(No Model.) 2 Sheets—Sheet 1.

C. FAIRBAIRN & M. WELLS.

APPARATUS FOR FORGING SCREWS.

No. 524,199. Patented Aug. 7, 1894.

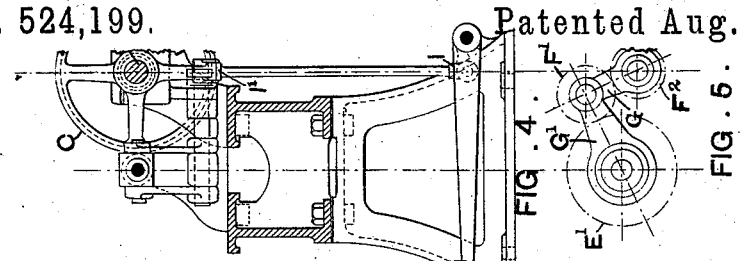

FIG. 4.

FIG. 5.

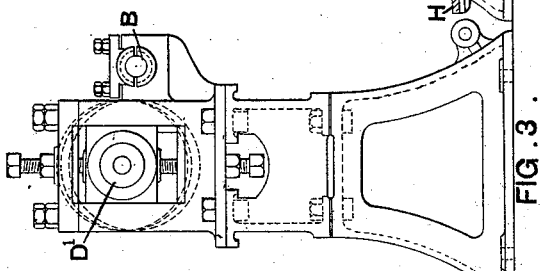

FIG. 3.

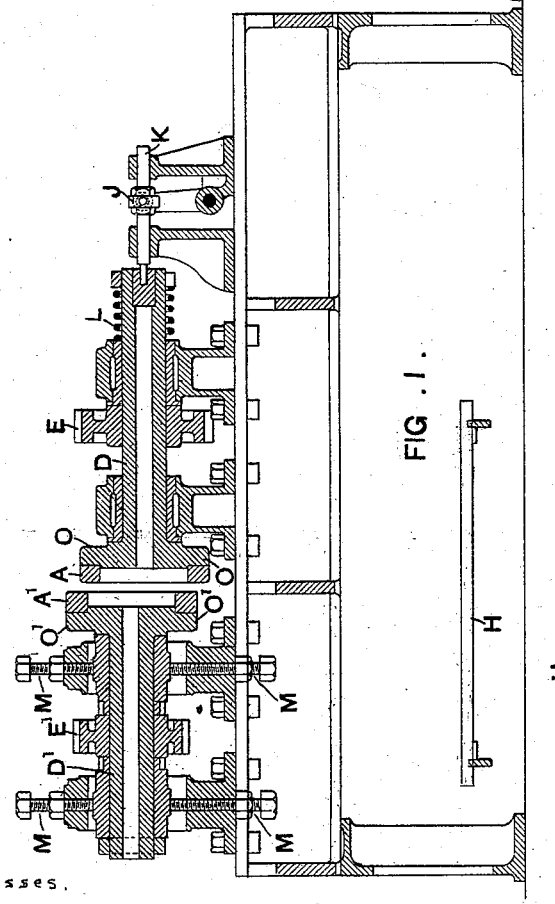

FIG. 1.

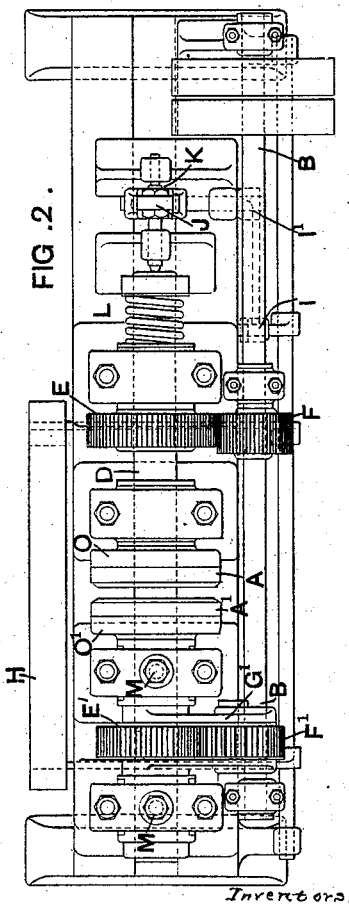

FIG. 2.

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(No Model.) 2 Sheets—Sheet 2.

C. FAIRBAIRN & M. WELLS.

APPARATUS FOR FORGING SCREWS.

No. 524,199. Patented Aug. 7, 1894.

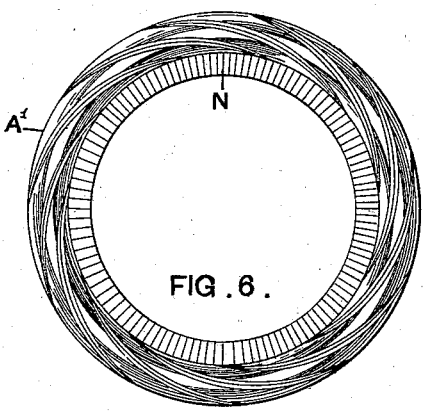

FIG. 6.

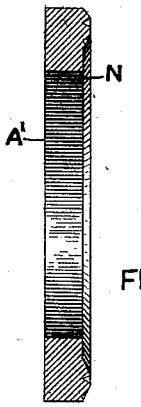

FIG. 7.

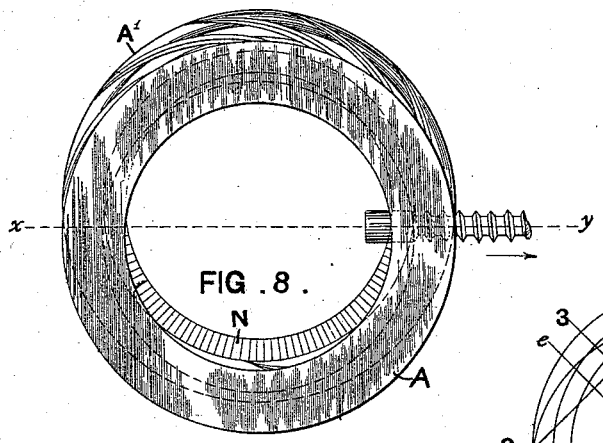

FIG. 8.

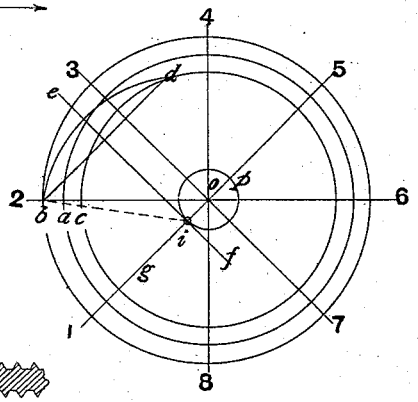

FIG. 10.

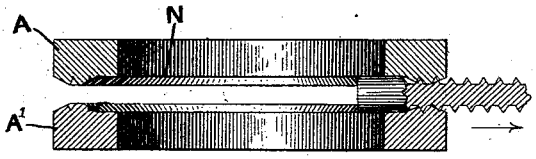

FIG. 9.

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UNITED STATES PATENT OFFICE.

CHARLES FAIRBAIRN AND MATTHEW WELLS, OF MANCHESTER, ENGLAND.

APPARATUS FOR FORGING SCREWS.

SPECIFICATION forming part of Letters Patent No. 524,199, dated August 7, 1894.

Application filed October 28, 1892. Serial No. 450,197. (No model.) Patented in England January 25, 1892, No. 1,421.

To all whom it may concern:

Be it known that we, CHARLES FAIRBAIRN and MATTHEW WELLS, subjects of the Queen of Great Britain and Ireland, residing at Manchester, in the county of Lancaster, England, have invented certain new and useful Improvements in Apparatus for Forging Screws, of which the following is a specification.

This invention relates to the construction and arrangement in machines for forging screws, of the rollers or disks between which the screws are forged, and has been patented in Great Britain, No. 1,421, January 25, 1892. In such machines as at present constructed the screws are forged between the faces of two opposed disks, the existing construction and arrangement of these rollers are open to objections which it is the object of the present invention to remove. For example, when the screws are forged between the opposed faces of two disks or rollers, the grooves by means of which the threads of the screw are formed, are annular and concentric with the axis of rotation of the disk. The disks are arranged eccentrically with respect to each other and the longitudinal motion of the screw is produced by the pressure at angles exerted by the disks in rotation. In order to make the annular grooves of the opposed disks cross each other at a sufficient angle, their respective axes of rotation have to be separated to such a distance that the blank or screw shall move through the distance of the pitch for each of its rotations. Consequently enough work cannot be put upon the screw to finish it properly, while at the same time, the threads are partly raised and partly sunk, and the raised half or portion of the thread has a larger diameter than the blank or unscrewed part.

According to our present improvements when the grooves are formed on the faces of two opposed disks, instead of making them annular, we form them in spirals over a comparatively narrow band near the edge of each disk. The two disks are arranged with their working faces parallel or inclined and opposed, and with their axes eccentric.

We will more particularly describe our said invention with reference to the accompanying drawings, in which—

Figure 1 is a longitudinal section, and Fig. 2 a plan of a machine in which the screws are forged between two opposed disks. Fig. 3 is an end elevation taken to the left of Figs. 1 and 2, and Fig. 4 is an end view, partly in section, showing the treadle motion. Fig. 5 is a detail showing the gearing required to rotate the disk to the left in an opposite direction to that of the disk to the right. Fig. 6 is a plan of one of the disks showing the spiral grooves formed on the annular band on the face of the disk. Both of the disks are formed alike. Fig. 7 is a section through the disk. Fig. 8 is a plan showing the eccentric arrangement of the two opposed disks. Fig. 9 is a section taken along the line *x*—*y* Fig. 8. The disks illustrated by Figs. 6 to 9, inclusive, are drawn to an enlarged scale. Fig. 10 is a diagram illustrating the manner of laying out the grooves.

We have illustrated our improvements as applied to existing machines in which the rollers are arranged in vertical planes, but there is no reason, other than that of convenience, why they should not be arranged horizontally and we may so arrange them without departing from our present invention.

In the machine illustrated by Figs. 1 to 4 inclusive, the two opposed rollers or disks A. A′. are rotated in opposite directions from the shaft B, which is driven by the fast and loose pulleys C. On the hollow spindles D D′. are fixed the wheels E E′. which gear, E with the pinion F on the shaft B, and E′ with the pinion F′. on the stud G, the pinion F′. also gearing with the pinion F^2. on shaft B. In consequence of the intermediate pinion F′, the shaft wheel E′., and consequently its shaft also, is driven in the opposite direction to that of E, and the disks rotate oppositely. The hollow spindle D on which one of the disks is mounted is capable of longitudinal movement so as to enable it to be brought nearer to or be removed farther from the other disk. This is for the purpose of enabling the heated blanks to be inserted and withdrawn at the commencement and end of each operation and is accomplished by the treadle H, which acts through the intermediary of the links and arms I I′. upon the clutch J fixed upon the push spindle K. This acts in one direction only, the return of the disk being effected by means of the spring

L. The amount of eccentricity of the disk is regulated by means of the adjusting screws M M. and the swing arm G′. of the gearing shown in Fig. 5, keeps the pinion fully in gear with the wheel E′., notwithstanding the eccentricity.

The grooves on the annular band may be set out as illustrated by the diagram Fig. 10. From the center *o*. draw as many equidistant radial lines 1. 2. 3. *n*, as there may be desired spirals in the annular band. In the example, there are supposed to be eight. With any convenient radius, which in the majority of cases may be taken from twelve to fifteen centimeters, set out the circle *a*. At a distance equal to about six or seven tenths of the diameter of the blank to be used in producing the screws, set out the inner and outer circles *b*. *c*. which will form the boundaries of the annular band. From the point of intersection of circle *b* and radius 2. at an angle of forty-five degrees from the radius, set out the line *b d*, terminating on the circle *c*. Bisect *b*. *d*, and draw therefrom the line *e f*. From the center *o*, draw the line *o g*, parallel with *b*. *d*, and cutting the line *e f*. Through the point of intersection *i* of the lines *e f*, and *o g* from the center *o*, describe the path of centers *p*, on which the centers of all the spiral curves will be found. The radius of curvature of the spirals is *b i*. The line *b d*, may be at a greater or less angle, according as a flat or round spiral is desired.

The amount of eccentricity between the centers of the disk must be separately determined in each case, and will vary with the amount of work to be done in making the screw. The greater the eccentricity, the more rapidly will the screw be forged, but this means also that the whole work of forging must be done in less time. For average cases the amount of eccentricity may be taken as one half to three fourths of the radius of the path of centers *p*.

The edges of the annular band should be beveled down as shown in Fig. 7.

The beveled edges are a necessity to the disks in practical work to enable the blanks to enter and to be seized between the disks. If the edges were not beveled, the commencement of the work on the heated blanks would involve a very sudden and heavy shock, which the beveling of the edges softens and renders harmless.

The insertion of the heated blank, and the release of the finished screw are effected by causing the disk A to approach the disk A′. after inserting the blank, by means of the treadle H. As soon as the screw has been forged, the treadle is released and the spring L then forces the disk back, when the finished screw may be removed. It is preferred to rotate the disks in such a direction that the blank is fully inserted, and is forced out by the action of the disks in forming the screw, in the direction shown by the arrow Fig. 8, where the screw is represented as being partly formed. The extent of the motion of the disk may be adjusted for different diameters of screws by means of the usual stop, or by fixing the clutch J on the push spindle nearer to or farther from the contiguous bracket which then forms the stop.

A plane or roughened feeding rim N may be formed within or outside and concentric with, the annular band, according to the direction of rotation. Thus, if the blank moves in the direction shown by Fig. 8, the feeding rim is constructed inside, if in the opposite direction, outside, the annular band.

The disks may be secured by set screws passing through the flanges O O′. formed upon the ends of the hollow shafts D D′., and their concentric position thereon may be secured by forming circular projections thereon which fit within the annular disks.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is—

1. In a screw forging machine, two opposed rollers each having on its face a narrow raised, annular band, containing spiral screw forming grooves, and a flat feeding band concentric with and adjacent to said raised groove band, substantially as described.

2. In a screw forging machine, a roller having on its face a narrow raised annular band, containing spiral screw forming grooves and having beveled edges, and a flat feeding band concentric with said raised band, substantially as described.

In testimony that we claim the foregoing as our invention we have signed our names, in presence of two witnesses, this 6th day of August, 1892.

CHARLES FAIRBAIRN.
MATTHEW WELLS.

Witnesses:
WM. E. HEYS,
GEORGE W. ROWE.