(No Model.) 3 Sheets—Sheet 1.

H. W. ARMSTRONG.

MACHINE FOR MAKING WASHERS.

No. 284,707. Patented Sept. 11, 1883.

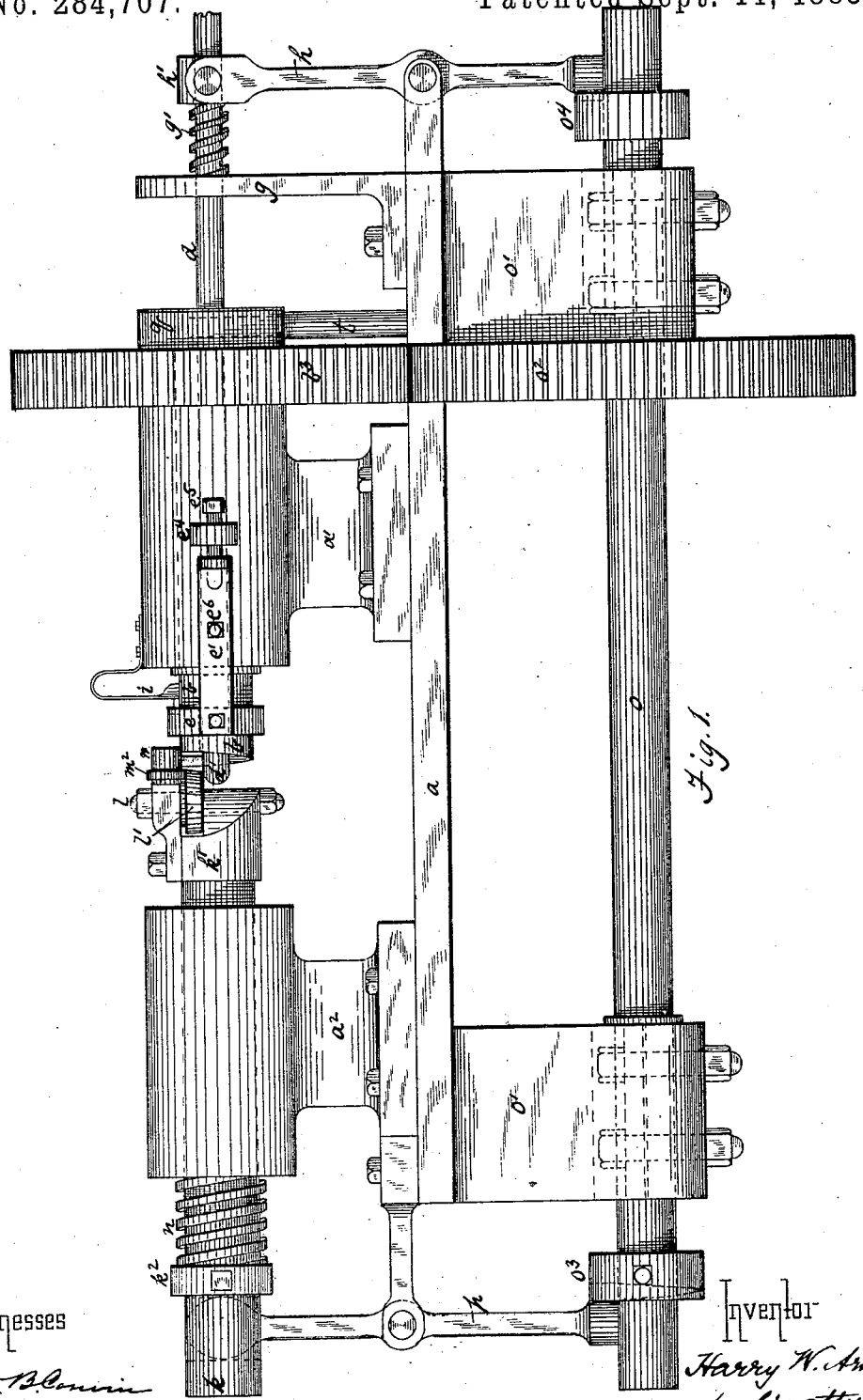

Fig. 1.

Witnesses
W. B. Corwin
Jno. K. Smith

Inventor
Harry W. Armstrong
by his attys
Bakewell & Kerr

(No Model.) 3 Sheets—Sheet 2.

H. W. ARMSTRONG.

MACHINE FOR MAKING WASHERS.

No. 284,707. Patented Sept. 11, 1883.

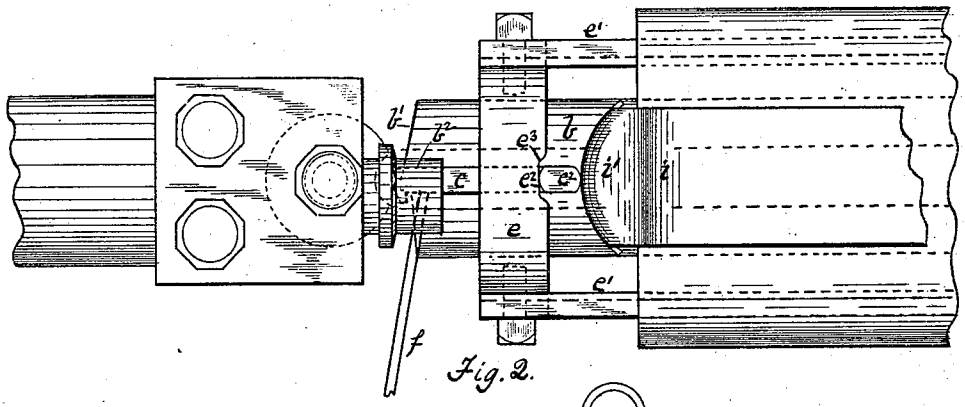

Fig. 2.

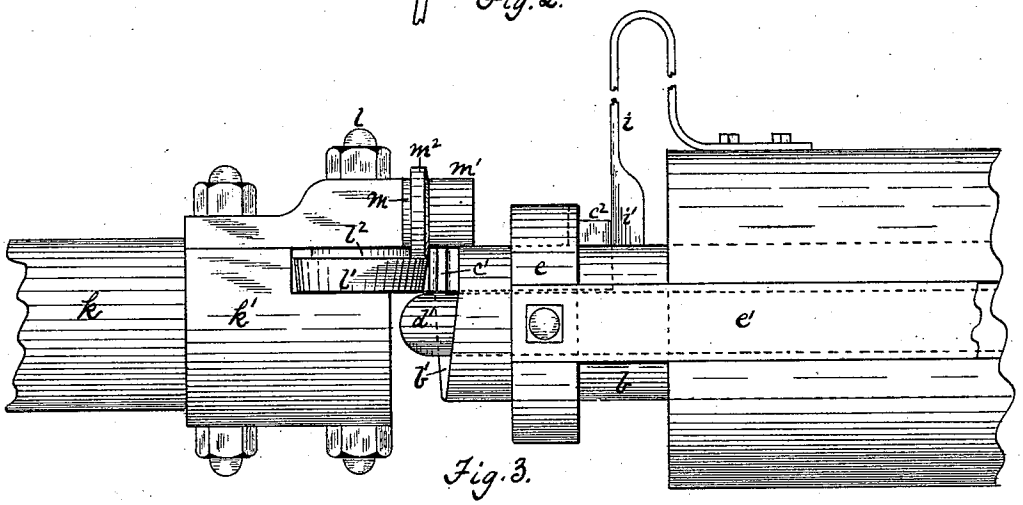

Fig. 3.

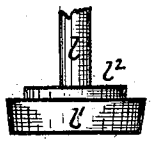

Fig. 4.

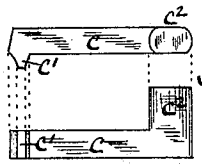

Fig. 5.

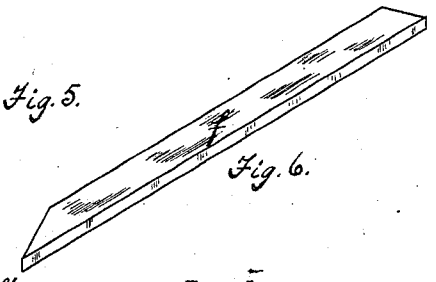

Fig. 6.

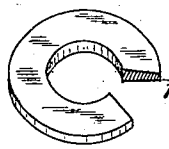

Fig. 7.

Witnesses

W. B. Conner

Jno. K. Smith

Inventor

Harry W. Armstrong

by his attorneys

Bakewell & Kerr

(No Model.) 3 Sheets—Sheet 3.

H. W. ARMSTRONG.

MACHINE FOR MAKING WASHERS.

No. 284,707. Patented Sept. 11, 1883.

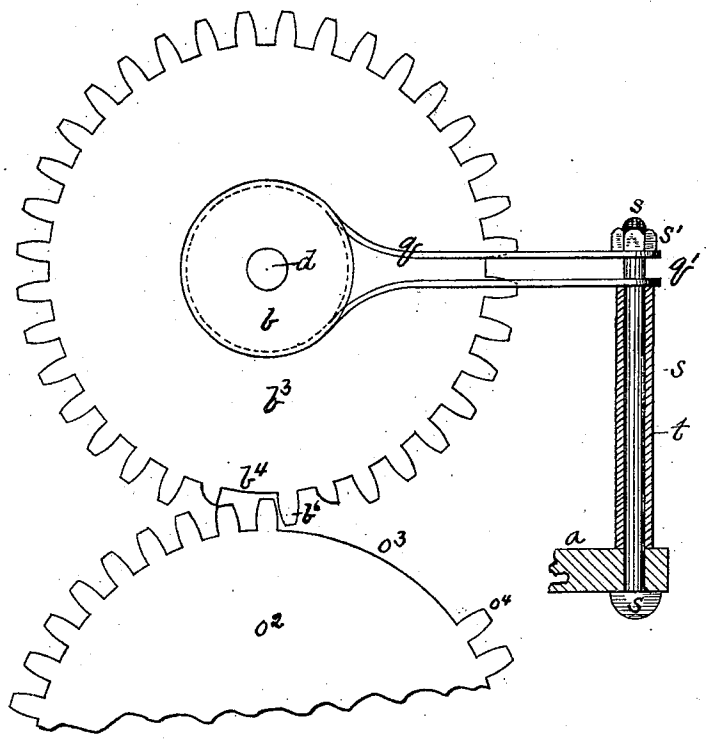

Fig. 8.

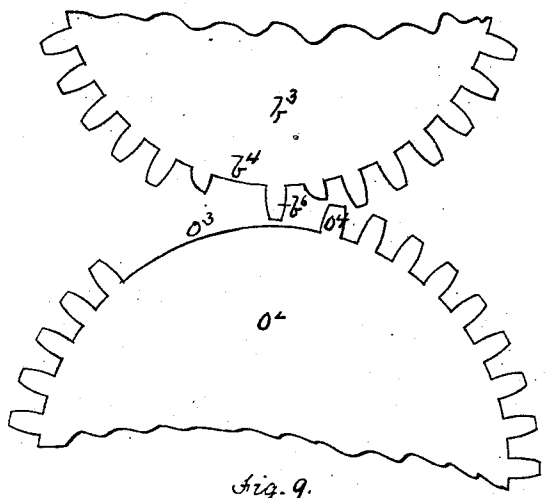

Fig. 9.

Witnesses
W. B. Corwin
Jno. K. Smith

Inventor
Harry W. Armstrong
by his attys
Bakewell & Kerr

UNITED STATES PATENT OFFICE.

HARRY W. ARMSTRONG, OF PITTSBURG, PENNSYLVANIA, ASSIGNOR TO METCALF, PAUL & CO., OF SAME PLACE.

MACHINE FOR MAKING WASHERS.

SPECIFICATION forming part of Letters Patent No. 284,707, dated September 11, 1883.

Application filed January 10, 1883. (No model.)

To all whom it may concern:

Be it known that I, HARRY W. ARMSTRONG, of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Machines for Making Spring-Washers; and I do hereby declare the following to be a full, clear, and exact description thereof, reference being had to the accompanying drawings, forming a part of this specification, in which—

Figure 1 is a side view of my improved machine for bending spring-washers. Fig. 2 is a plan view of the bending devices on a larger scale. Fig. 3 is a side view of the bending devices. Figs. 4 and 5 are details. Fig. 6 is a view of the blank. Fig. 7 is a view of a finished washer. Figs. 8 and 9 are views of the gear-wheels.

Like letters of reference indicate like parts in each.

In a bearing, a', placed on a suitable bed-plate, a, is a hollow rotating shaft, b, one end of which is cut on a spiral incline, as at b', like one turn of the thread on a screw. Where the ends of the incline meet or come into a common axial plane at the same side of the shaft a square edge or shoulder, b^2, is formed. The shaft b is grooved or recessed longitudinally at this point, and a sliding dog, c, whose outer side is flush with the surface of the shaft, is placed in the groove. The rear side of the outer end of the dog rests against the shoulder b^2, and at the front side the dog is provided with a lip or projection, c', which, as hereinafter described, catches the end of the blank f and holds it firmly against the end of the shaft b during the coiling operation.

Inside of the shaft b is a rod, d, one end of which extends to the front end of the hollow shaft b and constitutes the mandrel d', around which the washer is formed, and the other end extends beyond the rear end of the hollow shaft, and, after passing through a guide and support, g, is fastened to one end of a pivoted lever, h. A spring, g', is placed on the rod d, between the support g and the collar h', by which the lever h is fastened to the rod, and, being compressed between the support g and the collar h', exerts its force to throw the rod d backward. The backward movement of the rod is just sufficient to cause its forward end to come flush with the end of the hollow shaft b, and is for the purpose of discharging the washer from the mandrel when it has been bent around the same. The dog c is provided with a lateral projection, c^2, at its rear end, which projects up back of a stationary collar, e, which encircles the shaft b, and is secured to the bearing a' by straps e'. The rear side of the collar e is straight, except directly over the center of the shaft b, where it is recessed, as at e^2. Secured to the bearing a', back of the collar e, is a spring, i, having a broad convex face, i', opposite to the recess e^2, and projecting into the path of the projection c^2, so that when the rotation of the shaft b brings the latter around it is forced by the spring i into the recess e, throwing the dog c forward, as shown in Fig. 2. The further rotation of the shaft b causes the projection c^2 to encounter the incline e^3, which draws the dog c back, and it is held in that position by the straight side of the collar e until it again comes around to the recess e^2, when it is again thrown forward by the spring i.

Supported in a bearing, a^2, in line with the shaft b, is a sliding shaft, k, upon the inner end of which is a head, k', in which is a short vertical shaft, l, carrying a loose disk-roll, l', having a disk, l^2, of smaller diameter. Mounted loosely on a hub, m, which extends at a right angle to the shaft l, is a roller or wheel, m', having a collar, m^2, the inner side of which is beveled on the same angle as that of the face of the tapered or beveled roll l', and is so placed outside of the disk l^2 and with relation to the wheel l' that the beveled surfaces of the two are aligned with each other. The disk-roll l' is so arranged with relation to the mandrel d' as to be directly over or at one side of the latter when it projects from the shaft b, as shown in Figs. 1 and 3, and the beveled faces of the roll l' and collar m^2 stand directly in front of the inclined end b' of the hollow shaft b. A spring, n, is placed on the shaft k, and bears against the outer end of the bearing a^2

and the collar k^2, its pressure being exerted to throw the shaft k backward.

Sustained in suitable bearings, o', below the bed-plate a, is a power-shaft, o, which is driven in any desired way. On it is a gear-wheel, o^2, which drives the shaft b by means of a gear-wheel, b^3, mounted thereon.

On the shaft o are two cams, o^3 o^4, which, by means of the pivoted levers p and h, give a nearly simultaneous inward axial movement to the shaft k and rod d. The upper ends of the levers p and h bear against the recessed end of the shaft k and the collar k', respectively, and the lower ends bear against the eccentric surfaces of the cams o^3 and o^4. When the cams press the lower ends of the levers out, their upper ends are thrown in and force the shaft k and rod d inward, compressing the springs n and g'. The further rotation of the cams o^3 and o^4 permits the springs to react and throw the shaft and rod out again. The cams and gearing are so proportioned as to cause this movement to take place once at the completion of every revolution of the shaft b, so as to withdraw the mandrel d' and head k' in order to discharge the finished washer.

The gear-wheel o^2 is one-seventh larger than the wheel b^3, and has five of its teeth stripped, as at o^5, and the wheel b^3 has one tooth stripped, as at b^4. The purpose of this is to release the wheel b^3 once in every revolution of the wheel o^2, to permit the shaft b to stop long enough for the discharge of a finished washer and the feeding in of the next blank. The operation of the wheels o^2 and b^3 is as follows: When the space b^4 comes around next to the wheel o^2, the teeth of the latter will turn out of it without striking the tooth b^5, and so it is permitted to come instantly to rest. When the tooth o^4 comes up, it gears with the tooth b^6 and starts the wheel b^3 again. If the tooth b^4 were not omitted, the wheel b^3 would be pushed forward the distance of one tooth by the wheel o^2 in clearing it, and thus shorten the period during which it would be at rest and make the operation of the machine less precise.

In order to prevent the momentum of the wheel b^3 from turning the shaft b when it is not in gear with the wheel o^2, I have provided an adjustable friction-strap, q, which passes around the shaft and has its ends q' fastened to the bolt s in the standard t. It is made adjustable by means of the nut s', which may be secured farther on or off of the bolt to compress or release the ends q', as it is desired to increase or reduce the friction.

For making the washer I use a steel blank, f, either of the form shown in Fig. 6 or of any other desired form, and feed it into the machine, when the dog c is in the position shown in Fig. 2, by inserting the end between the lip c' and the inclined face b' of the shaft b, as shown in Fig. 2. The rotation of the shaft causes the projection c^2 to come in contact with the incline c^3, which forces the dog back and causes the lip c' to clasp the end of the blank tightly against the end of the shaft b. The spring n then forces the wheel l' and collar m^2 against the side of the blank and holds it against the inclined end b' of the shaft b, while the roller m', bearing on its outer edge, holds it down on the mandrel d'. The bending devices, operating together in this manner, cause the blank f to be bent into a washer of spiral form, as shown in Fig. 7. When the bending is completed, the cams o^3 and o^4, operating on the levers p and h, cause the head k' and mandrel b' to be withdrawn and permit the washer to be discharged.

The effect of the stretching of the outer edge of the blank, caused by bending it into a flat washer, is to reduce its thickness at that point, as shown at f', Fig. 7. The reason I bevel the faces of the wheel l' and collar m^2 is to cause them to bear on the side of the tapered washer as it is being bent. The solid face of the roller m' being opposed to the edge of the blank prevents it from rising off of the mandrel.

If desired, the faces of the disk-roll l' and collar m^2 may be made straight, instead of beveled; but in such case the blank f used therewith should be of tapered form in cross-section, and should be fed to the machine with the base or broader edge upward, so that the stretch of the metal shall cause the outer and inner edges of the finished washer to be equal and the cross-section to be of rectangular form.

If it is desired, a non-rotating device may be substituted for the roller m'; but I prefer the latter, as it relieves friction, and is a better construction.

I prefer to secure the straps e' partly by means of adjusting-screws e^5 to lugs e^4, so as to be able to take up any slack that may be produced, by wear or otherwise, between the dog c and former b', or collar e. The straps e' are slotted for the passage of the bolts e^6, by which also the straps e' are fastened. When it is desired to take up the slack of the collar e, the bolts e^6 are slackened, and then the straps may be drawn back the extent of the slots.

In this machine the spirally-inclined face b' of the shaft b constitutes a former, against which the washer is given its spiral or spring form by means of disk-roll l', the mandrel d' giving it its inside form.

My machine is designed as an improvement on the apparatus for forming spiral washers, patented to William Metcalf on March 26, 1876; and while it is adapted to the making of precisely such washers as are made by the Metcalf machine, it is also specially adapted to the forming of spiral washers out of steel blanks which are of greater width than thickness (see Fig. 6) by rolling the blank on edge and producing a washer such as is shown in Fig. 7. Such washers, owing to their being of greater width than thickness, have been heretofore made by stamping them out of a plate of steel, and then giving them a spiral shape or set by compression between dies. This, however, is

objectionable, as the washer thus made is not as strong as if made from a strip of steel of the desired width and thickness bent on edge around a mandrel. This cannot be done, where the difference between the width and thickness of the blank is considerable, by a machine constructed like the Metcalf machine, and it is the accomplishment of this result which is the special design of my invention. To this end I hold the forward end of the blank, by means of the dog *c*, firmly against the spirally-inclined face *b'* of the revolving shaft *b*, with the end of the blank resting against the shoulder b^2 during the whole of its rotation, and until it is finished and ready to be discharged from the machine, and at the same time confine the blank at the side opposite to the face *b'* of the shaft or former *b* by means of the collar m^2 and wheel, or loose disk-roll *l'*, which are held up to it by spring-pressure, while the blank is wound around the mandrel *d'* by means of the roller *m'*, thus preventing the buckling of the thin blank while it is being rolled on edge and stretched, as it must be, at the circumference of the washer, while it is merely bent at the inner edge, which is in contact with the mandrel.

The mandrel and spirally-faced shaft of my machine are like the corresponding parts of the Metcalf machine, and are not herein claimed otherwise than in combination with other parts of my machine.

I have described my disk-roll l^2 as having its axis at right angles to that of the mandrel as the most convenient construction; but it is obvious that it is not necessary that these axes should be exactly at right angles, so that the disk-roll be set to operate with its periphery pressing against the side of the blank and opposite to the spirally-inclined face of the shaft or former *b*.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In a machine for bending spiral steel washers, the combination of a central mandrel and a rotating shaft having its end cut on a spiral incline to constitute the former against which the washer is bent, with a disk-roll having its axis substantially at right angles to that of the mandrel, arranged opposite to said spiral incline to bear on the opposite face of the washer, substantially as and for the purposes described.

2. In a machine for bending spiral steel washers, the combination of a mandrel, a rotating spirally-inclined former, a disk-roll having its axis substantially at right angles to that of the mandrel, operating in conjunction with such former, and a retaining device placed opposite to and parallel with the mandrel to hold the blank down in the pass, substantially as and for the purposes described.

3. The combination of the mandrel and hollow shaft, the end of which constitutes the former, with an axially-moving gripping device mounted in the shaft, and devices for causing it to seize the end of the blank and hold it against the forming-face during the bending operation, substantially as and for the purposes described.

4. The combination of the mandrel and the hollow shaft, the end of which constitutes the former, with a sliding dog or gripping device mounted in the shaft and actuated by a recessed collar and a spring, substantially as and for the purposes described.

5. In combination with the rotating shaft *b* and mandrel *d*, the sliding dog *c*, parallel with the axis of the shaft *b* and rotating therewith, the spring *i* and stationary collar *e*, with its recess e^2, as a device for holding the blank against the face of the shaft *b* or "former," substantially as described.

In testimony whereof I have hereunto set my hand this 8th day of January, A. D. 1883.

HARRY W. ARMSTRONG.

Witnesses:
W. B. CORWIN,
T. B. KERR.