(No Model.)

2 Sheets—Sheet 1.

J. C. SEWELL, E. HULTON & J. BETHEL.

SECTIONAL WARPING AND BEAMING MACHINE.

No. 335,636. Patented Feb. 9, 1886.

FIG. 1.

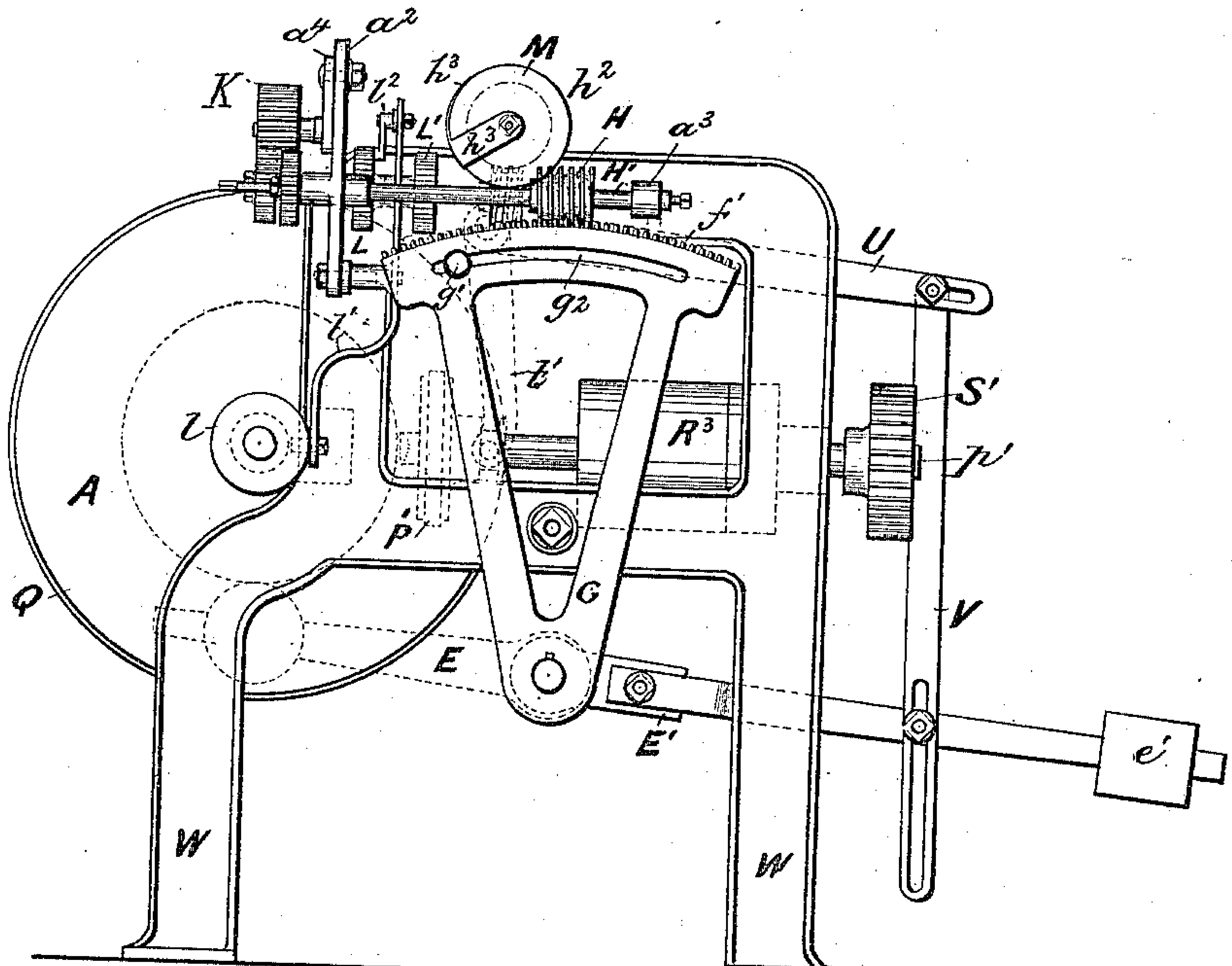


FIG. 2.

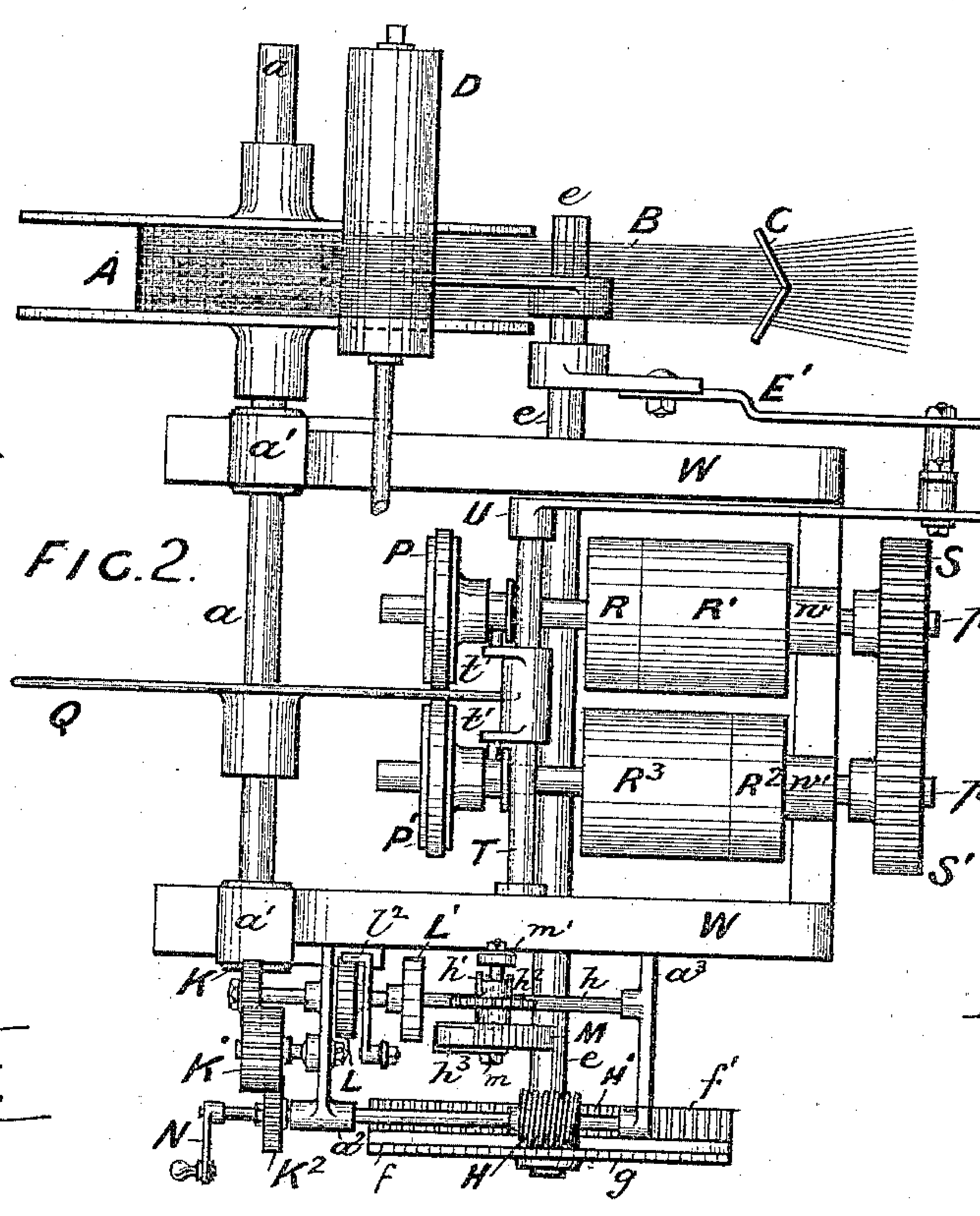
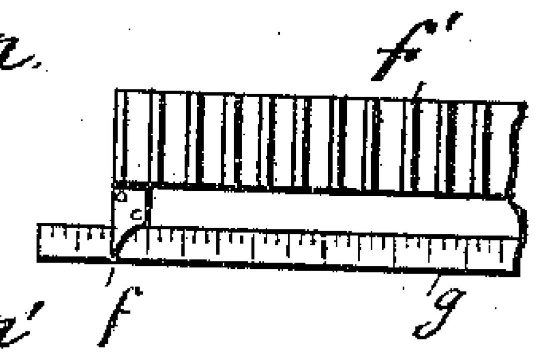


FIG. 2a



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(No Model.)

2 Sheets—Sheet 2.

J. C. SEWELL, E. HULTON & J. BETHEL.

SECTIONAL WARPING AND BEAMING MACHINE.

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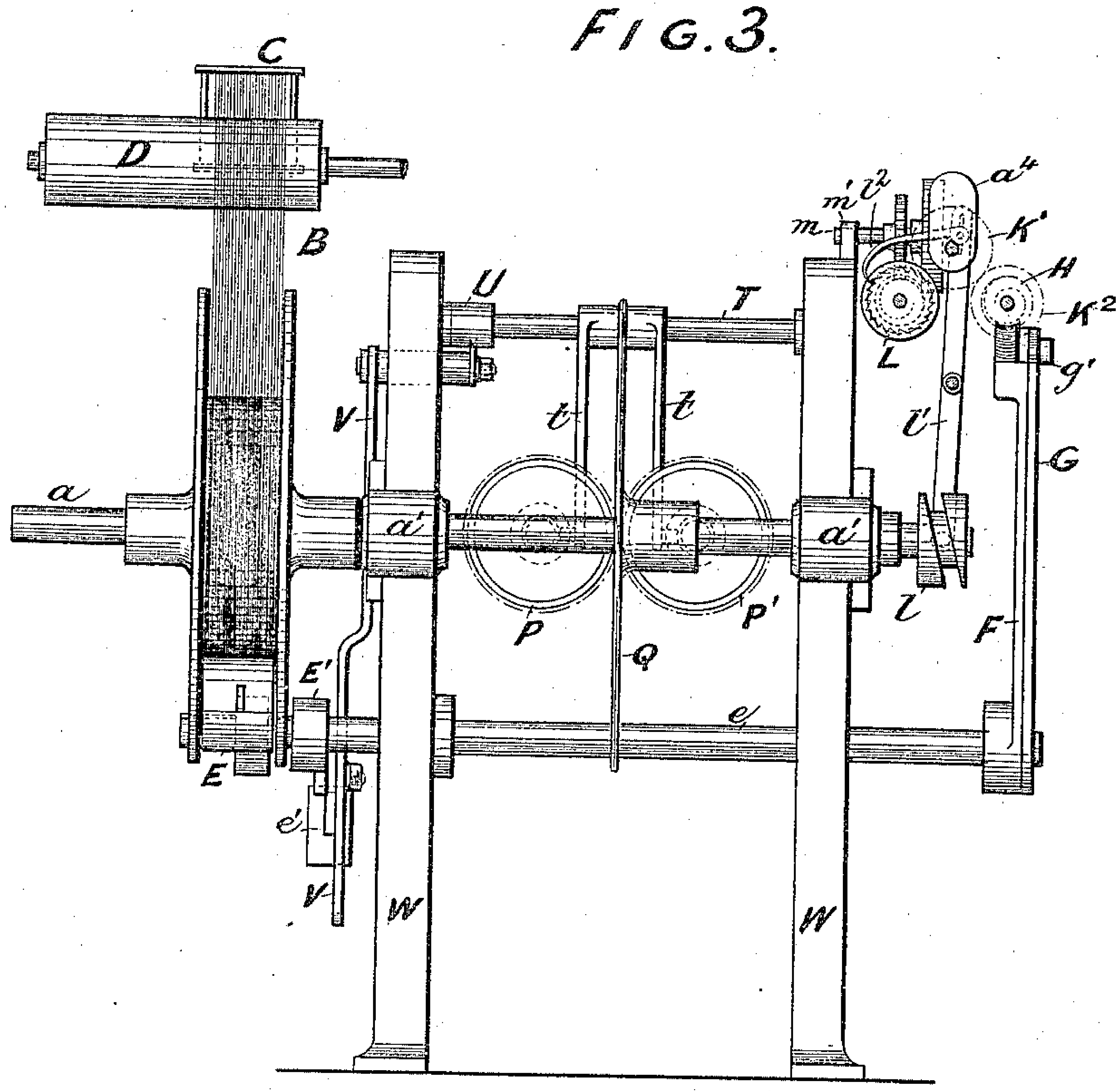
FIG. 3.



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UNITED STATES PATENT OFFICE.

JOHN C. SEWELL, EUSTACE HULTON, AND JOHN BETHEL, OF MANCHESTER, ENGLAND.

SECTIONAL WARPING AND BEAMING MACHINE.

SPECIFICATION forming part of Letters Patent No. 335,636, dated February 9, 1886.

Application filed May 24, 1883. Serial No. 95,986. (No model.) Patented in England December 14, 1880, No. 5,234, December 13, 1881, No. 5,440, and April 12, 1882, No. 1,732.

To all whom it may concern:

Be it known that we, JOHN CHRISTMAS SEWELL, EUSTACE HULTON, and JOHN BETHEL, of Manchester, England, have invented new and useful Improvements in Sectional Warping and Beaming Machines, (for which we have obtained patents in Great Britain No. 5,234, dated December 14, 1880; No. 5,440, dated December 13, 1881, and No. 1,732, dated April 12, 1882,) of which the following is a specification.

Our invention has for its object to remove the difficulties that were first met with in carrying out the principle of sectional warping. This principle or system consists in warping the number of threads required for the pattern on a drum between flanges set a few inches apart, thus forming a section of the entire warp. A number of these sections or "cheeses," as they are called, are afterward placed side by side on a beam until there are a sufficient number to make up the width intended.

It is clear that in order to avoid waste and distorted patterns in weaving all sections should have the same diameter as well as the same length and tension of yarn. For this purpose we provide a movable presser adapted to be kept in contact with the circumference of the section by a weight or spring, a pair of sectors adapted to turn on the same axis as the presser, one of the said sectors being rigidly connected with the presser, while the other is mounted loose on its axle and provided with means for attaching it to the fixed sector at various angles, one of the said sectors being also provided with a graduated scale for measuring their angular motion relatively to each other and mechanism adapted to transmit the rotary motion of the section-shaft to the loose sector, such mechanism comprising means for varying the rate of transmission and for disconnecting the said sector from the section when desired.

In the further description of the invention reference will be made to the accompanying drawings, of which—

Figure 1 is a side view of a warping-machine embodying our invention. Fig. 2 is a plan of the same with the addition of the reed and guide-roller for guiding the yarn on its way to the section-drum. Fig. 2^a is an enlarged detail view of part of the graduated scale g and teeth f. Fig. 3 is a front view of the machine with the omission of some parts or bearings for supporting the mechanism interposed between the section-shaft and the movable sector.

a is a section-shaft, carrying a drum, A, upon which the yarn B is wound after passing through the reed C and over the guide-roller D.

E is the presser, fixed on shaft e, which also carries a lever, E', provided with a weight, e', which tends to keep the presser in contact with the yarn-section on the drum A. The section-shaft turns in fixed bearings a', and may be set in motion from a driving-shaft in any suitable manner; but, preferably, we employ a friction-plate and a pair of bowls or friction-rollers and a pair of driving-shafts geared together by spur-wheels, as hereinafter described more fully.

For automatically indicating the motion of the presser during the winding of the first section, we use a pair of sectors, F and G, mounted on the presser-shaft, and for reproducing this motion while any of the following sections is being wound we connect the section-shaft with the presser-shaft by means of a helically-grooved disk or cam plate, l, fixed on the shaft a, a lever, l', carrying a pawl, l^2, and adapted to receive oscillating motion from the said disk, a ratchet-wheel, L, fixed on a shaft, h, and adapted to receive motion from the pawl l^2, a shaft, H', carrying a worm, H, a train of change-wheels, K K' K^2, adapted to drive the shaft H' from the shaft h, and a toothed rim, f', attached to or formed on the circumference of the sector F. The sector G is keyed or otherwise secured to the presser-shaft so as to take part in any rotary motion of the same, and has upon its rim a graduated scale, g, as shown in the enlarged detail view Fig. 2^a. The sector F is loose upon the presser-shaft and carries upon its periphery an index-finger, f, which passes over and points out the divisions on the graduated rim of the sector G.

The sector F has formed upon its rim a series of teeth, f', as mentioned above, into which gears the worm H, and through which the sector F may receive a rotary motion on the presser-shaft. The two sectors are capable of being secured together in any position relatively to each other by means of a screw-bolt, g', and nut passing through a slot, g^2, in one of the sectors. (See Fig. 1.)

Upon the ratchet-shaft h is keyed a worm, h', gearing into a small worm-wheel, h^2, upon the axle m, on which is fixed an index-finger, h^3, which points to the divisions upon a graduated disk, M. The worm-wheel h^2 and disk M are rigidly connected by a sleeve, and are loose on their axle m, the latter being fixed by a bracket, m', attached to the machine-frame.

The method of using this invention may be described as follows: The measuring apparatus is put out of gear by withdrawing the pawl l^2. The sectors are disengaged from each other by unscrewing the bolt g', and the pointer f of the free sector F is made to point to zero on the graduated scale of the fixed sector G. The first section of the warp is then filled in with the required length of yarn, in the usual manner. During this operation the presser E will be held against the section by the weight e', and recede from the section-shaft in proportion as the diameter of the section is increasing. The free sector F will be held stationary by the worm H, gearing into it, while the fixed sector G will move with the presser-shaft. When the section has been filled in, the pointer on the sector F will be found to point to a number on the graduated scale of the sector G. This number indicates the angular motion of the presser-shaft during the operation of filling, and is also a measure for the number of teeth the change-wheels require to produce the ratio between the angular motion of the presser-shaft and the number of revolutions of the section-shaft to fill the second and all the succeeding sections.

In order to simplify calculation, we divide the arc of the sector for producing the graduated scale so as to establish a simple relation between these divisions and the pitch of the toothed rim on the periphery of the sector, and make the number of the teeth of the change-wheel K identical with the number pointed out by the index-finger on the graduated arc g.

The number of teeth required for the change-wheel K^2 may be calculated in the following manner: Let t be the number of teeth of the ratchet-wheel, and n the number of revolutions of the section-shaft to fill the first section. Then the corresponding number of revolutions of the ratchet-wheel is $\frac{n}{t}$. Let d be the number of divisions of the graduated arc g of the sector F, along which the index-finger has traveled during the filling of the first section; and supposing, for example, that the pitch of the teeth f' on the sector F is twice the length of a division on the graduated arc g, then the number of revolutions of the worm-shaft H' during the winding of the first section is $\frac{d}{2}$; consequently, in order to produce by the connection of the sectors with the section-shaft the same angular motion of the presser during the winding of the second section which the presser had described during the winding of the first section by its contact with the circumference of the latter, the change-wheel K must make $\frac{d}{2}$, and the change-wheel K^2 must make $\frac{n}{t}$ revolutions. Now, let k be the number of teeth of the change-wheel K and k^2 the number of teeth of the change-wheel K^2, then it is evident that the ratio between k and k^2 must be equal to the ratio between $\frac{d}{2}$ and $\frac{n}{t}$ because the ratio between the number of teeth of the change-wheels is inverse to that existing between the number of their revolutions in a given time—that is to say, $\frac{k}{k^2} = \frac{dt}{2n}$. As only the ratio between k and k^2 is fixed, but not the the absolute magnitude of these numbers, we may choose any convenient number for k and then calculate k^2. If, for the sake of simplicity, k is make equal to d, the preceding equation will be reduced to $\frac{1}{k^2} = \frac{t}{2n}$, from which $k^2 = \frac{2n}{t}$—that is to say, the number of teeth of the wheel K^2 must be equal to twice the number of revolutions of the section-shaft made during the winding of the first section, divided by the number of divisions of the graduated arc g through which the index-finger f has traveled during the same time. If, for instance, the ratchet-wheel has twenty teeth, and if it be found that during the winding of the first section the section-shaft has made two thousand revolutions, and that after this period the index-finger points to the one-hundredth division of the graduated sector, then we have—

$$t=20$$
$$n=2000$$
$$d=100$$
$$k=d=100$$
$$k^2=\frac{2n}{t}=\frac{2.2000}{20}=200—$$

that is, the required ratio of angular motion may be obtained by taking for K a wheel with one hundred and for K^2 a wheel with two hundred teeth. The divisions of the graduated arc g may be any convenient fraction of the pitch of teeth on the sector F, and any convenient number of teeth on the ratchet or worm-wheel may be employed. The change-wheels K and K^2 having been fixed in their relative positions and put into gear by the intervention of an idle or intermediate change-wheel, K', the graduated sector G is brought back to zero, and thereby the presser E placed in contact with the empty drum A on the section-shaft from which the first section has been previously removed, the two sectors are pinned or bolted together, the apparatus is put into gear, and the winding of a second section commences. During the winding of the second and of any succeeding section a uniformly intermittent motion is given by the section-shaft to the ratchet-wheel through the grooved disk l, lever l', and pawl l^2, and this is transmitted by means of the change-wheels, worm, and sectors, to the presser, so that the presser always occupies precisely the same position relatively to the center of the section-shaft for any given number of revolutions made by a section, and all the sections have therefore the same diameter and equal lengths of yarn.

The number of revolutions made by the section-shaft during the winding of the first section may be ascertained in any convenient manner, but preferably by means of the special apparatus connected with the ratchet-shaft h, and constructed as hereinbefore described, this apparatus comprising the worm h', worm-wheel h^2, graduated disk M, index-finger h^3, axle m, and bracket m'.

To ascertain the number of revolutions of the section-shaft, the intermediate wheel, K, is removed, but the pawl l^2, left in gear with the ratchet-wheel L, and the section-shaft is set in motion. The revolution of the ratchet-shaft h, caused by the section shaft, grooved disk l, lever l', pawl l^2, and ratchet-wheel L will be transmitted to the disk M through worm h' and worm-wheel h^2, which is rigidly connected with the disk M, while the index-finger h^3, fixed to the axle m, remains stationary; consequently the angular motion of any point on the disk M relatively to the index-finger h^3 is a measure for the number of revolutions of the section-shaft, and the circumference of the disk M can be divided and marked so as to show immediately the number of revolutions of the section-shaft, which corresponds to any relative position of the disk M to the index-finger h^3.

N is a handle for turning the worm-shaft independently of the change-wheels when required.

L' is a ratchet-wheel of coarse pitch, into which the pawl l^2 may be made to gear by fixing it on the opposite side of the lever l'.

a^2 and a^3 are brackets for holding the shafts h and H.

a^4 is a plate secured to the bracket a^2, and serving to hold the axle of the intermediate wheel, K'. The bracket a^2 also serves to hold the fulcrum of the pawl-lever l'.

In order to secure a uniform rate of travel for the yarn while it is being wound upon the section, it is necessary, because of the gradually-increasing diameter of the section, to gradually decrease its speed of rotation. To effect this object, we transmit the motion from a pair of driving-shafts to the section-shaft by means of friction-rollers and a face-plate. The distance of the friction-pulleys or bowls from the center of the face-plate is automatically controlled by the position of the presser with regard to the section-shaft.

In the accompanying drawings, p and p' are the driving-shafts, placed on opposite sides of the face-plate and carrying a pair of friction-rollers, P and P', mounted on the respective shafts by groove and feather, so as to allow a short sliding motion of the friction-rollers along the shafts. The shaft p also carries a fixed pulley, R, loose pulley R', and a fixed spur-wheel, S, while the shaft p' carries a fixed pulley, R^2, loose pulley R^3, and a fixed spur-wheel, S', gearing into the spur-wheel S.

Q is the friction-plate, keyed on the shaft a. The diameters of the friction-roller, pulley, and spur-wheel on the shaft p are equal to those of the corresponding parts on the shaft p', so as to insure the same speed on the circumference of the two friction-rollers if the driving-belt for the pulley R is set in motion from the same drum on a horizontal counter-shaft as the driving-belt of the pulley R^2. The counter-shaft (not shown in the drawings) is situated vertically over or under the disk Q and parallel with the same, so that the two driving-belts have a tendency to pull the pulleys R and R^2, together with the friction-rollers P and P', toward the plane of the disk Q. The hubs of the bowls or friction-rollers P at P' are provided with circular grooves, into which project a pair of pins secured to a pair of levers, t t', which are made in one piece or rigidly connected with each other, and are fixed on a shaft, T. On this shaft is also fixed a lever, U, connected with the lever E' on the presser-shaft by a link, V. The outer end of the lever U and the lower end of the link V are slotted, in order to allow an adjustment of the position of the lever U with regard to the lever E'.

The bearings w and w', for the driving-shafts p p', are formed on a cross-beam of the machine W, and are constructed, so as to allow a slight pivotal motion of the center lines of the shafts p and p' against each other in order to keep the friction-rollers P and P' in contact with the friction-plate Q. The speed of the shaft a, and therefore of the section, is governed by the position of the friction-rollers P P' relatively to the face-plate. Thus if the friction-rollers are near the circumference of the face-plate the speed of the section is low. If, then, the friction-rollers are near the center of the face-plate at the commencement of the operation of winding a section and are gradually moved toward the circumference as the operation proceeds, it is obvious that a uniform travel of the yarn or rate of winding may be maintained.

An examination of the drawings will show that the connection between the presser and the friction-rollers is adapted to fulfill this condition, for, in proportion as the diameter of the section increases and the presser E descends, the lever E', together with the link V and the lever U, will rise, and the shaft T will be turned so as to remove the lever *t* and the rollers P P′ from the center of the shaft *a*.

What we claim is—

1. The combination of a section-shaft and drum with a presser consisting of a lever adapted to be held in contact with the yarn wound on the drum, and a pair of sectors adapted to turn on the same axis as the presser, one of the said sectors being rigidly connected with the presser while the other is mounted loose on its axle and provided with means for attaching it to the fixed sector at various angles, one of the sectors being also provided with a graduated scale for measuring their angular motion relatively to each other, substantially as described.

2. The combination of a section-shaft and drum with a presser consisting of a lever adapted to be held in contact with the yarn wound on the drum, a pair of sectors adapted to turn on the same axis as the presser, one of the said sectors being rigidly connected with the presser while the other is mounted loose on its axle and provided with means for attaching it to the fixed sector at various angles, one of the sectors being also provided with a graduated scale for measuring their angular motion relatively to each other, and a train of change-wheels with devices intermediate the section-shaft and change-wheels and intermediate the change-wheels and the loose sector, substantially as described.

3. The combination of section-shaft *a* and section-drum A with presser E and weighted lever E′, sector-shaft *e*, sectors F G, the latter provided with graduated scale and the former with the toothed rim *f*′, means for securing the two sectors together at various angles, worm H, and shaft H′, change-wheels K K′ K^2, ratchet-wheel L, pawl l^2, and ratchet-shaft *h*, and mechanism intermediate the section-shaft and the pawl, substantially as described.

4. The combination of a section-shaft and drum with a movable weighted presser and presser-shaft, a pair of sectors, one of which is provided with a toothed rim, a worm gearing into such toothed rim, a train of change-wheels, a shaft for supporting said worm, mechanism for transmitting the rotary motion of the section-shaft to the change-wheels, a face-plate adapted to transmit motion to the section-shaft, a pair of friction-rollers adapted to move along their axes parallel to the face-plate, and mechanism for transmitting motion from the presser to the friction-rollers, substantially as and for the purposes described.

In testimony whereof we have signed this specification in the presence of two subscribing witnesses.

JNO. C. SEWELL.
EUSTACE HULTON.
JOHN BETHEL.

Witnesses:
GEO. W. STEPHENSON,
JAS. G. NEWTON.