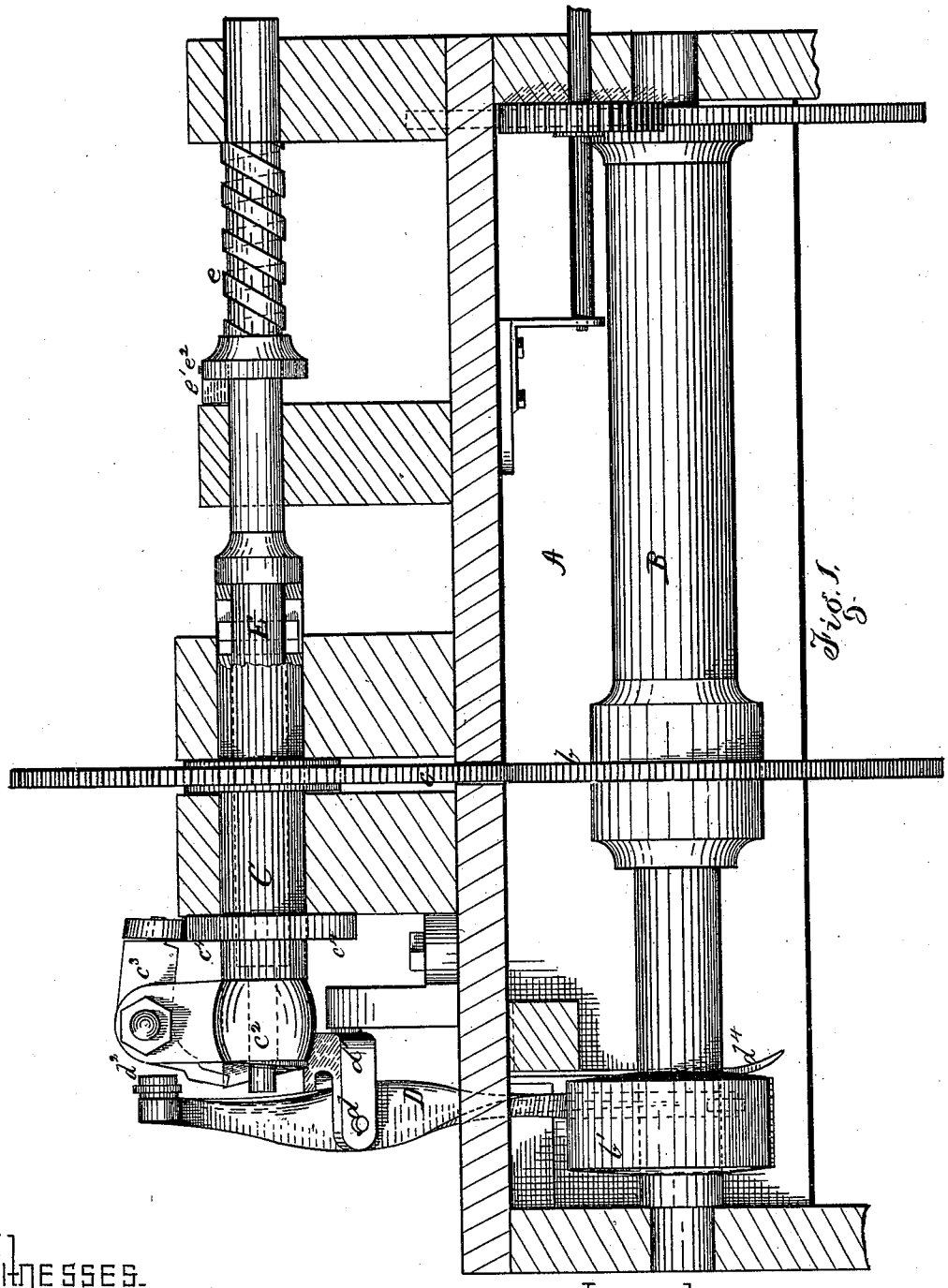
2 Sheets—Sheet 1.

W. METCALF.

MACHINES FOR FORMING SPRING-WASHERS.

No. 175,484. Patented March 28, 1876.



Witnesses.

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R. C. Winchell

Inventor.

William Metcalf

by Bakewell & Kerr

Attys

2 Sheets—Sheet 2.

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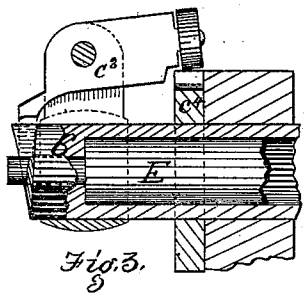

Fig. 3.

Fig. 2.

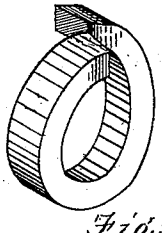

Fig. 5.

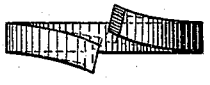

Fig. 6.

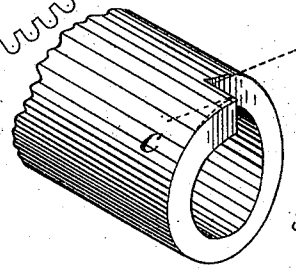

Fig. 4.

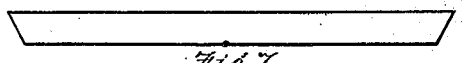

Fig. 7.

WITNESSES.

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UNITED STATES PATENT OFFICE.

WILLIAM METCALF, OF PITTSBURG, PENNSYLVANIA, ASSIGNOR TO METCALF, PAUL & CO.

IMPROVEMENT IN MACHINES FOR FORMING SPRING-WASHERS.

Specification forming part of Letters Patent No. **175,484**, dated March 28, 1876; application filed December 13, 1875.

To all whom it may concern:

Be it known that I, WILLIAM METCALF, of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Machine for Forming Spring-Washers; and I do hereby declare the following to be a full, clear, and exact description thereof, reference being had to the accompanying drawing, forming part of this specification, in which—

Figure 1 is a side elevation of a machine embodying my improvements, portions of the frame being in section. Fig. 2 is an end view of the same, showing the die-face and forming-lever. Fig. 3 is a side elevation of a portion of the die and the griper, partly in section. Fig. 4 is a perspective of the end and face of the die. Figs. 5, 6, and 7 are views of a spring-washer and blank for forming the same.

Like letters refer to like parts wherever they occur.

My invention relates to machinery for bending and shaping spring-washers, and for similar purposes, by winding a blank around a revolving mandrel and against the face of a suitably-shaped die, as hereinafter described.

This invention is an improvement on the machine shown in Letters Patent No. 159,232, granted to Samuel Tretheway January 26, 1875. In that machine two helical-faced dies were employed to bend the blank, and the feed being central, and somewhat obstructed by the frame, the operator was in the main guided as to the time of feeding in the blank by the clicking sound caused by the withdrawal and return of the mandrel. As a consequence an occasional blank would be improperly fed, and the machine would foul and have to be stopped. The time of the feed and discharge being identical and very limited necessitated the employment of skilled labor to feed the machine, and even then many revolutions of the machine were lost.

The object of the present invention is, first, to avoid the central feed; second, to simplify the machine by dispensing with one of the helical-faced dies; third, to obviate all tendency of the machine to foul; fourth, to obtain an appreciable space of time for the discharge of the spring-washer and feeding in of the blank during each revolution; and, fifth, to insure forming or shaping pressure upon all parts of the blank.

I will now proceed to describe the devices by which I obtain the specified results, so that others skilled in the art to which it appertains may apply my invention.

In the drawings, A indicates the frame or bed of the machine, in which is journaled the shaft B, provided with a pinion, *b*, and cam *b'*, the former gearing with a pinion, *c*, upon the die C, and the cam operating a bent forming-lever, D, pivoted on the frame A. C is a die, journaled in suitable bearings on the frame A, and provided with a pinion, *c*, which gears with pinion *b* of the power-shaft, the pinions *c b* being mutilated at certain points, for reasons hereinafter specified. Through the axis of die C passes a mandrel, E, which projects beyond the face of the die, and is held forward by a spring, *e*, and withdrawn by cams e^1 e^2 upon the mandrel and upon the frame or bearing. The mandrel is caused to revolve with the die by a slot and pin, as shown, by a spline, or in other suitable manner. Secured to the die C, near its face, is a collar, c^2, to which is pivoted a lever or griper, c^3, operated by a cam, c^4, fixed on the frame or bearings of the die C. Die C has an inclined face, of helical form, but not necessarily a true helix, as will be seen by referring to Fig. 4, in which the dotted line represents the true helix, the full line indicating the curve given to the face of the die, which is a departure from a true helix. D is a forming-lever, pivoted at D to a block or arm, d^1, which is journaled on the main frame, so that the forming-lever is capable of motion in line with the axis of the die, and also to and from the axis of the die, the first motion enabling it or a forming-roll, d^2, to follow the curve of the die-face, the second motion enabling it to move from the axis of the die and out of the way of the gripe at the time of feeding in the blank, and toward the axis of the die after the blank has been fed in, so as to sweep or bend the blank against the mandrel. These several motions of the forming-lever and its friction or forming roll d^2 may be obtained by means of a cam, *b'*, and springs d^3 d^4, or other suit-

able and well-known devices. d^2 is a forming-roll, journaled on the end of the forming-lever D, and operating with the die C. This roll I prefer to form with a collar about midway of the roll, so that the roll can be reversed when worn, or when other reasons render it desirable so to do.

It is evident that the end of the lever, or a projection thereon, might be substituted for the roll, to operate with the helical-faced die; but for reasons well known to mechanics the roll is preferable.

The operation of my machine is as follows: The several devices being in the position shown in Fig. 1—that is to say, the mandrel projecting slightly beyond the face of the die, the griper retracted, the forming-lever and its forming-roll raised or moved away from the axis of the die (to the initial position, marked by the letter *i* in Fig. 2,) and the mechanism at an appreciable rest, owing to the juxtaposition of the mutilated portions of pinions *b c*—the blank, which is a piece of straight steel rod of proper length, and having beveled ends, is fed in under the forming-roll, and (the mutilated portions of the pinions having passed) the end of the blank is seized by the griper and held against the mandrel. The instant after the griper has been brought into action by the movement of the die the forming-lever is operated by the cam on the power-shaft, so as to bring the forming-roll toward the axis of the die and into its final position (*f*, Fig. 2) behind the gripe, thus bending the blank against the mandrel and helical face of the die with a sweeping motion which relieves the griper from undue strain. The final position of the bending-roll being, as shown, behind the gripe and in advance of the discharge, the tail of the blank is firmly pressed against the mandrel, insuring the formation of a circular washer in less than one revolution of the machine. The instant the tail of the blank has passed under the forming-roller the cam of the power-shaft releases the forming-lever and the forming-roll moves away from the axis of the die, out of the line of feed and into the initial position, the mandrel being at the same instant retracted by its cams to discharge the washer, and again forward by its spring. The mutilated portions of the pinions being again in juxtaposition, an appreciable arrest of motion results, which gives ample time for accurately feeding in the blank.

If the face of the die is a true helix, the spring-washer formed would likewise be a true helix, but, as has been before specified, the face of the die may be curved from the helical line, so as to form a spring-washer having projecting points at the cut, such washer being the subject of a separate application of even date herewith.

The advantages of the present machine are, first, that the central feed is avoided and a clear feeding-space obtained; second, owing to the manner of operating the device which acts with the die in forming the blank, the blank is never pulled from the griper, or undue strain put upon the griper; third, owing to the same construction, every revolution of the machine can be utilized to form a washer; fourth, ample time is obtained in which to discharge the washer and to feed in the blank without losing a revolution of the machine; and, finally, the machine cannot foul, for the reason that, should the griper fail to seize the end of the blank, the blank would pass through between the face of the die and forming lever or roll, the same as between two rolls escaping from the machine.

Wherever, in the specification or claims, I use the terms "forming or bending roll," I wish to be understood as including a device which coacts with the die, said device being capable of movement in line with and to and from the axis of the die, for the purposes specified, having used the term "forming-roll" for clearness, and because a roll is best adapted to the purpose.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. The combination of a revolving mandrel, carrying a helical-faced die concentric therewith, with a forming or bending lever or roll capable of motion toward the axis of the mandrel as well as toward the face of the die.

2. The combination of a die, having inclined or helical face, with a forming or bending roll that is caused to press the blank against the face of the die, substantially as described.

3. The combination of a rotating mandrel and helical die for shaping the blank, with a tool for pressing the blank against the face of the die, as well as sweeping it at the same time around the mandrel, substantially as described.

4. The combination of a helical-faced die, having a central mandrel revolving therewith, but capable of retraction for the discharge of the finished article, with a griper for holding the blank against the mandrel and up to the face of the die, and a forming or bending tool whereby the blank is forced to conform to the face of the die, substantially as described.

5. The combination of the revolving helical-faced die, concentric with a central mandrel, the griper mounted on and moving with said die, the fixed cam for operating the griper, and the forming-lever acting with the helical-faced die for forming the blank thereon, substantially as described.

In testimony whereof I, the said WILLIAM METCALF, have hereunto set my hand.

WILLIAM METCALF.

Witnesses:
F. W. RITTER, Jr.,
T. B. KERR.