

(No Model.)

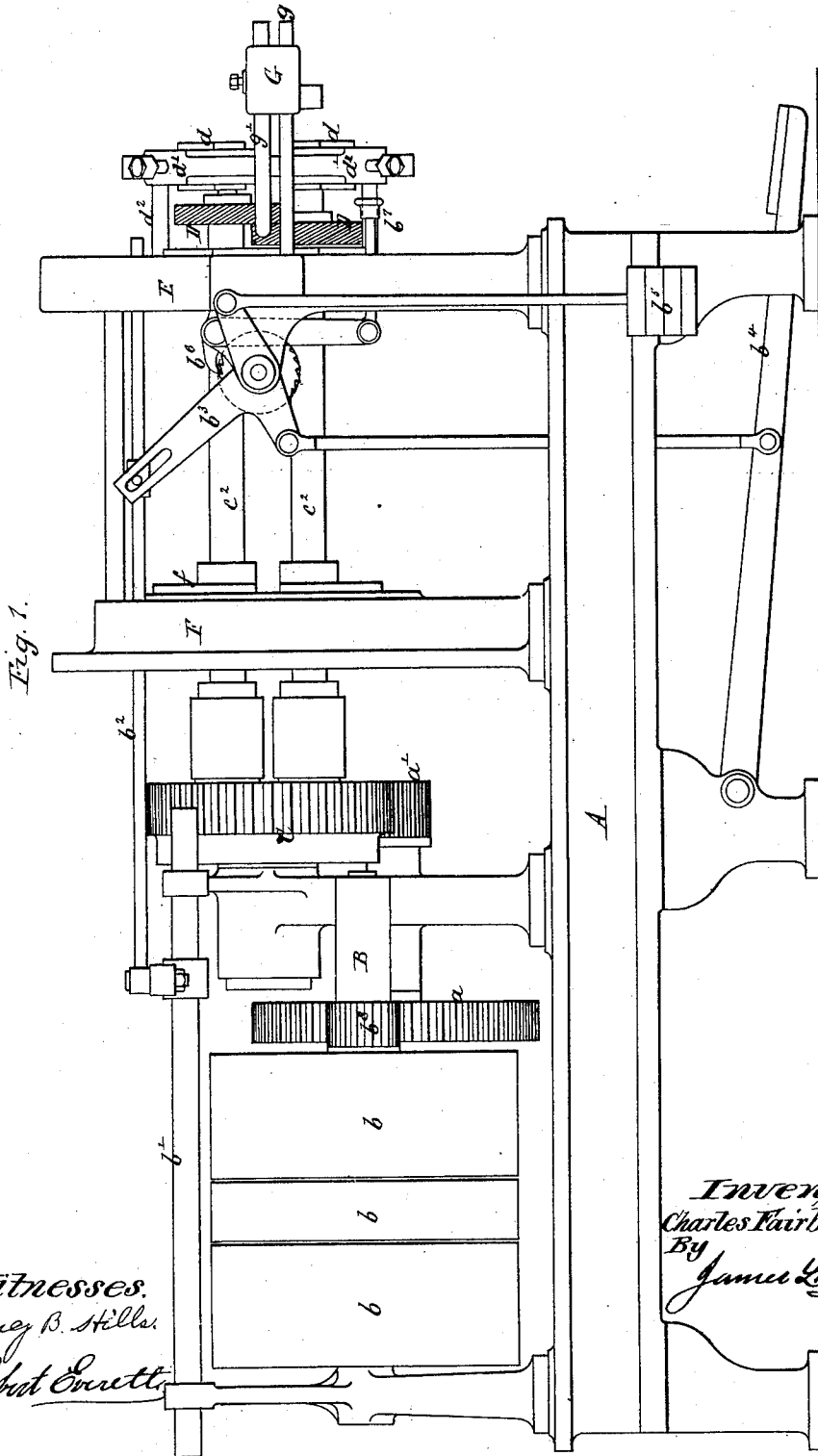
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C. FAIRBAIRN.

SCREW SWAGING MACHINE.

No. 345,959.

Patented July 20, 1886.



Witnesses.
Perce B. Hillis
Robert Emmett

(No Model.)

6 Sheets—Sheet 2.

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Fig. 2.

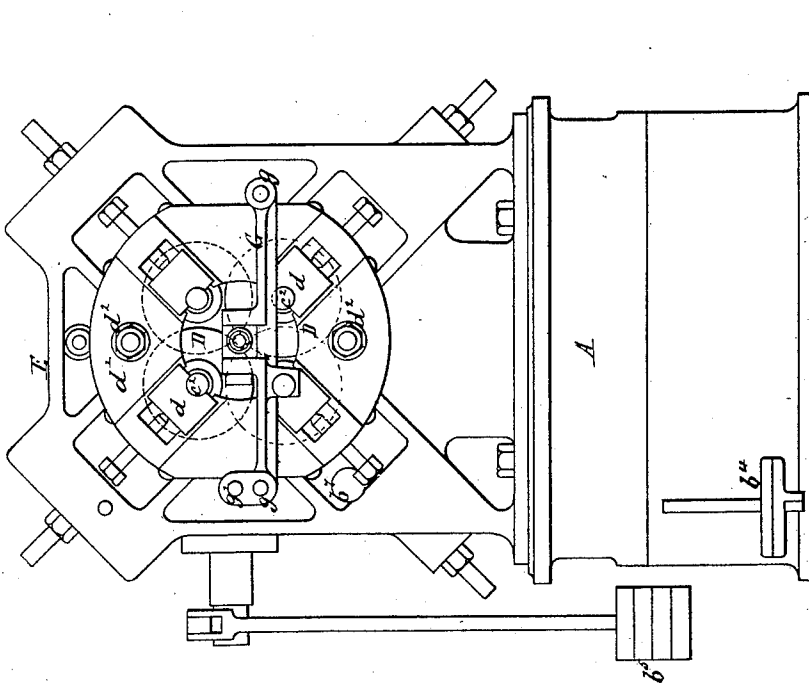
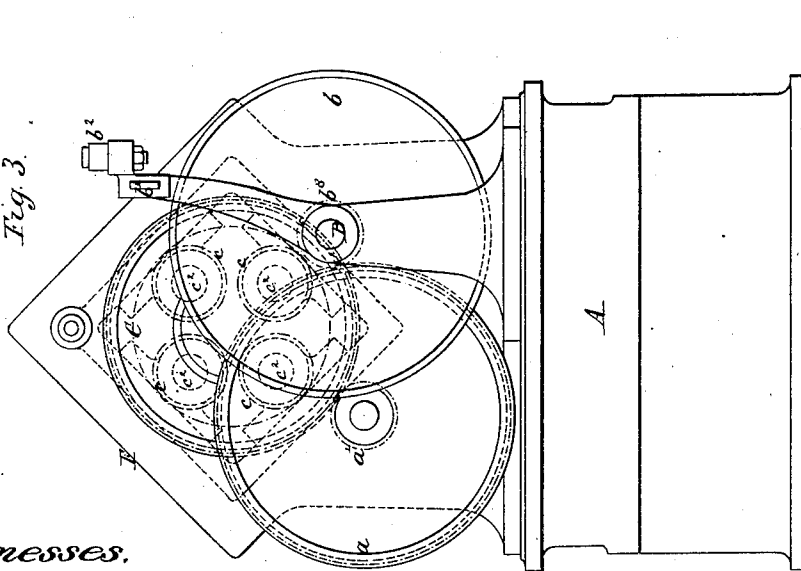


Fig. 3.



Witnesses.

Percey B. Stills.
Robert Everett.

Inventor.
Charles Fairbairn.
By James L. Norris.
Atty.

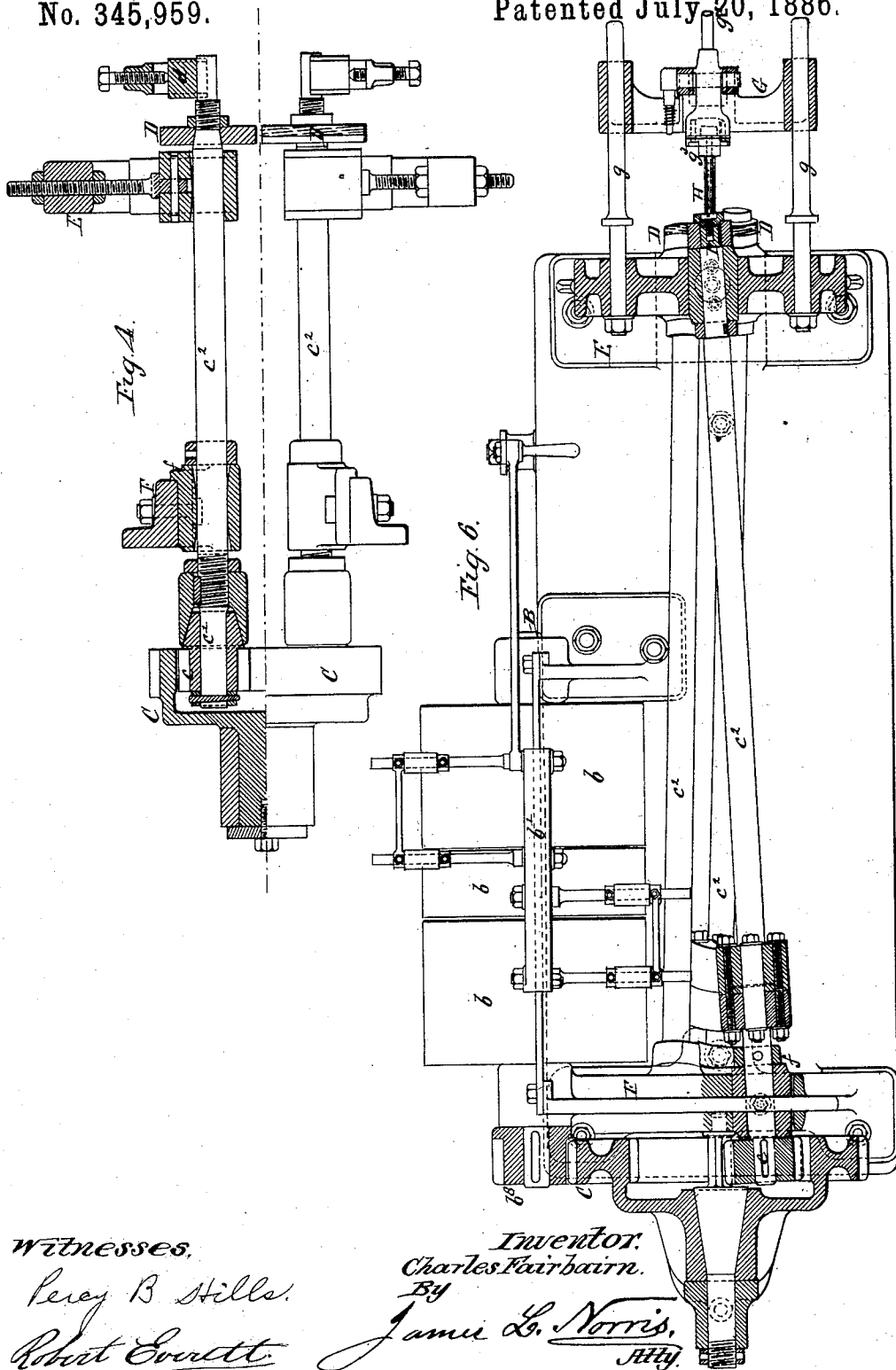
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Witnesses.

Percy B. Hills.
Robert Everett.

Inventor.
Charles Fairbairn.

By

James L. Norris,
Atty.

(No Model.)

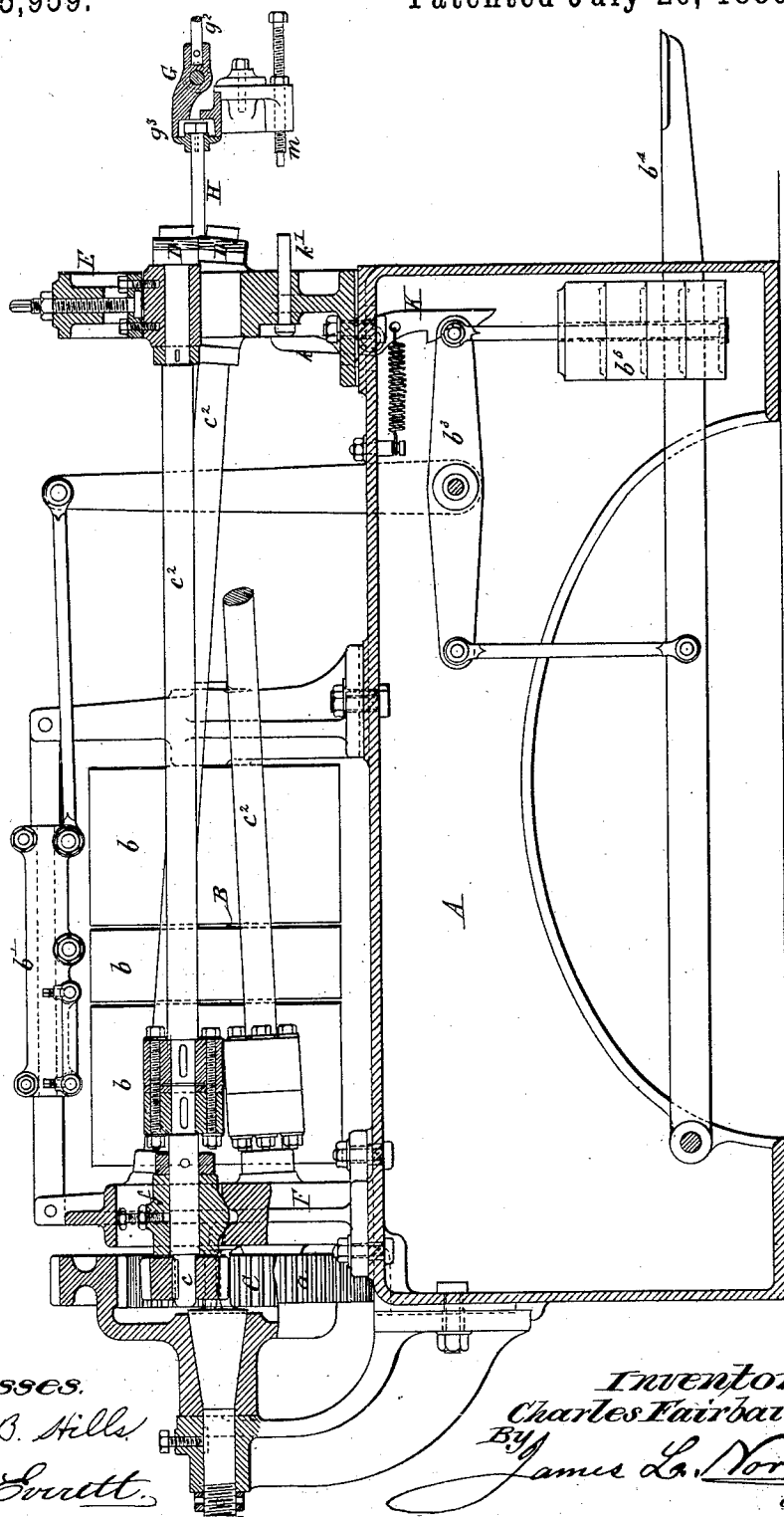
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Fig. 5.



Witnesses.

Percy B. Hills.
Robert Everett.

Inventor.
Charles Fairbairn.
By James L. Norris.
Atty.

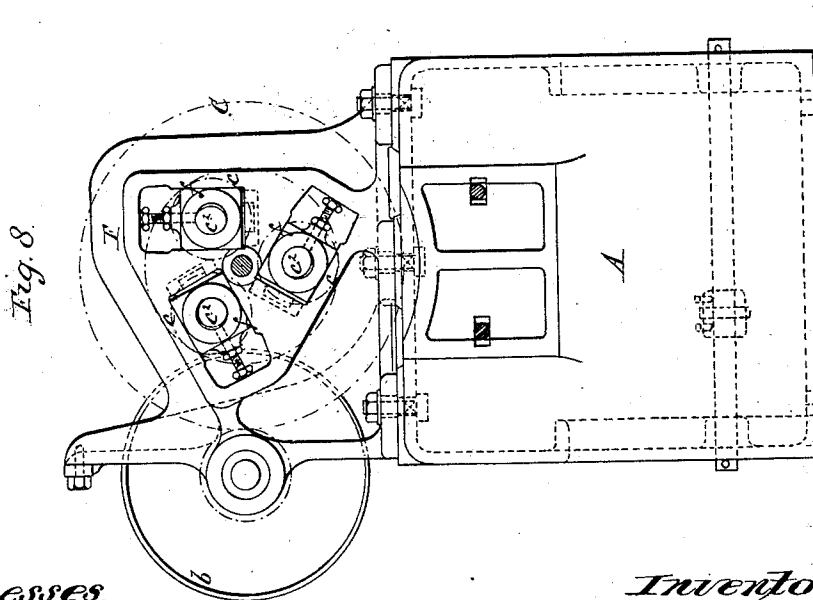
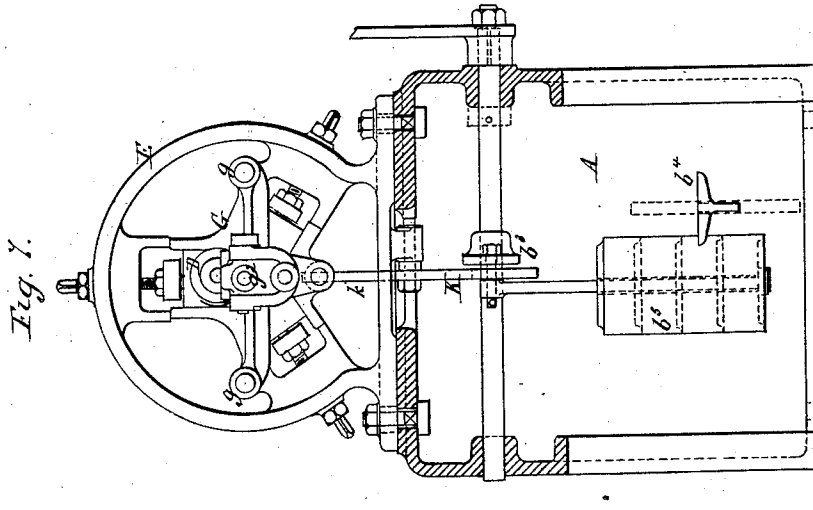
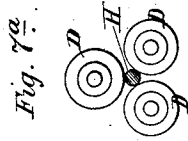
(No Model.)

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Witnesses.

Percy B. Hills.
Rhet. Everett.

Inventor:
Charles Fairbairn.
By James L. Norris.
Atty.

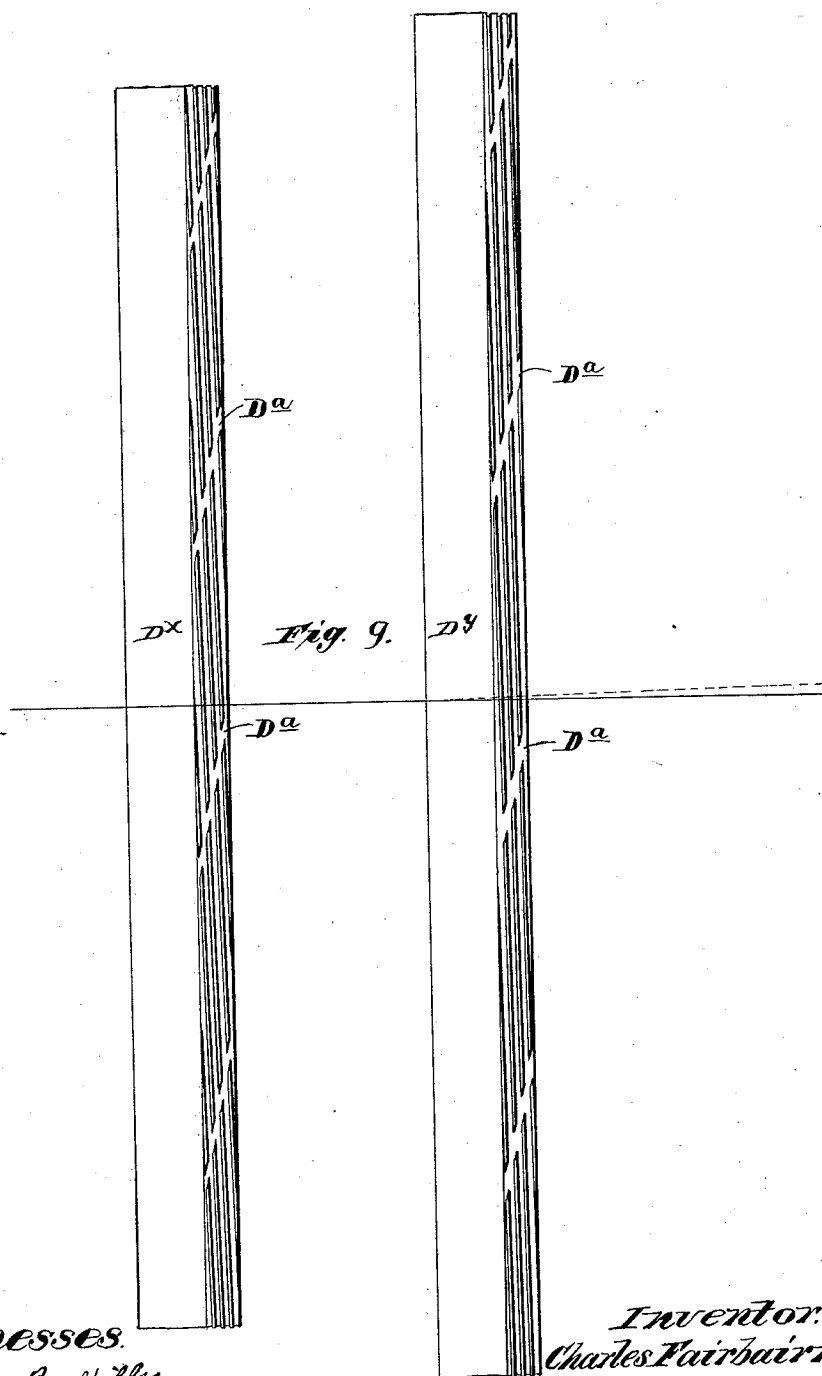
(No Model.)

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C. FAIRBAIRN.
SCREW SWAGING MACHINE.

No. 345,959.

Patented July 20, 1886.



Witnesses.

Lucy B. Hill.
Robert Everett.

Inventor.
Charles Fairbairn.

By James L. Norris.
Att'y

UNITED STATES PATENT OFFICE.

CHARLES FAIRBAIRN, OF MAYBANK, SALE, COUNTY OF CHESTER,
ENGLAND.

SCREW-SWAGING MACHINE.

SPECIFICATION forming part of Letters Patent No. 345,959, dated July 20, 1886.

Application filed January 27, 1886. Serial No. 189,956. (No model.) Patented in France December 31, 1885, No. 173,257; in Belgium December 31, 1885, No. 71,445, and in England January 1, 1886, No. 45.

To all whom it may concern:

Be it known that I, CHARLES FAIRBAIRN, a citizen of England, residing at Maybank, Sale, county of Chester, England, have invented a new and useful Apparatus for Forging Screws by Rollers, (for which I have obtained patents in Great Britain, dated January 1, 1886, No. 45; in France, dated December 31, 1885, No. 173,257, and in Belgium, dated December 31, 1885, No. 71,445,) of which the following is a specification.

This invention relates to apparatus whereby a piece of metal rod which may have a head constituting a bolt or screw blank being introduced between the peripheries of helically-grooved rotating rollers that are pressed toward each other is caused by the action of the rollers to revolve, and also to travel to and fro between them, having by this action a screw-thread formed upon it. There may be three or four rollers employed, and when there are four these may be arranged in either of two ways—either with their faces all nearly in the same plane or, when the blank to be operated on is small, there may be two in one plane opposite one another and the other two in a plane in front of so as to overlap the former.

I will describe a four-roller machine and also a three-roller machine, referring to the accompanying drawings.

Figure 1 is a side view of a four-roller machine. Figs. 2 and 3 are end views of the front and back heads, respectively, and Fig. 4 is a part longitudinal section along the axis, of one of the rollers. Fig. 5 is a longitudinal section, partly in elevation, of a three-roller machine. Fig. 6 is a plan, partly in section, and Figs. 7 and 8 are end views, partly in section, of the front and back heads, respectively, of said three-roller machine. Fig. 7^a is a detail elevation showing the arrangement of the three rolls in forging a large screw. Fig. 9 is a detail showing the surfaces of the forging-rolls laid out flat.

Referring to Figs. 1 to 4, inclusive, A is the framing or bed of the machine; B, a driving-shaft, carrying pulleys *b* for reversing by shifting the driving-belts, in the usual way,

by means of forks on a sliding bar, *b'*. This bar is worked by a rod, *b²*, which is jointed to a lever, *b³*, moved by a treadle, *b⁴*, in the one direction, and by a weight, *b⁵*, in the other direction, unless when it is held by a pawl, *b⁶*, which engages with ratchet-teeth on the boss of the lever *b³*. The pawl *b⁶* can be released by the inward push of a knob, *b⁷*, in which case the weight *b⁵* effects the shift of the driving-belts, and thereby reverses the motion of the machine. On the shaft B is a toothed pinion, *b⁸*, gearing with a wheel, *a*, on the shaft of which is a pinion, *a'*, gearing with the external teeth of a wheel, C, which, as seen in Fig. 4, has also internal teeth. Within the wheel C are the four pinions *c*, each connected through a cone friction-clutch, *c'*, to the spindle *c²* of one of the rollers D, the spindle being prolonged beyond the roller to receive the support of an adjustable bearing, *d*, these four bearings being arranged in a plate, *d'*, which is secured by bolts *d²* to the front head, E, of the machine, in which, also, as well as in the middle head, F, there are adjustable bearings for the roller-spindles *c²*. By adjusting, radially, the bearings in head E and plate *d'* the rollers D can be brought nearer to or farther from one another to suit the size of the screw on which they have to operate. By adjusting, laterally, the bearings *f* in the head F the spindles of the rollers can be set at a little inclination to the axial line, so that their axes can be made to take a slightly-twisted attitude relatively to one another. Each of the rollers D has its periphery grooved helically, (see Figs. 4, 5, and 6,) with a number of grooves inclined to its axis at nearly the same angle as that which the thread of the screw that is to be formed by them bears to its own axis, and the interval from groove to groove on each roller is equal to the pitch or interval from thread to thread on the screw. The grooves of the rollers may be formed and arranged in any manner suitable for the conditions required. The four rollers are not all of the same size; two of them—say the lower two—being somewhat larger than the other two—the upper pair—as shown in Figs. 2 and 4. Owing to the difference of diameter, the obliquity of

the grooves on the smaller roller is not quite equal to that on the larger. I therefore adjust the back bearings, *f*, of the smaller rollers so as to give their axes a slight twist, bringing the obliquity of their grooves into correspondence with that of the grooves on the larger rollers. In front of the machine project two guide-bars, *g*, carrying a cross-head, *G*, in which is held the head of the blank, this head being placed between a front and back cheek, which prevent the blank from moving longitudinally in the holder while it is free to revolve. The cross-head *G* also carries an adjustable stop, *g'*, which can pass through a hole of the front head, *E*, and butt against the pawl-lever, thereby releasing the pawl *b'*, and effecting reversal of the machine when the blank has advanced sufficiently far between the rollers. In Figs. 1 and 2, the rollers *D* are shown as they would be adjusted for a screw of comparatively small diameter, one pair of them being in front and overlapping the other pair. They need not, however, overlap, but may all be in the same plane when the screw is sufficiently large to fill in the space between their peripheries, as is indicated in Fig. 7^a, where three rollers *D* are shown tangential to the blank *H*, and in the same vertical plane.

The three-roller machine, shown in Figs. 5 to 8, inclusive, is similar in construction to the four-roller machine above described, and in these figures parts corresponding to those in Figs. 1 to 4, inclusive, are marked by similar letters. In this case the pinion *b'*, on the driving-shaft *B*, gears directly with the external teeth of the wheel *C*, which has internal teeth gearing with the three pinions *c* on the spindles of the rollers *D*. In the front frame, *E*, are radially-adjustable bearings for the spindles of the three rollers *D*, which in this case overhang their bearings. In the back head, *F*, are laterally-adjustable bearings, *f*, by which the roller-spindles can be set to the desired twist. The treadle *b'*, weight *b''*, and lever *b''*, work the sliding fork *b'*, as already described; but instead of the pawl and the lever *b''* having a ratchet on its boss, with the devices for releasing the lever *b''*, there is a ratchet-toothed lever, *K*, from the upper end, *k*, of which projects a tappet-rod, *k'*, so that an adjustable bolt in the cross-head *G*, which carries the blank, on butting against it moves the lever *K* and releases *b''*, allowing the weight *b''* to descend and effect reversal. The blank is held in *G*, with its head in the recess *g'* under a hinged jaw, which can be opened upward for insertion or removal of the blank by depressing the handle *g''*. The recess *g'* is sufficiently large to allow the head of the blank, which is generally square or hexagonal, to revolve freely. When I employ three rollers, I make one—say the uppermost—somewhat larger than the other two, giving the spindles of the latter the twist necessary to make the obliquity of their grooves correspond with that of those on the largest roller.

The operation of the mechanism may be described as follows: Let it be supposed that a screw is to be forged of a given diameter—say three-fourths of an inch—with a thread of one-tenth-inch pitch, the same mode of operation applying to the manufacture of screws of a different size and pitch. In the four-roller machine one pair of said rolls will have a diameter of, say, six inches, and the other (overlapping) pair will then be of a diameter of six and three-quarters inches, the diameter of the one pair being a multiple of the diameter of the screw, being exactly eight times that of the latter, while the diameter of the other and larger pair will be a larger multiple by one, being nine times the diameter of the screw. Now, let it be supposed that the peripheries of one of the larger and one of the smaller rolls are laid upon a flat surface, as in Fig. 9, the rolls being divided parallel to their axes and the grooved surfaces rolled out into horizontal planes. As the shorter periphery, *D**, belonging to the roll of less diameter, is eight times the circumference of the screw, or thereabout, it is supposed to be divided into eight equal parts, in each of which the threads are repeated eight times, these threads being of the exact pitch of those to be forged on the screw, and being preferably crossed at equal intervals by grooves *D**, which are oblique to the threads. The larger circumference, *D'*, Fig. 9, being nine times that of the screw to be forged, is also considered to be divided, like the smaller roll, into eight equal parts; but as the threads in each of these parts are longer by one-eighth than the threads in each division of the lesser circumference, the inclination of the threads to the plane of revolution is a little less than that of the threads in the shorter circumference. Consequently in mounting these rollers in the machine their axes are slightly inclined toward each other, as indicated by dotted line, Fig. 9, to bring the longer threads to lie parallel with the shorter. As the difference of inclination is very small, the adjustment of the axes to correspond is a very small quantity. As all four rollers have the same angular velocity, the circumferences of the larger pair will travel faster than those of the smaller pair, the relative surface-speed being as the difference in diameter, and therefore the screw operated upon must revolve at a speed which is the mean between the speed of the smaller and that of the larger rollers. Being driven by the larger roller at a speed a little greater than that of the smaller roller, it will necessarily have a travel in the direction of its axis, and it is by this means that the blank is automatically fed forward, and at the same time impressed by the forging-rolls until the machine is reversed, whereupon the screw is in the same manner fed out of the rollers. It will be seen, therefore, that no additional mechanism is required to feed the blank-holder *G* forward. The oblique grooves *D** present cutting-edges like those of an ordinary screw-tap,

and as the blank travels forward these edges have a gradual cutting action upon the partly forged thread, trimming them off and rendering said threads smooth and true.

5 Having thus described the nature of my invention and the best means I know for carrying it into practical effect, I claim—

10 1. In a machine for forging screw-threads on a blank, a series of overlapping laterally-adjustable rollers of two different diameters, the surfaces of said rollers having forging-threads, and the axis of the larger roller or rollers being very slightly inclined to the axis of the smaller, and mechanism for driving
15 said rollers, whereby they have synchronous revolutions, substantially as described.

20 2. In a machine for forging screw-threads on a blank, rollers having their circumferences helically grooved to form forging-threads, and provided with grooves crossing said threads obliquely, substantially as described.

25 3. In a machine for forging screw-threads on a blank, the combination, with a series of rollers of two different diameters having forging-threads upon their peripheries, of mechanism for imparting synchronous revolution to said rollers, a device for carrying

the blank, a lever having a ratchet-boss, a pawl holding said ratchet, an adjustable bar 30 on the blank-carrier for tripping said pawl, a weight actuating the lever, and a belt-shifter connected with the latter, substantially as described.

4. In a machine for forging screw-threads 35 on a blank, the combination, with four overlapping rollers, whereof two are of equal diameter and the other two of a greater diameter, the peripheries thereof being grooved to form threads, and having grooves crossing 40 said threads obliquely, of mechanism for giving synchronous revolution to said rollers, means for adjusting each radially relatively to the axis of the screw to be forged, and a device for holding the blank, substantially as 45 described.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this seventh day of January, A. D. 1886.

CHARLES FAIRBAIRN.

Witnesses:

E. BUTLER ROWLEY,
Notary Public, Manchester.
GEORGE BROWN,
His clerk.