.
Pennie & Goldsborough

No. 791,751. PATENTED JUNE 6, 1905.

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

MANUFACTURE OF SPRINGS.

APPLICATION FILED NOV. 27, 1903.

3 SHEETS—SHEET 3.

Fig. 3.

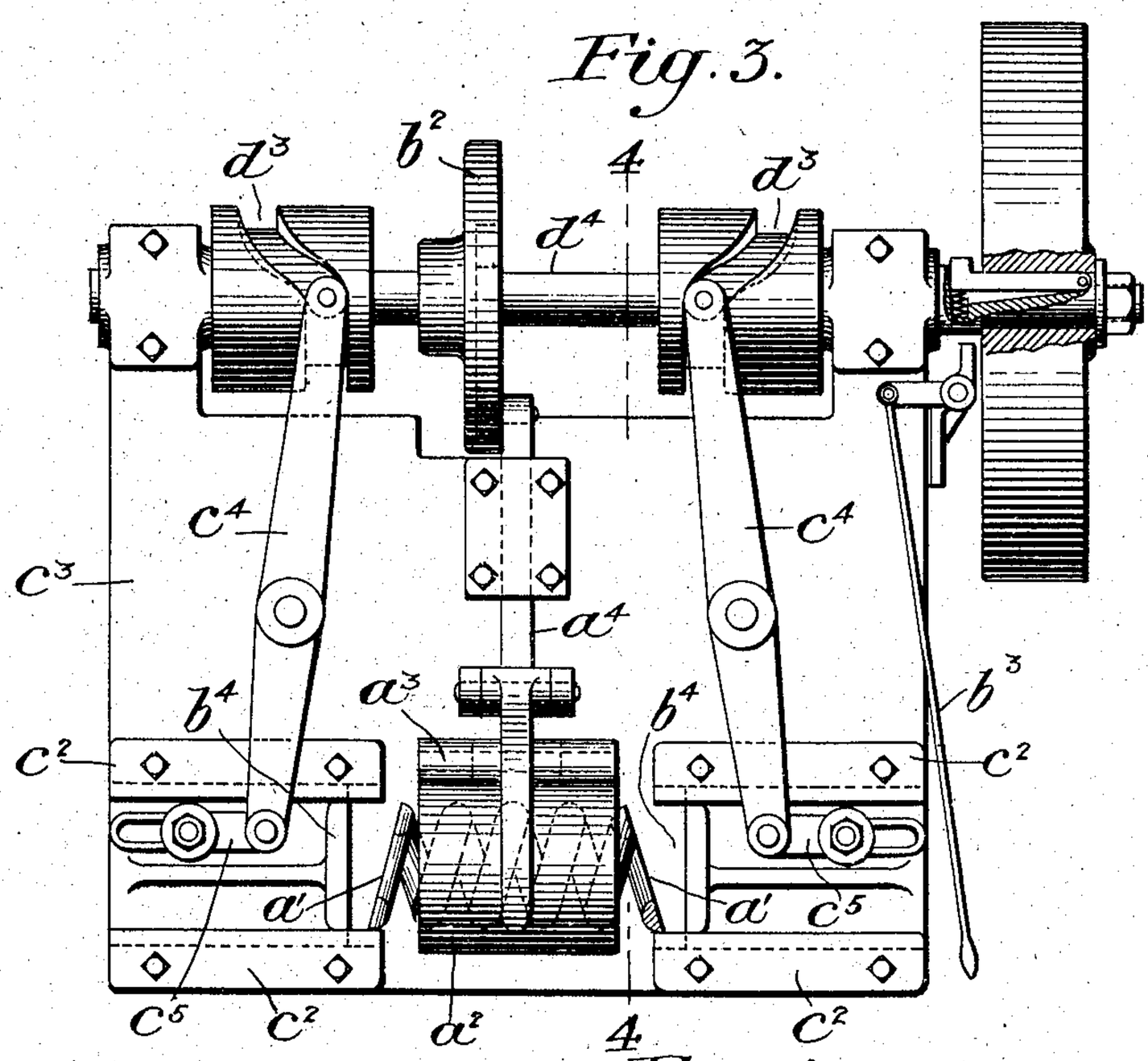
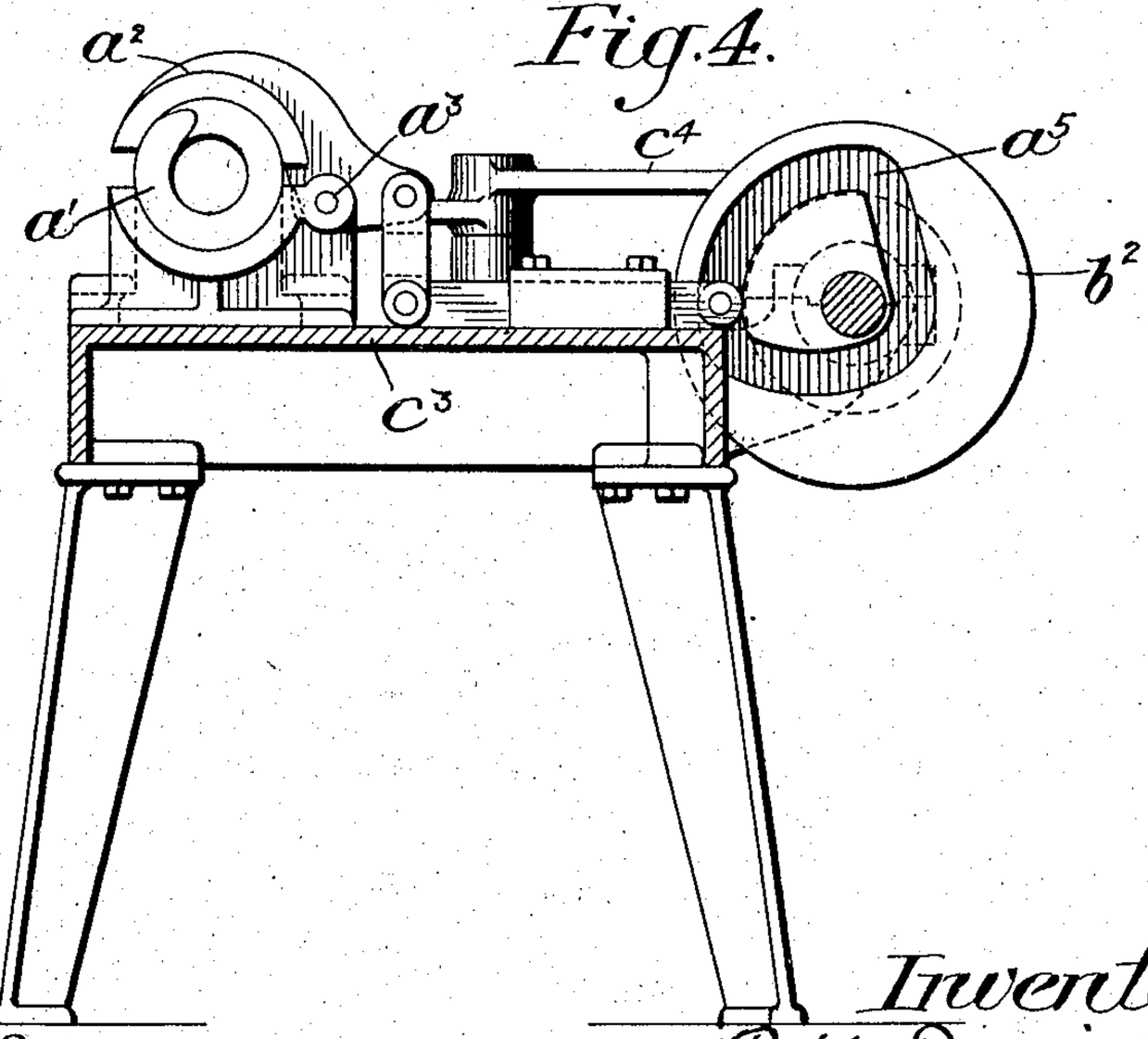


Fig. 4.



Witnesses:
W. Beall Williams
J. E. Hutchinson Jr.

Inventors.
F. H. Daniels and
C. S. Marshall
By their attys.
Dennie & Goldsborough

No. 791,751. Patented June 6, 1905.

UNITED STATES PATENT OFFICE.

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

MANUFACTURE OF SPRINGS.

SPECIFICATION forming part of Letters Patent No. 791,751, dated June 6, 1905.

Application filed November 27, 1903. Serial No. 182,795.

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.

In an application filed by us of even date herewith we have illustrated, described, and claimed an improvement upon the invention of the above patent, consisting generally in completing the winding before any closure of the convolutions takes place, pinching or compressing the coil so as to close the convolutions where it is desired to sever the coil, and then cutting across the coil in a plane perpendicular to its axis where the closed convolutions occur.

The present invention is an improvement upon those of the above patent and application, particularly in respect of the time and manner of severing the coil.

Instead of closing the convolutions before the coil is severed and cutting the coil in a plane perpendicular to its axis we now complete the winding operation with the convolutions of uniform pitch throughout, then sever the coil by cutting across it in a plane that is oblique to its axis, and finally close the end convolutions, so as to bring the plane of cut perpendicular to the axis of the coil.

The accompanying drawings illustrate apparatus for carrying out the present invention.

In these drawings, Figure 1 is a plan view of a machine for cutting the coil obliquely. Fig. 2 is a side elevation of the same. Fig. 3 is a plan view of a machine for closing the convolutions adjacent to the severed ends of the coil. Fig. 4 is a section on the line 4 4, Fig. 3; and Fig. 5 is a cross-section on the line 5 5, Fig. 1.

The coil is wound in the usual way with open convolutions of any desired pitch. Any suitable machine may be employed for this purpose. Many such machines are known at the present time. If preferred, the winding-machine illustrated and described in the patent above referred to may be employed, the mechanism for closing the windings at predetermined points being thrown out of action, so as to wind the entire coil with a uniform open pitch.

After the coil is wound in the manner described it is placed on the machine shown in Figs. 1 and 2 of the present drawings, where *a* denotes a saw, which is mounted upon a sliding carriage *b* and revolved at a high speed, as usual in metal-sawing machines. The carriage *b* is mounted upon one end of the frame *c* of the machine and is provided with a gear-train *d* for feeding the saw forward.

At its opposite end the machine is provided with clamps *e e'*, that are preferably cylindrical on their inner surfaces and have an interior diameter corresponding to the exterior diameter of the coil. The clamps are mounted in a bracket *f*, which is bolted or otherwise secured to the frame *c*, and each clamp consists of a fixed semicylindrical piece *g* and a similar movable piece *h*, which is set opposite to the fixed piece and is adapted to be moved toward and from the latter by means of levers *i i*, pivoted to the bracket *f* and connected at their upper ends, preferably by links *j j*, to rods *k k*, that are connected to the movable pieces *h h* of the clamps, springs *l l* being preferably interposed between the connection

of the rods *k k* with the levers *i i*, so as to cause the coil to be held in the clamps with a yielding pressure. The levers *i i* have anti-friction-rollers at their lower ends working in cam-grooves *m* in the sides of disks *n n*, that are mounted upon a counter-shaft *o*. This shaft is connected by gearing *p* to the driving-shaft *q*, whose motion is controlled by the operator, a hand-lever *r* being provided for this purpose.

As best shown in Fig. 1, the clamps *e e'* are set at an angle to the shaft *s* of the saw, so that the coil will be held on a line that is oblique to the plane of the saw. The angle of the clamps to the shaft of the saw corresponds to the angle which the convolutions of the coil make to the coil's axis, so that the plane of the saw will pass lengthwise through a convolution for a distance equal to the diameter of the coil in contradistinction to making a short cut transversely across the convolution, as would be the case were the plane of the saw perpendicular to the axis of the coil. The clamps are opened and closed once for every revolution of the counter-shaft *o*, and the coil is inserted endwise into the clamps and held there until the saw has been fed forward sufficiently to cut clear across the coil. The clamps are preferably made long enough to embrace the coil for a considerable portion of its length and are best located so as to leave only sufficient space between them for the saw to work freely. When the coil has been cut by the saw, its ends will be left as best shown in Fig. 3—that is to say, with a long flat surface *a'* on each end convolution which is oblique to the axis of the coil. The next step in the method is to bring these flat surfaces into planes that are perpendicular to the coil's axis, because as these surfaces are to form the seats upon which the coil stands it is necessary that they should be perpendicular to the axis of the coil. We therefore take the cut sections of the coil from the sawing-machine of Fig. 1 to the compressing-machine of Figs. 3 and 4, where the body of each coil-section is clamped in a cylindrical clamp a^2 throughout its length, except the convolutions at the extreme ends. The clamp a^2 is similar in construction and function to the clamps of the sawing-machine—that is to say, it has a cylindrical inner surface having a diameter corresponding to the exterior diameter of the coil—so that when the coil is closed in the clamp all the convolutions will be held against closing, excepting only those at the extreme ends, which are outside of the clamp. The clamp of the compressing-machine should be practically of the length of the completed spring, and its movable section is preferably hinged at a^3 and operated by means of a slide a^4, that is moved to and fro by a cam-groove a^5 in the side of a disk b^2 on the main shaft of the machine. This shaft is operated by any suitable means, the rotation of which the operator may control by a clutch b^3. In connection with the clamp a^2 two sliding jaws b^4 b^4 are provided to pinch or compress the free end convolutions of the coil against the body of the coil which is inclosed in the clamp. These jaws are mounted to slide in ways c^2 c^2 on the bed c^3 in line with the clamp a^2, and they are operated so as to close together and compress the convolutions of the coil by levers c^4 c^4, that are pivoted on the machine-bed, and are connected to them by adjustable links c^5 c^5, the levers being operated in unison in opposite directions by means of oppositely-disposed cam-grooves d^3 d^3 in hubs that are fixed upon the main shaft d^4.

Having now described suitable machines for carrying out the present invention, it is to be understood that the improved method embraced herein is not limited to the employment of these or any particular machines for cutting the coil or closing the end convolutions.

It will be understood, of course, that the cutting and pinching or compressing operations above described are preferably performed on the coil while it is hot. The invention, however, is not limited to these details.

Having thus described our invention, what we claim, and desire to secure, is—

1. In the art of making spiral coiled springs, the herein-described improvement, consisting in winding a rod or wire into an open coil, severing the coil in a plane oblique to its axis, and closing the convolutions adjacent to the severed end so as to bring the plane of cut perpendicular to the axis of the coil.

2. In the art of making spiral coiled springs, the herein-described improvement consisting in winding a length of rod or wire into a coil with open convolutions, cutting clear across the coil in the oblique plane of one of the convolutions so as to cut the coil into a plurality of parts, clamping one of the severed parts for nearly its entire length leaving only the end convolutions unclamped, and squeezing the coil endwise till the unclamped end convolutions are closed against the others.

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

FRED H. DANIELS.
CLINTON S. MARSHALL.

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