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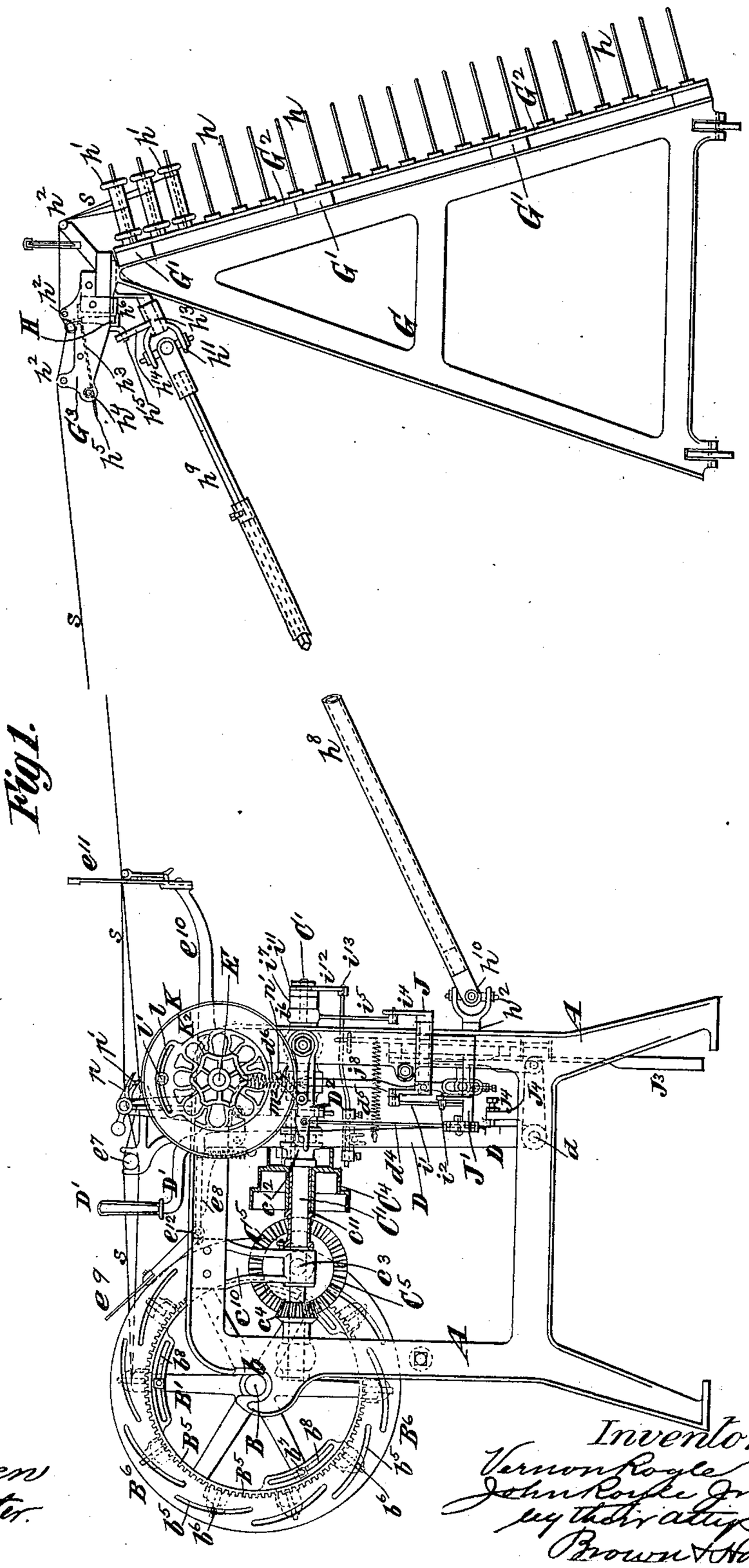
8 Sheets—Sheet 1.

V. ROYLE & J. ROYLE, Jr.

WARPING OR REELING MACHINE.

No. 370,162. Patented Sept. 20, 1887.

Fig 1.



Witnesses:
C. L. Sundgren
Emil Reuter.

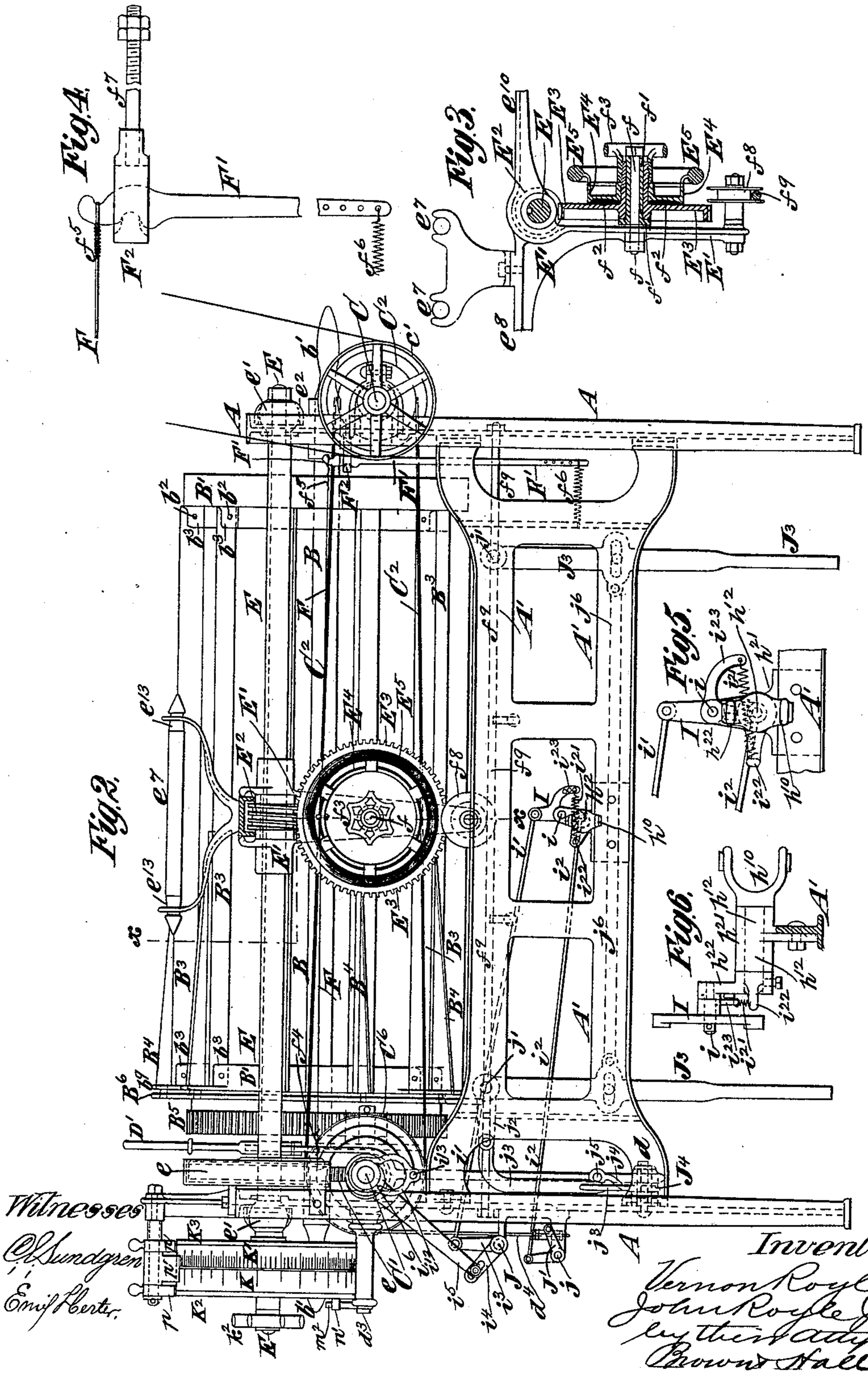
Inventors.
Vernon Royle
John Royle Jr.
by their attys
Brown & Hall

(No Model.) 8 Sheets—Sheet 2.

V. ROYLE & J. ROYLE, Jr.

WARPING OR REELING MACHINE.

No. 370,162. Patented Sept. 20, 1887.



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WARPING OR REELING MACHINE.

No. 370,162. Patented Sept. 20, 1887.

Fig. 8.

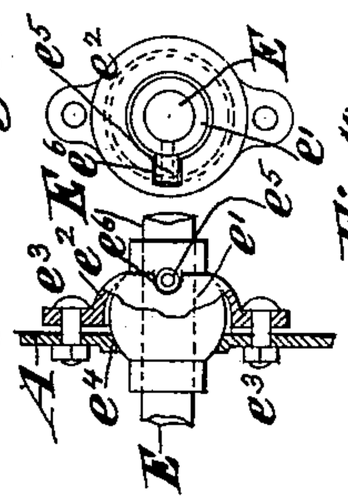


Fig. 9.

Fig. 10.

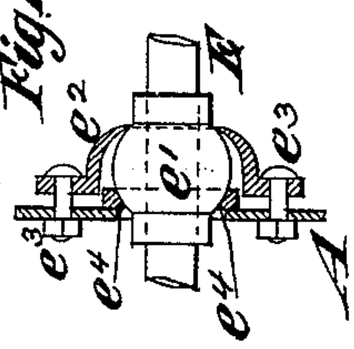


Fig. 11.

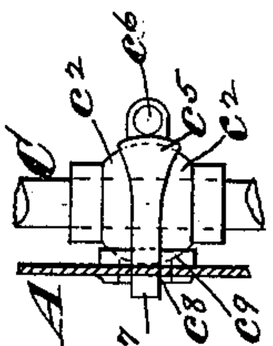


Fig. 12.

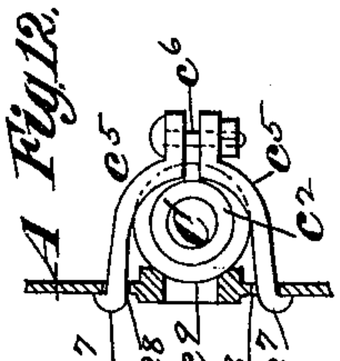
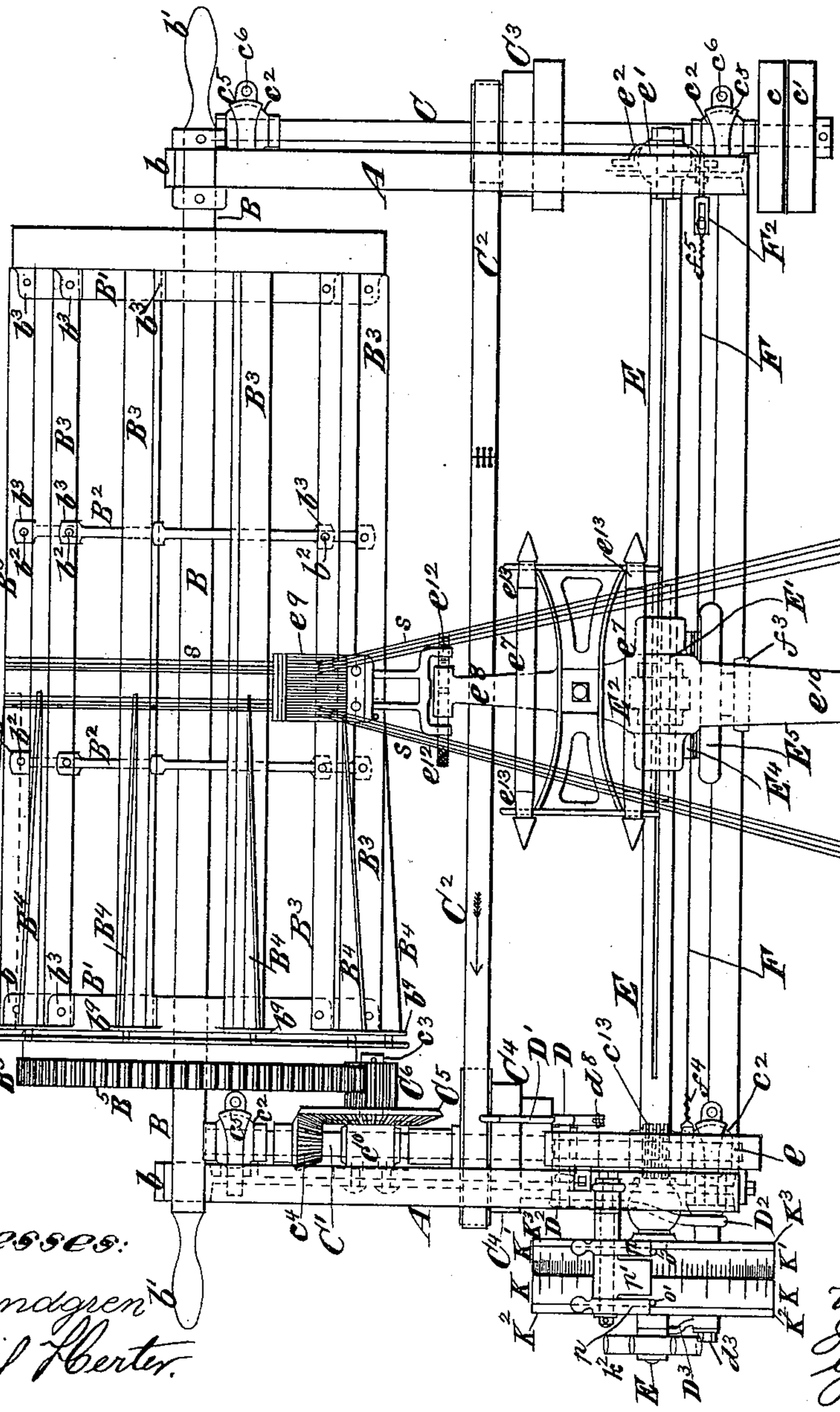


Fig. 7.



Witnesses:
C. L. Sundgren
Emil Aberter.

Inventors:
Vernon Royle
John Royle Jr.
by their Attys
Brown & Earle

(No Model.) 8 Sheets—Sheet 4.

V. ROYLE & J. ROYLE, Jr.

WARPING OR REELING MACHINE.

No. 370,162. Patented Sept. 20, 1887.

Fig. 15.

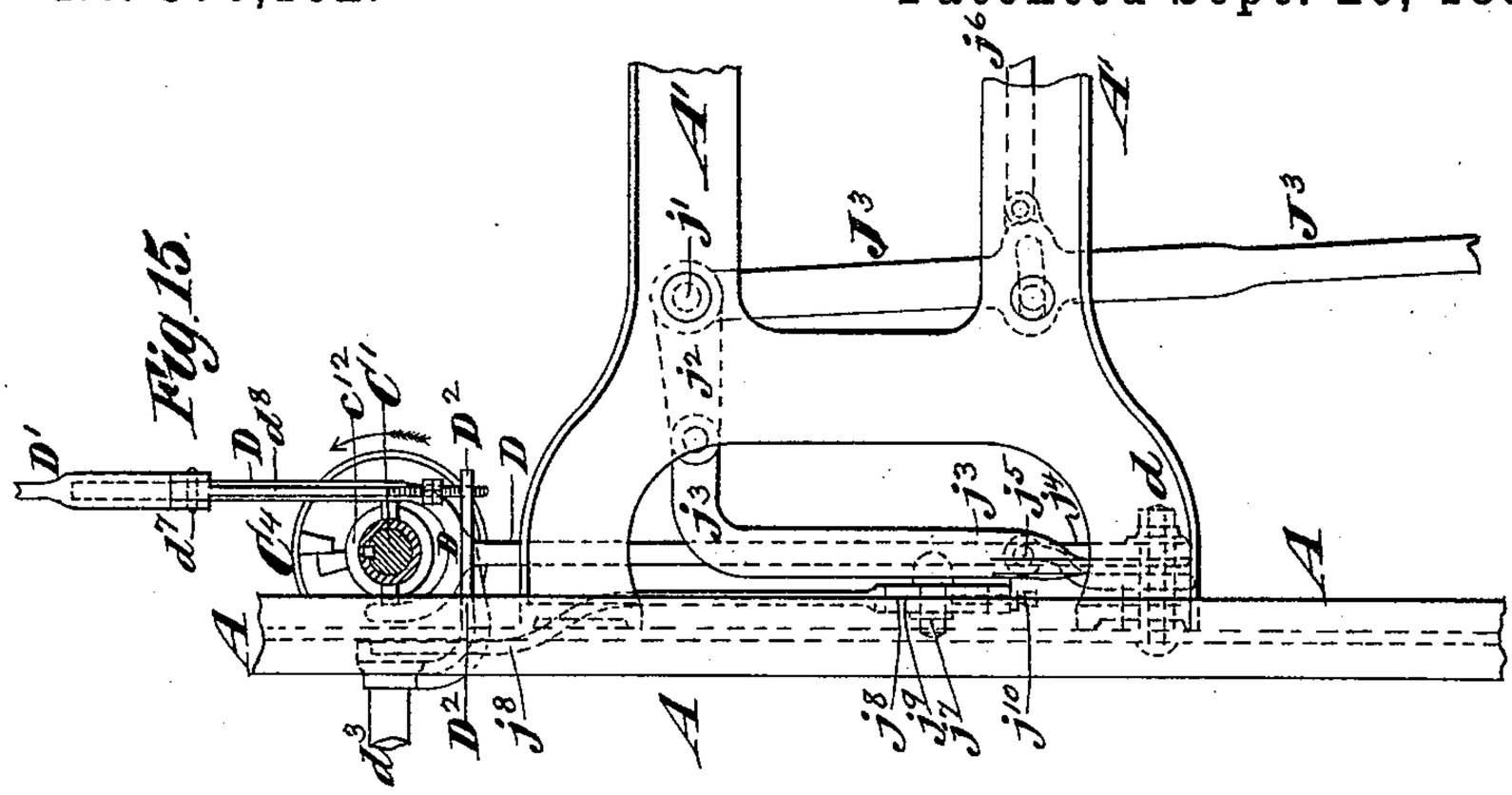


Fig. 14.

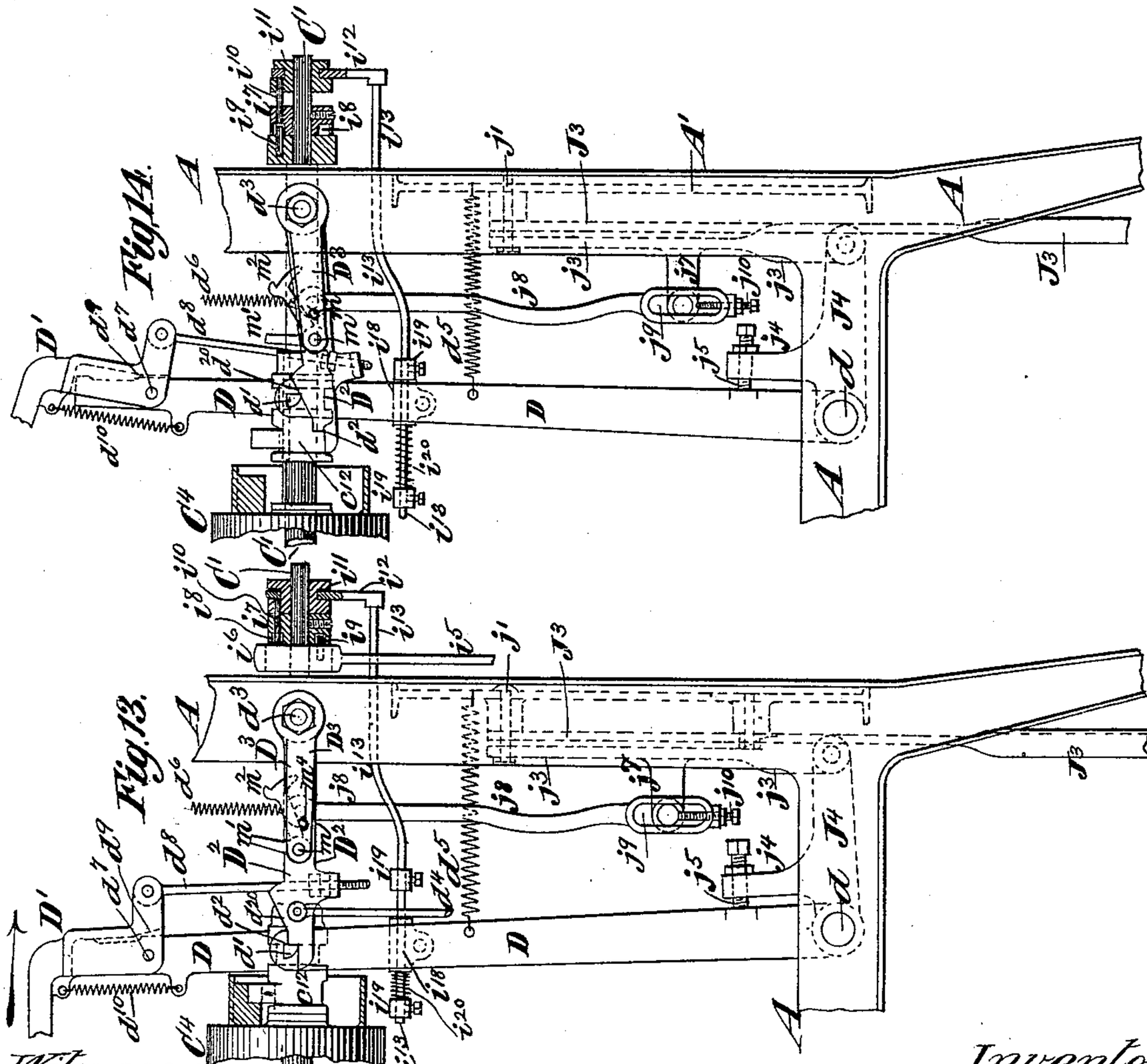


Fig. 13.

Witnesses:
C. L. Sundgren
Emil Herter

Inventors:
Vernon Royle
John Royle Jr.
by their Attys
Brown & Hall

(No Model.) 8 Sheets—Sheet 5.

V. ROYLE & J. ROYLE, Jr.

WARPING OR REELING MACHINE.

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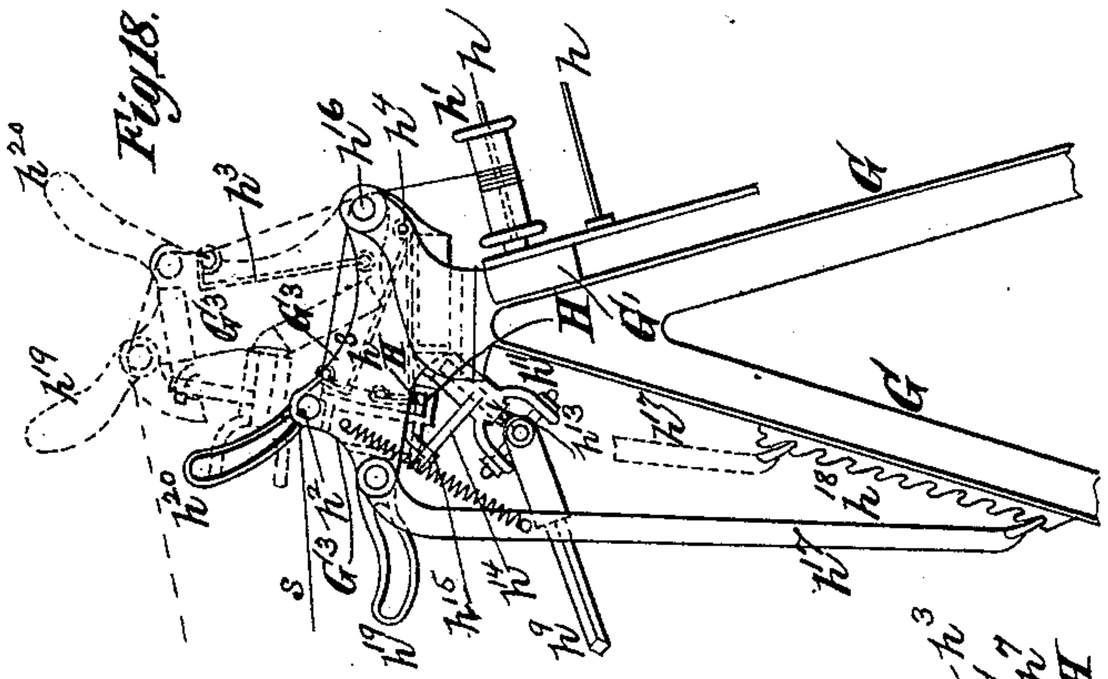


Fig. 18.

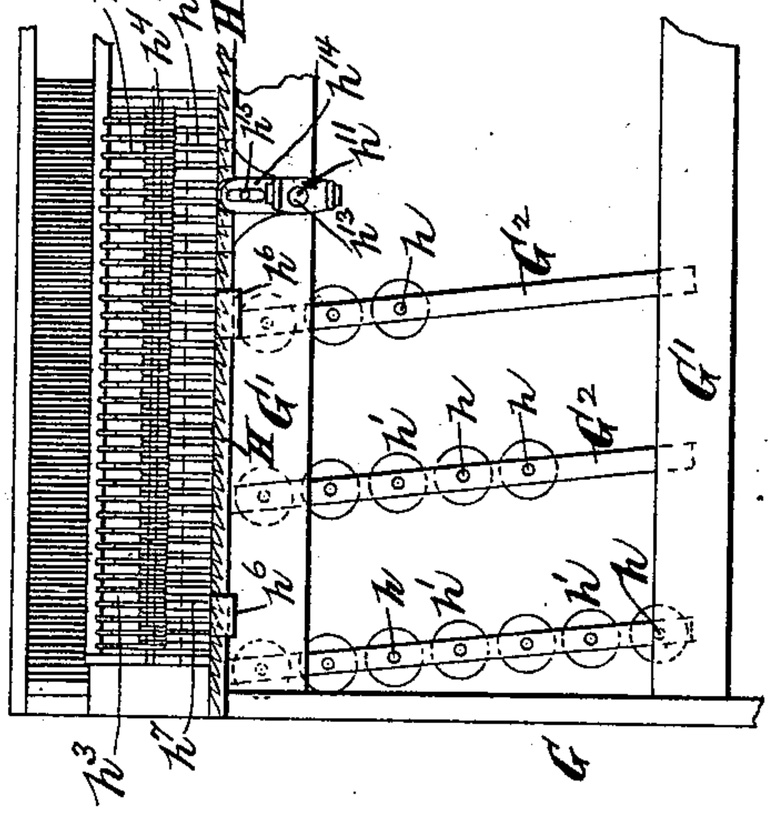


Fig. 16.

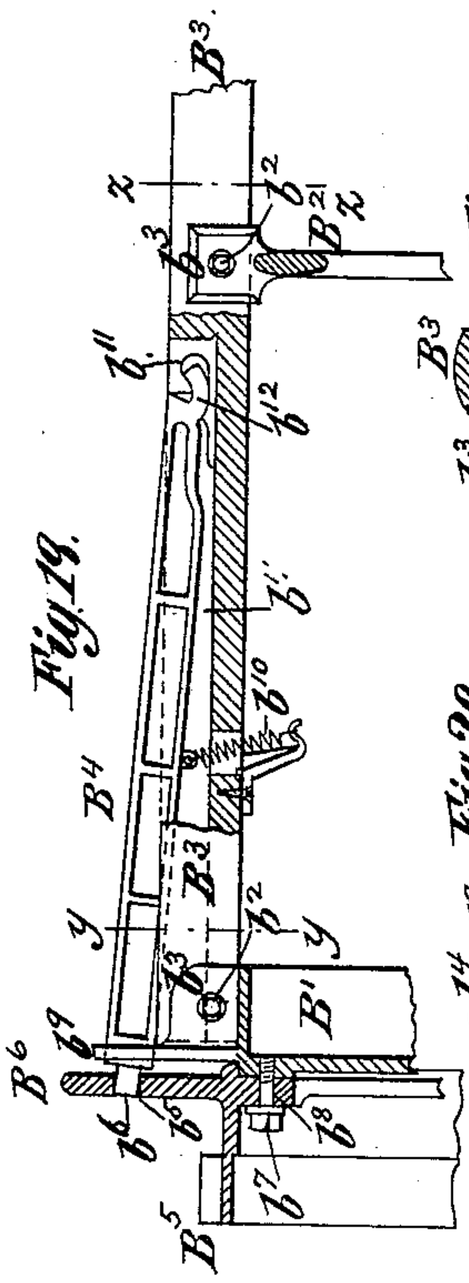


Fig. 19.

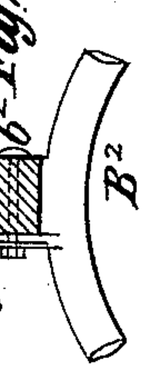


Fig. 21.

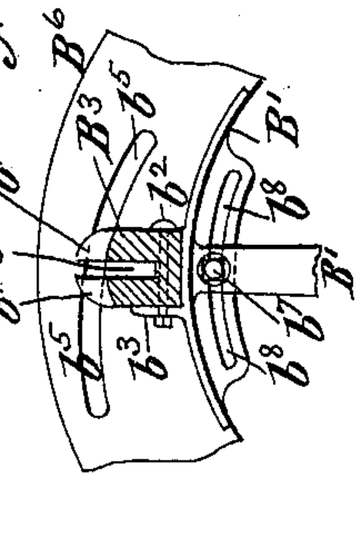


Fig. 20.

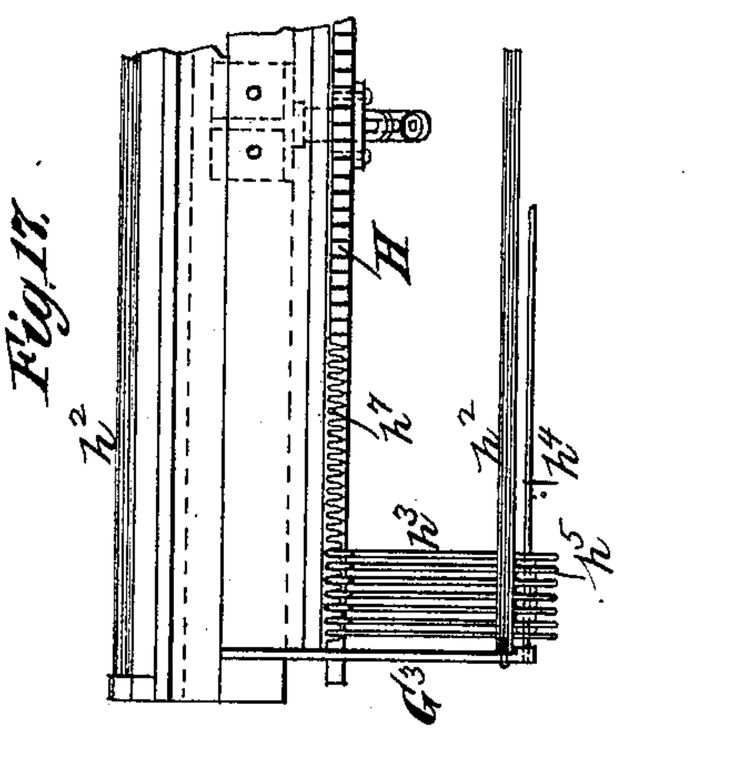


Fig. 17.

Witnesses:
C. L. Sundgren
Emil Herter

Inventors:
Vernon Royle
John Royle Jr.
by their Attys
Brown & Hall

(No Model.) 8 Sheets—Sheet 6.

V. ROYLE & J. ROYLE, Jr.

WARPING OR REELING MACHINE.

No. 370,162. Patented Sept. 20, 1887.

Fig. 23.

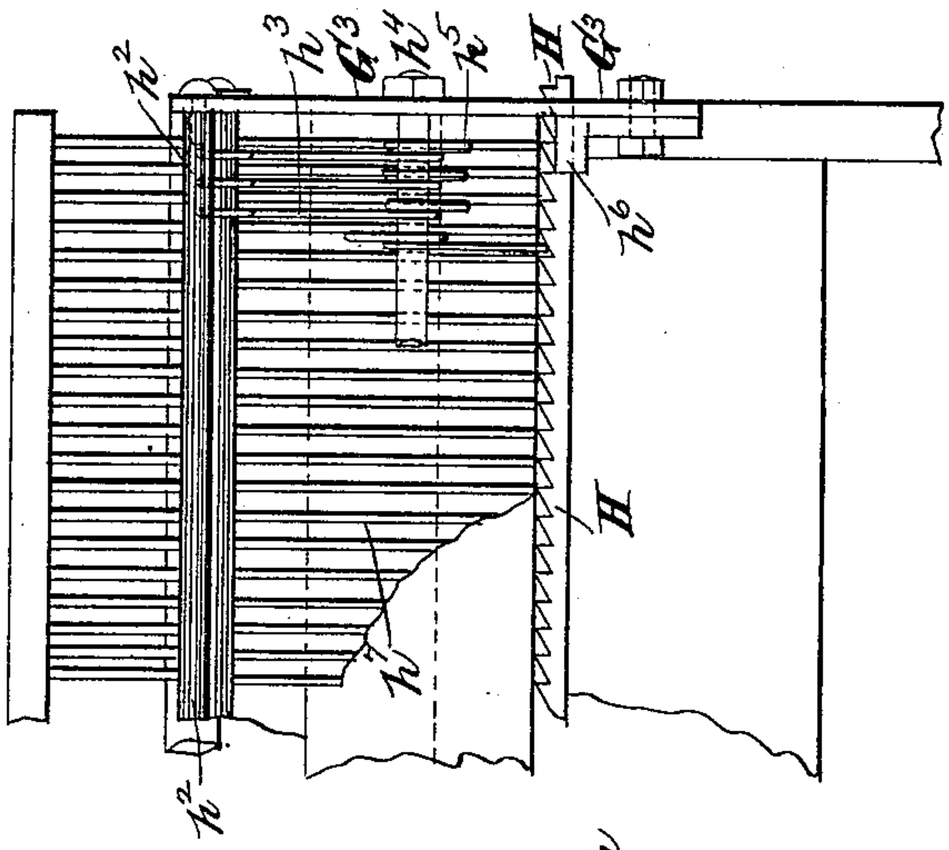


Fig. 22.

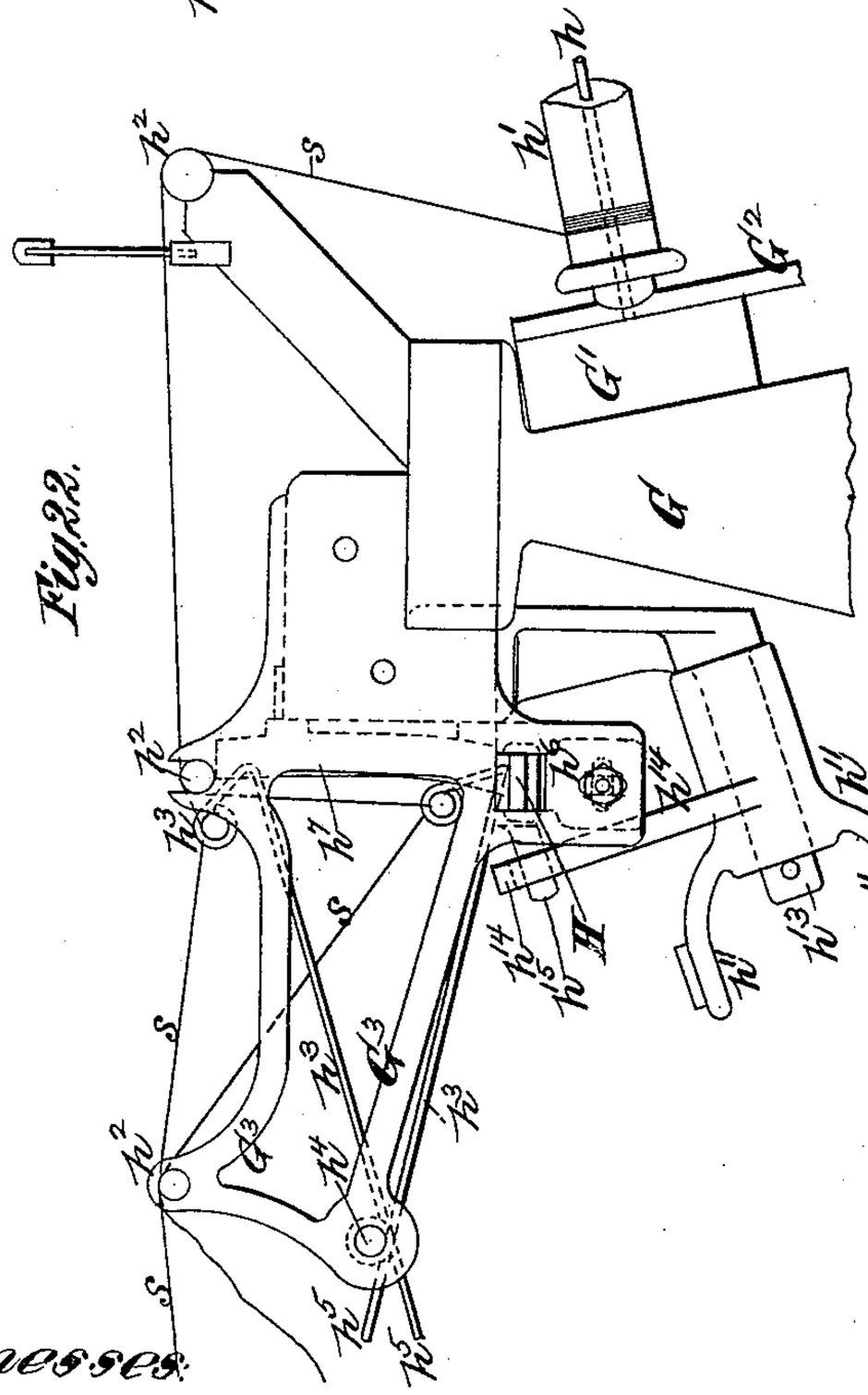
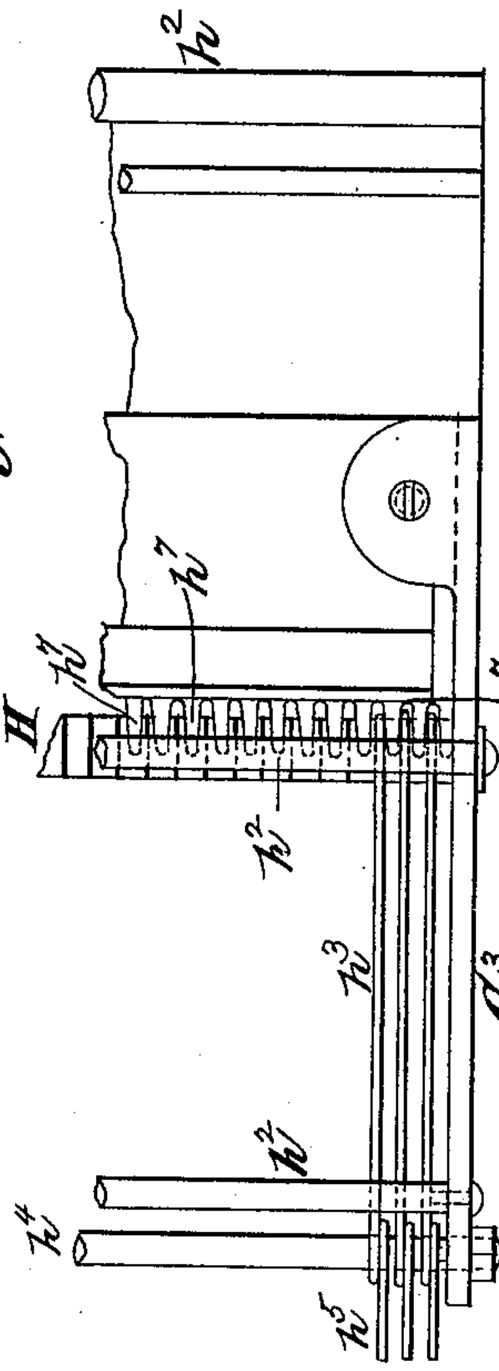


Fig. 24.



Witnesses:
C. Sundgren
Emil Carter.

Inventors:
Vernon Royle.
John Royle Jr.
by their Attys
Brown & Hall

(No Model.) 8 Sheets—Sheet 7.

V. ROYLE & J. ROYLE, Jr.

WARPING OR REELING MACHINE.

No. 370,162. Patented Sept. 20, 1887.

Fig. 25.

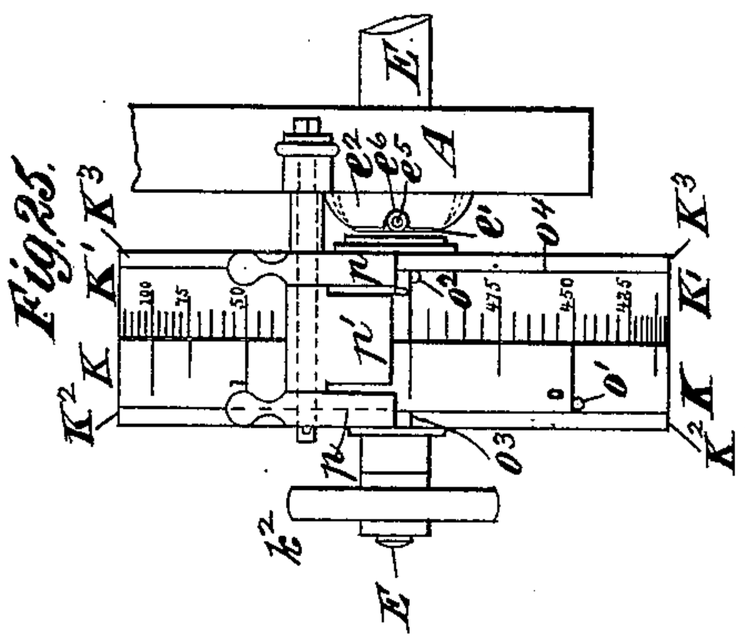


Fig. 30.

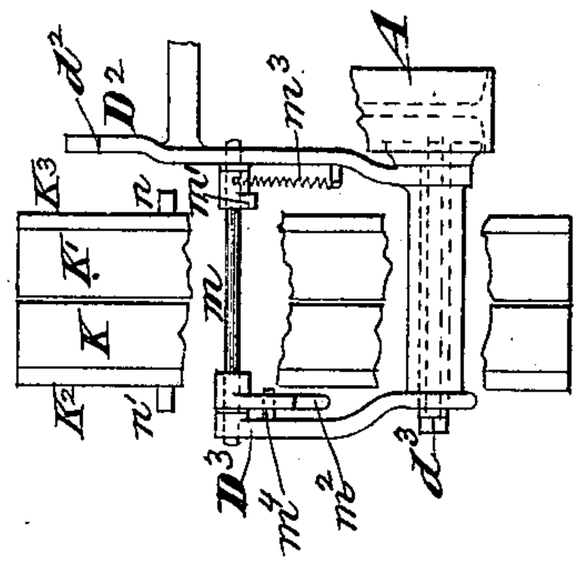


Fig. 26.

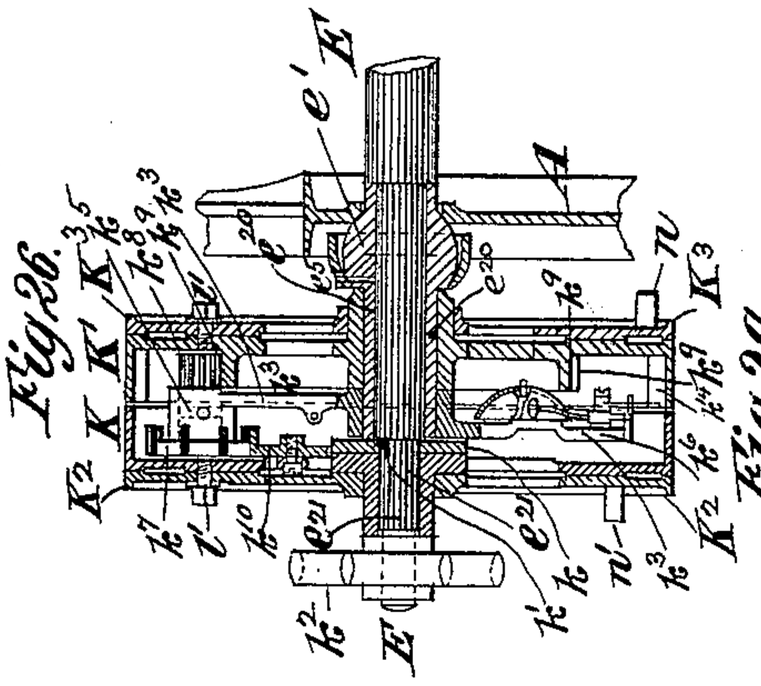


Fig. 29.

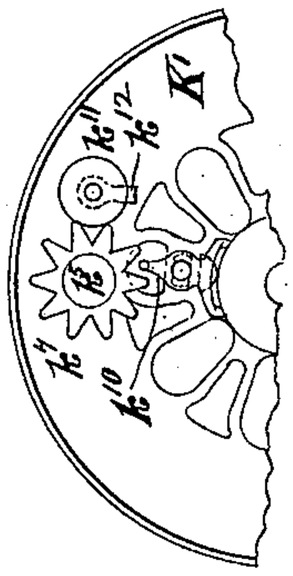


Fig. 27.

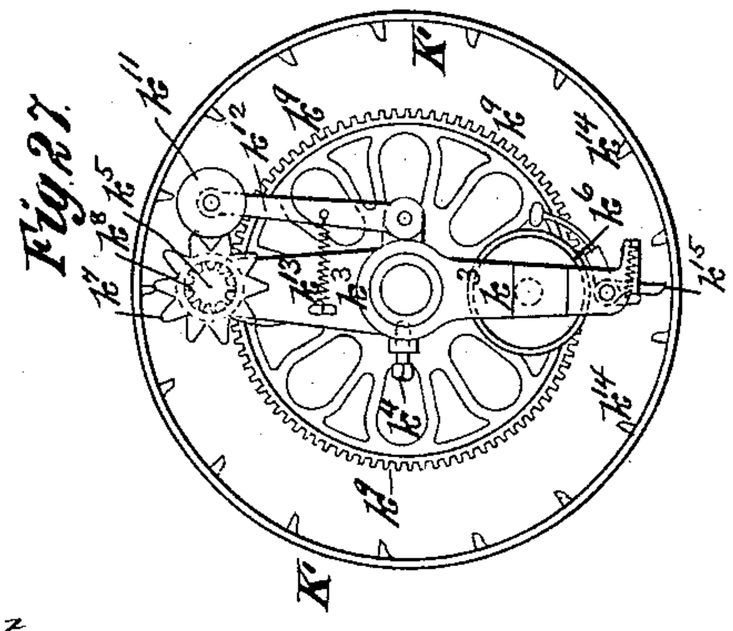
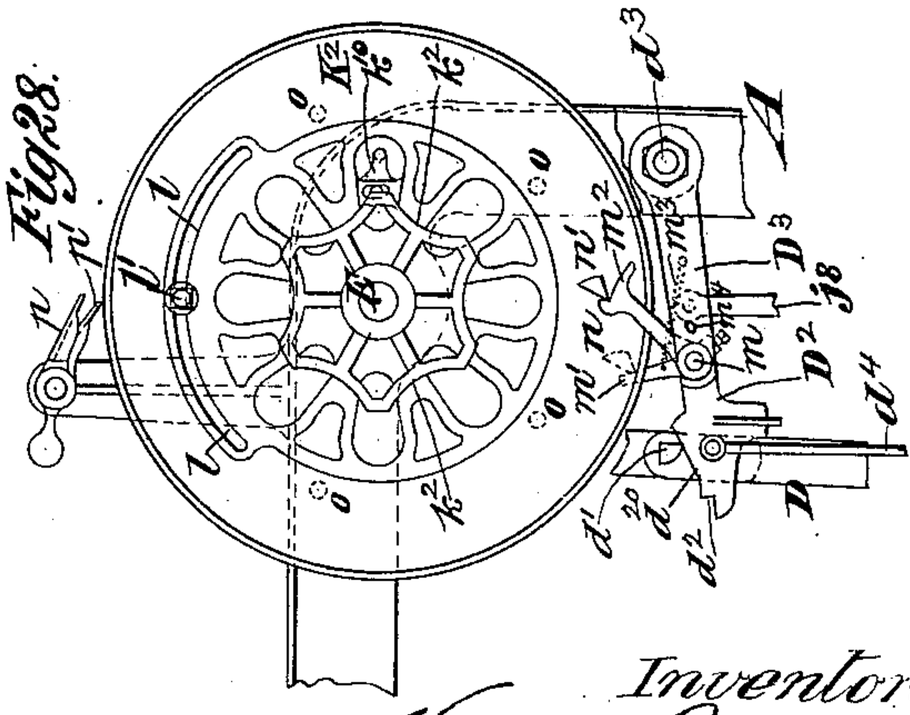


Fig. 28.



Witnesses:
C. L. Sundgren
Emil Herter

Inventors:
Vernon Royle
John Royle Jr.
by their Attys
Brown & Hale.

(No Model.) 8 Sheets—Sheet 8.

V. ROYLE & J. ROYLE, Jr.

WARPING OR REELING MACHINE.

No. 370,162. Patented Sept. 20, 1887.

Fig. 31.

Fig. 32.

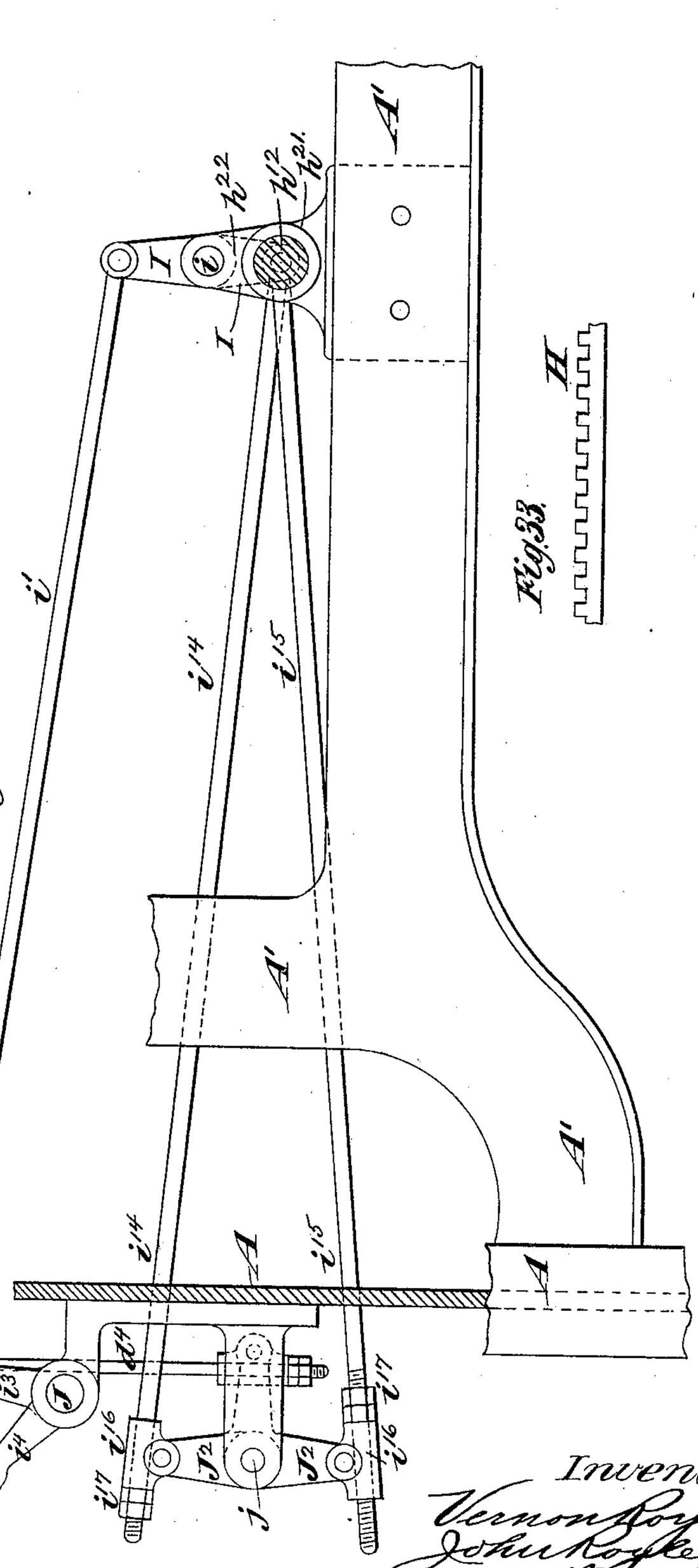


Fig. 33.

Witnesses:
C. L. Sundgren
Emil Herter.

Inventors:
Vernon Royle
John Royle Jr.
by their Attys
Brown & Hall

UNITED STATES PATENT OFFICE.

VERNON ROYLE AND JOHN ROYLE, JR., OF PATERSON, NEW JERSEY.

WARPING OR REELING MACHINE.

SPECIFICATION forming part of Letters Patent No. 370,162, dated September 20, 1887.

Application filed October 1, 1886. Serial No. 215,053. (No model.)

To all whom it may concern:

Be it known that we, VERNON ROYLE and JOHN ROYLE, Jr., both of Paterson, in the county of Passaic and State of New Jersey, have invented a new and useful Improvement in Warping or Reeling Machines, of which the following is a specification.

Although our invention is more particularly intended for warping-machines for winding or reeling silk-warp preparatory to weaving, certain features thereof may be embodied in other reeling-machines for silk and in warping or reeling machines for other materials.

Among those features of the invention which are applicable to reeling-machines generally are the stop-motion, whereby the reeling is stopped automatically when a thread breaks, and the indicator, whereby the number of yards of thread wound is indicated and the machine automatically stopped when the desired quantity is wound or reeled; and also the mechanism for traversing the parting-bar and reed-carriage may be embodied in other reeling-machines for silk, and in warping or reeling machines for other fibers and materials.

Our invention consists in novel combinations of parts, hereinafter described, and pointed out in the claims, in the mechanisms for producing the traverse motion of the parting-bar and reed-carriage, whereby we provide a mechanism which admits of the carriage being very quickly and precisely adjusted or set relatively to the screw which operates it. Heretofore the carriage has commonly been operated directly by a screw and a split nut or a nut-section, which could be set only to the pitch of the screw, except the screw be turned by hand. According to this part of our invention, we provide a worm carried by the carriage and fitted to a splined shaft, and we journal on the carriage a worm-wheel and a drum, which may be clamped to turn by frictional engagement with the worm-wheel, and around which is passed, as many times as is necessary, a cable or cord having its ends fixed at opposite sides of the machine. When the carriage is to be stopped, the drum is released from the worm-wheel, and when the carriage is to be started the drum is turned by hand to bring the carriage to the desired adjustment and is then clamped to turn with the worm-wheel.

The invention also consists in novel combinations of parts, hereinafter described, and pointed out in the claims, in the stop-motion, through which the machine is stopped on the breaking of a thread. According to this part of our invention, the machine is operated by driving mechanism, which may have a shipper or lever controlling a clutch and which is held in operative position by a trigger or movable stop, and this trigger or stop is controlled through suitable mechanism by a bar provided with ratchet-shaped or spur teeth, and to which a rapid reciprocating movement is imparted in a plane transverse to the planes in which the fallers or faller-wires are arranged. So long as the threads are intact the reciprocating notched or toothed bar meets with no resistance, but on the breaking of a thread its faller drops onto the notched or toothed bar and locks it against reciprocation, and the resistance which it encounters causes it to react on its operating mechanism and to throw off the trigger or stop, thereby releasing the shipper and clutch and stopping the machine. The machine may also be stopped by the hand or foot of the attendant.

The invention also consists in a novel construction and arrangement of a faller or faller-wire frame, whereby provision is afforded for swinging the frame into such position that the faller-wires will stand nearly vertical and the threads will thereby be relieved of the greater part of their weight, such faller-wire frame being used with the reciprocating notched or toothed bar hereinabove referred to.

The invention also consists in a novel combination of parts, including a rotary indicator, whereby the trigger or movable stop will be automatically thrown off to release the clutch when the desired quantity of yards or meters of filaments or threads are wound on the reel.

The invention also consists in specific combinations of parts hereinafter described, and pointed out in the claims, and relating to the mechanism whereby the reel, the shaft for moving or traversing the parting-bar and reed-carriage, and the indicator are driven, and to the construction of the bearings for the several shafts, whereby provision is afforded for adjusting the shafts into proper alignment and without necessitating any careful fitting of the bearings to the frame of the machine.

The invention also consists in novel combinations of parts hereinafter described, and pointed out in the claims, and relating to the construction of the reel, such combinations including a novel connection of the bars or lags with the heads and intermediate spiders or supports, a novel connection of the elevating blades or bevels with the bars, and a novel means of adjusting and guiding said blades or bevels.

The invention also consists in other features of construction hereinafter described, and pointed out in the claims.

In the accompanying drawings we have illustrated a warping machine or mill particularly designed for silk, and which embodies all the features of our invention.

In the drawings, Figure 1 is an end elevation of the warping-machine proper and the creel or spool-frame, one cone-pulley of the machine only being in section. Fig. 2 is a front elevation of the machine proper on a larger scale, the crossing-reed only being removed and its supporting-arm shown in section. Fig. 3 is a partly-sectional elevation on the plane of the dotted line *x x*, Fig. 2, of a part of the mechanism for traversing the parting-bar and reed-carriage. Fig. 4 is an elevation on a still larger scale of an adjustable and spring-sustained lever, whereby the desired tension may be maintained in the cable or cord through which the parting-bar and reed-carriage are operated. Figs. 5 and 6 are respectively front and side elevations, upon a larger scale than Fig. 2, of parts of the stop-motion shown in said figure. Fig. 7 is a plan of the machine proper on the same scale as Fig. 2. Figs. 8 and 9 are respectively a horizontal section and partial plan and a front view of a part of the frame and a bearing of novel construction for one of the shafts of the machine; and Fig. 10 is a view similar to Fig. 8, illustrating a slight modification of the invention. Figs. 11 and 12 are respectively a plan and an end view of a bearing for the end or cross shafts of the machine, including a section of part of the frame. Figs. 13 and 14 are partly-sectional elevations, on a much larger scale, of parts of the frame, the main shaft, and stop-motion, the former figure showing the parts in operative position and the latter figure showing them thrown off. Fig. 15 is an elevation in a plane at right angles to Figs. 13 and 14 and on the same scale. Fig. 16 is an elevation of a part of the creel, with faller-wires and their supporting-frame. Fig. 17 is a plan of parts shown in Fig. 16. Fig. 18 is an end elevation of part of a creel, with faller-wires and a frame therefor, which is pivoted to swing upward in order to relieve the threads of the larger part of the weight of the faller-wires. Fig. 19 is a sectional view of a part of the reel in a plane parallel with its axis. Figs. 20 and 21 are sectional views on the planes indicated, respectively, by the dotted lines *y y* and *z z*, Fig. 19. Figs. 22, 23, and 24 are respectively an end elevation, a front elevation, and a plan, on a larger scale, of a part of the creel shown in Figs. 16 and 17, including faller-wires and a part of their supporting-frame. Figs. 25 and and 26 are respectively a plan and an axial section of the indicator on a larger scale than in Figs. 2 and 7. Fig. 27 is a side view of one half thereof, the outer half or disk, which has the quicker rotary motion, being removed. Fig. 28 is a side view of the indicator complete, including the tripping mechanism and the trigger or movable stop controlled thereby. Fig. 29 shows in its upper part a side view of part of the inner disk, and in its lower part a similar view of the outer and quicker-moving disk, together with the trigger or stop and tripping mechanism, showing the latter in operative position. Fig. 30 is a plan of the trigger or stop and tripping mechanism, also including parts of the indicator to illustrate their relative position. Fig. 31 represents one of the parting-bars. Fig. 32 is an elevation, on a larger scale, of part of a stop-motion embodying our invention in a form adapted for use with a reciprocating bar having square or spur teeth and notches, instead of a bar having ratchet-shaped teeth; and Fig. 33 represents part of a reciprocating bar having such square or spur teeth.

Similar letters of reference designate corresponding parts in all the figures.

In Fig. 1 we have shown an end view of the warping-machine proper and of the creel which carries the spools from which the threads are taken, and have also represented a telescopic shaft, which transmits from the warping-machine proper the rocking motion necessary to reciprocate the notched or toothed bar, which forms an essential element of our stop-motion, and which is upon the creel. In Figs. 2 and 7 the warping-machine proper is shown in front elevation and in plan upon a somewhat larger scale, and the creel is omitted.

A A designate two end frames or standards of the warping-machine proper, which are connected by longitudinal frames or stretchers A′, one of which is represented in Fig. 2. At the back of the machine is arranged the reel, which has a central shaft, B, supported in open bearings *b* in the end standards, A. At the opposite ends of this reel-shaft are handles *b′*, whereby the reel may be lifted and removed entire from the machine, as is usual in warping-machines. The reel is shown in the general views, Figs. 1, 2, and 7, and the details of its construction, which are included in our invention, are illustrated in Figs. 19, 20, and 21. At opposite ends of the reel are heads or spiders B′, which are secured upon the reel-shaft B, and have smooth cylindric peripheries similar to pulleys, and intervening between the end heads or spiders, B′, are arranged one or more supporting frames or spiders, B^2.

The heads and intermittent frames B′ B^2 have secured to them the bars or lags B^3 of the reel, which are usually of wood; but instead of these bars or lags being secured directly to the periphery of the heads or frames B′ B^2 by

means of bolts or screws inserted radially to the central shaft, B, as is usual, the bars or lags are secured by screws or bolts b^2 to the faces of flanges b^3, which are formed upon the heads or frames B′ B², and which project therefrom approximately radial to the shaft B. Near the end portions the bars or lags B³ are slotted from their outer surfaces inward, as shown at b^4, and in these slots are arranged the bevels or elevating-blades B⁴, which are usually of metal, and which at their inner ends are connected by a joint with the bars or lags B³, and at their outer ends are adjustable toward and from the shaft B to vary their angle of inclination relatively to the bars or lags B³.

At the end of the reel is a pinion or gear wheel, B⁵, which is formed integral in one casting with a broad flange, B⁶, extending outward transversely to the shaft B, as best shown in Fig. 19, and in this flange are oblique slots b^5, of substantially the form shown in Fig. 20, and which receive projections b^6 upon the outer ends of the elevating blades or bevels B⁴. The casting forming the pinion and flange B⁵ B⁶ is adjustably connected with the arms of the heads or end frames, B′, by means of bolts or screws b^7 and segmental slots b^8, as shown best in Fig. 20; and hence it will be seen that by turning the flange B⁶ relatively to the end frame or head, B′, of the reel the elevating bevels or plates B⁴ will, by the engagement of their ends with the oblique slots b^5, be shifted outward or inward at their outer ends, so as to give them a greater or less inclination relatively to the bars or lags B³. The heads or end frames, B′, are also provided with forked or bifurcated flanges b^9, which receive the outer ends of the elevating blades or bevels B⁴, and serve to guide the blades or bevels in their outward and inward movement and to hold them against shifting transversely to the length of the bars B³, and prevent their splitting such bars by bearing against the sides of the slots b^4. Springs b^{10} are also connected with the blades or bevels B⁴, for drawing them inward into the slots b^4.

In the end of the slot b^4 in each bar or lag B³ is inserted a casting, b^{11}, having an undercut notch or recess which forms the female member of a knuckle-joint, and the blade or bevel B⁴ is formed with a curved tongue or male member, b^{12}, which enters such notch or recess and forms therewith a knuckle-joint or dovetailed connection between the blade or bevel B⁴ and the bar or lag B³. One peculiar feature of the joint described is that the center on which the joint b^{11} b^{12} works, and on which the blade or bevel swings, is and always remains coincident with the point at which the outer face of the blade or bevel intersects the outer face of the bar or lag, and hence such point remains stationary even when the blade or bevel is inclined at different angles.

At one end of the machine is a shaft, C, which may be provided with fast and loose pulleys c c', and which is fitted to bearings c^2, secured to the end frame, A, as we shall hereinafter describe. Near the other end of the machine is a similar shaft, C′, which is also fitted to bearings c^2, secured to the end frame, A, and which receives motion by a belt, C², running on reversely-set cone-pulleys C³ C⁴ from the shaft C.

C⁵ C⁶ designate a bevel-wheel and a spur-pinion, which are here represented as journaled upon a stud, c^3, and which may be rotated as one, and motion is transmitted from the shaft C′ to the reel-shaft by means of the bevel-pinion c^4 on the shaft C′ engaging the bevel-wheel C⁵ and by the pinion C⁶ engaging the spur wheel or circle of the teeth B⁵ upon the end of the reel. Although this form of gearing for imparting motion to the reel is very desirable, it is obvious that other equivalent arrangements of gear-wheels might be employed.

A desirable construction of the bearings for supporting the shafts C C′ from the end frames or standards, A, is represented in Figs. 11 and 12. The bearing c^2, to which the shaft C or C′ is fitted, is convex externally and is secured to the frame A by an inwardly-concave clamp, c^5, which is divided, as shown in Fig. 12, and the two halves or portions of which are drawn together and caused to bear tightly upon the bearing c^2 by a bolt, c^6, connecting them, as shown in Fig. 12. The ends of these clamping-sections c^5 are hooked or shouldered, as shown at c^7, and engage holes or perforations c^8, formed in the frame A, as shown in Fig. 12, and the convex exterior of the bearing c^2 is supported on one side by the divided clamp c^5 and at a diametrically-opposite point by a concave seat, c^9, formed upon the frame A. Although we consider this construction very desirable for the shafts C C′, it is obvious that bearings of other construction might be employed. As here represented, the stud c^3, on which the wheel and pinion C⁵ C⁶ turn, projects from a hanger, c^{10}, depending from the frame portion, as shown in Fig. 1, and to this hanger is secured a fixed sleeve, c^{11}, (see Fig. 1,) which surrounds the shaft C′, and on which the cone-pulley C⁴ rotates loosely. The cone-pulley C⁴ is therefore not fixed upon the shaft C′, but is connected therewith by a clutch, c^{12}, which is fitted to slide upon the shaft C′ into and out of engagement with the pulley C⁴, and which is controlled by a stopping and starting lever or shipper, D, as is best shown in Figs. 13, 14, and 15, and which will be hereinafter fully described. The pulley, clutch, and shipper, or stopping and starting lever, constitute driving mechanism, which may be adjusted to drive the machine and there held operative by a trigger, or thrown out by a spring or equivalent weight when released from the trigger, so that the parts of the machine will be stationary and the shaft C and pulley C⁴ only will be operated.

Upon the shaft C′ is a worm or screw, c^{13}, which engages a worm-wheel, e, secured upon the shaft E, which extends lengthwise of the machine parallel with the reel and has bear-

ings e', whereby it is supported from the end frames, A. These bearings may be of any suitable construction; but what we now consider a very desirable construction is shown in Figs. 8, 9, and 10. The bearing e', to which the shaft E is fitted, has a convex exterior, and is held in place by the concave clamp e^2, secured by screws or bolts e^3 to the frame A, the frame having an opening and concave seat, e^4, whereby the bearing e' is supported at the side opposite the clamp e^2. The concave seat e^4 may be formed upon the frame itself, or may be formed by a ring-support separate from the frame and bearing against the frame opposite the perforation or opening through which the shaft E and the bearing e' project, as shown in Fig. 10. We have also shown the bearing e' as having a radial projection, e^5, which may engage a notch, e^6, in the concave clamp e^2, and which locks the bearing to the clamp, so that the bearing cannot turn with the shaft. Through this projection may be bored an oil-hole for lubricating the shaft.

E′ designates a carriage, which is arranged at the front of the machine, and which has a reciprocating motion lengthwise of the shaft E. This carriage E′ supports the parting-bars e^7, and it has a rearwardly-projecting arm, e^8, which carries the distributing-reed e^9, and a forwardly-projecting arm, e^{10}, which carries the crossing-reed e^{11}. The distributing-reed e^9 may have a screw-connection, e^{12}, with the arm e^8, which provides for the fine adjustment of the reed e^9 relatively to the arm e^8 and to the reel onto which the threads s pass.

The mechanism whereby the carriage E′ is traversed along the shaft E is best represented in Figs. 2, 3, and 7. The shaft E is splined or grooved through the principal portion of its length, as shown in Figs. 3 and 7, and upon it is fitted a worm or screw, E^2, which, by means of the spline or feather and groove, is locked to turn with the shaft, but is free to slide along the shaft. In the carriage E′ is secured a stud or fixed journal, f, upon which is fitted a sleeve or thimble, f', as shown in Fig. 3.

E^3 designates a worm-wheel, which is journaled upon the sleeve or thimble f' and which engages the worm or screw E^2, and this worm-wheel has a hub, which projects forward and supports a cylindric drum, E^4, having cast integral with it a hand-wheel, E^5. The drum and hand-wheel E^4 E^5 are not, therefore, connected immovably with the worm-wheel E^3; but they are fitted loosely upon the hub of such worm-wheel, and between the drum and the face of the worm-wheel is introduced a washer, f^2, which may be of leather or other friction-producing material. To the outer end of the hub of the worm-wheel E^3, on which the drum E^4 is journaled, is applied a clamping-nut, f^3, and by screwing up this nut the drum E^4 and the worm-wheel E^3 may be locked together by the frictional contact produced through the washer f^2, and may be made to turn as one, while when the clamping-nut f^3 is loosened the drum and wheel E^4 E^5 may turn independently of the worm-wheel E^3.

F designates a small wire cable or other flexible connection, which at the end f^4 is fast to the end frame, A, of the machine, and at the opposite end, f^5, is secured upon the upper end of the lever F′, which has a fulcrum-bearing in the movable stirrup F^2, as best shown in Fig. 4, but also in Fig. 2. Applied to the lower end of the lever F′ is a spring, f^6, and the stirrup, which forms the fulcrum-bearing of the lever, is connected by a screw-threaded shank, f^7, with the end standard or frame, A. By screwing up the nuts, which are shown in Fig. 4 as upon the screw-threaded shank f^7 of the stirrup F^2, all slack in the cable or other flexible connection, F, may be taken up, and a uniform tension will be maintained upon the cable, and it will be held extended by the constant action of the spring f^6. The cable or other connection, F, is passed as many times as may be necessary around the drum E^4, and may be secured thereto, and hence it will be obvious that when the drum E^4 is locked fast to the worm-wheel E^3 by the clamping-nut f^3 the drum will turn with the worm-wheel as the latter is rotated by the screw E^2, and by taking up a portion of the flexible cable F on one side of the drum and paying out such cable from the opposite side of the drum the carriage E′ will traverse along the shaft at a speed necessary to lay the warp properly upon the reel. As here shown, the carriage E′ has a bearing on the shaft E, and is partially supported thereby, and said carriage is here represented as having at the lower portion a wheel or roller, f^8, which, by bearing upon the rod f^9, extending parallel with the shaft E, prevents the carriage E′ from turning on the shaft E.

The creel for the spools from which the threads are taken is shown in Fig. 1. The upper portion of the creel, including the fallers and such other parts of the stop-motion as are thereon, are shown in end view in Fig. 22, in side view or front view in Fig. 23, and in plan in Fig. 24.

G designates the end frames or standards of the creel, which are connected by horizontal bars or rails G′, upon which are secured the slats or bars G^2, from which project pins or spindles h for receiving the spools h'. The threads s pass from the several spools h' over guide-rods h^2 and through the eyes at the ends of the fallers or faller-wires h^3. At opposite ends of the creel are end plates or frames, G^3, which are connected by the rods h^2 and by a third rod or stretcher, h^4, on which the fallers or faller-wires h^3 are pivoted. The portions of the fallers which extend forward beyond the rod h^4, as shown in Fig. 22, may serve as handles h^5, whereby the fallers may be lifted to enable the threads to be passed through eyes which are at their free ends. Fitted to a suitable guide-frame, h^6, in the upper portion of the creel is a bar, H, which ex-

tends lengthwise of the creel, and is toothed or notched upon its upper surface, as best shown in Fig. 23. A reciprocating motion is imparted to the bar H, as we shall hereinafter describe, and it continues such motion until any faller, which may be allowed to drop by its thread breaking, falls upon the top of the bar and thus engages with its teeth or notches. When this occurs, the resistance which is opposed by the faller-wire to the movement of the bar H reacts through the mechanism which moves the bar and throws off the driving mechanism, as we shall hereinafter describe. In the present example of the invention the bar H has ratchet-shaped teeth or notches; but it might be formed with notches or projections resembling spur-teeth. In order to support the fallers h^3 against lateral movement and to enable them to oppose such a resistance to the movement of the bar H as will be effective when they drop into engagement with the bar, we have represented a channeled plate, h^7, as secured to the front of the creel, as best shown in Fig. 24, and receiving in the spaces or channels between its projections the free ends of the fallers h^3. Consequently when any faller drops upon the bar H its end immediately adjacent to the bar is supported laterally by the channeled plate h^7, and the bending of the faller laterally is prevented.

The bar H is reciprocated by means of a rocking shaft extending from the creel to the warping-machine, and shown in Fig. 1 as consisting of two sections, h^8 h^9, sliding one within the other telescopically, and connected by couplings h^{10} h^{11} with the warping-machine and creel. By the coupling h^{10} the telescopic shaft is connected with a short shaft, h^{12}, upon the warping-machine, and the coupling h^{11}, which is at the creel, is free to turn upon the fixed stud h^{13}, supported by a hanger from the creel, and said coupling h^{11} has upon it an arm, h^{14}, which engages a stud or arm, h^{15}, projecting laterally from the bar H, as shown in Fig. 22. Consequently it will be seen that any rocking motion which the shaft h^8 h^9 receives from the short stop-motion shaft h^{12} on the warping-machine will be communicated to the coupling portion h^{11} of the creel, and through the arm h^{14} and stud h^{15} will produce a rapid reciprocation of the toothed or notched bar H.

In reeling very light silk it may be desirable to relieve the threads of the weight of the fallers h^3, to which the threads are subject with the arrangement of the parts shown in Figs. 22, 23, and 24, and for this purpose we may arrange the faller-wire frame, which is formed by the end pieces, G^3, and the rods h^2 h^4, connecting them, upon pivots h^{16}, as is shown in Fig. 18, so that the entire frame containing the faller-wires can be swung upward from the position shown by full lines in Fig. 18 to the position shown by dotted lines in said figure. The fallers h^3 will then stand in a nearly vertical position, and will bear with extreme lightness upon the silk. In connection with such pivoted faller-frame we may employ a pivoted leg or pawl, h^{17}, which may engage a series of ratchet-teeth, h^{18}, on the end standard of the creel G, as is shown in Fig. 18, in order to hold the faller-frame in its elevated position, and such faller-frame may be provided with end handles, h^{19}, and a center handle, h^{20}, by either of which it may be raised into the position shown by dotted lines in Fig. 18.

Figs. 16 and 17 are views corresponding to Figs. 23 and 24, but are on a smaller scale, and for this reason we have referred particularly in the foregoing description to Figs. 22, 23, and 24.

The mechanism through which a rocking motion is imparted to the telescopic shaft h^8 h^9 from the short shaft h^{12} upon the warping-machine is best illustrated in Figs. 1, 2, 5, 6, 13, 14, and 15. The short shaft h^{12} is fitted to a bearing, h^{21}, secured to the stretcher A′, and said short shaft has upon it a crank-arm, h^{22}. To this crank-arm is pivoted a lever, I, having its fulcrum upon a wrist-pin, i, which is in the end of the crank-arm, and having connected with its opposite ends rods i' i^2.

J designates a rock-shaft journaled in a bearing secured to the end frame, A, of the machine and having upon it two arms, i^3 i^4. The rod i' is connected with the arm i^3, and with the arm i^4 is connected the rod i^5 of an eccentric, i^6, which is loose upon the end portion of the shaft C′. The eccentric i^6 is not fast upon the shaft C′, for a reason hereinafter explained, but is connected therewith by a clutch, which, as here shown, comprises a collar, i^7, fast upon the shaft and having in its face an annular groove, i^8. The eccentric i^6 has a pin, i^9, which enters the annular groove, and i^{10} designates another pin, which is fast in a collar, i^{11}, fitted to slide upon the end of the shaft C′ and controlled by an arm, i^{12}, and a rod, i^{13}. When the collar i^{11} is pushed outward to the position shown in Fig. 14, the pin i^{10}, which it carries, will be entirely withdrawn from the annular groove i^8 in the collar i^7, and the collars i^7 i^{11} will rotate with the shaft C′, while the eccentric i^6 will remain stationary. When, however, the collar i^{11} is slid inward upon the shaft C′ to the position shown in Fig. 13, the pin i^{10} will project into the annular groove i^8, and as the collars i^7 i^{11} turn with the shaft C′ the pin i^{10} will come laterally against the pin i^9 in the eccentric i^6, and the eccentric will thereafter be rotated and will impart a rocking motion to the shaft J and a reciprocating motion to the rod i', which is connected with the lever I.

As we have before stated, the clutch c^{12}, which constitutes a part of the shifting driving mechanism, is controlled by means of a lever or shipper, D, and which at the upper end is forked or bifurcated, as shown in Fig. 15, to embrace the clutch, and has one branch or arm of its fork extended upward and provided with an operating-handle, D′, whereby it may be moved to shift the clutch c^{12}. This lever is

fulcrumed or pivoted to the frame at d, and is provided with a pin or locking projection, d', with which engages a shoulder, d^2, upon a trigger or pivoted stop, D^2, which latter is pivoted to the frame at d^3. The trigger or pivoted stop D^2 is connected by a rod, d^4, with one arm of a bell-crank lever, J′, which is fulcrumed at j, and with the other arm of said lever is connected the rod i^2, as shown in Fig. 2. By the engagement of its shoulder d^2 with the pin or stop projection d', the trigger or pivoted stop D^2 serves to hold the clutch c^{12} and the lever D in the position shown in Fig. 13, which is their operative position for locking the pulley C^4 to the shaft C′, so that said shaft will be rotated continuously.

Whenever the trigger or pivoted stop D^2 is pushed downward to the position shown in Fig. 14, so as to disengage its shoulder d^2 from the pin or projection d', the lever D will be pulled back by the action of a spring, d^5, and will withdraw the clutch c^{12} from engagement with the pulley C^4, thereby stopping the shaft C′ and the entire machine. So long as the trigger or pivoted stop D^2 remains in engagement with the pin or projection d', such engagement will constitute a sufficient resistance, acting through the rod d^4, the bell-crank J′, and the rod i^2, to hold the lower end of the lever I against movement, and the point of connection of the rod i^2 with the lever I will then constitute the fulcrum on which the lever I is swung by the eccentric i^6, acting through the rod i^5, the rock-shaft J, and the rod i'. The wrist-pin i, which supports the lever I, being between the points of attachment of the rods i' i^2, the crank-arm h^{22}, and the short shaft h^{12}, will receive a reciprocating rotary or oscillating motion so long as the lower end of the lever I is held against movement by the rod i^2, and through the telescopic shaft h^8 h^9 the toothed or notched bar H will receive a short reciprocating motion. When one of the threads s breaks, the faller h^3 which it controls will drop into engagement with the notched or toothed bar H, and thereby will lock said bar against reciprocation. When this occurs, the resistance to the oscillation of the shaft h^{12} and the crank-arm h^{22} will be very much greater than the resistance which opposes the movement of the rod i^2, and by the positive motion transmitted through the rod i' the lever I will be swung upon the pin i as a fulcrum, and through the rod i^2 the bell-crank J′ and the rod d^4 will pull down the trigger or pivoted stop D^2, whereupon the shipper-lever D will be released, and said lever and clutch c^{12} will be drawn back by the spring d^5 and will stop the machine.

When the reciprocating notched or toothed bar H is provided with ratchet-shaped teeth or saw-like teeth, as shown in Fig. 23, and as it is supposed to have when the mechanism just described is employed to operate it, it is obvious that the fallers h^3 will when dropped lock the bar H against movement in one direction only, and if the bar be moved in the opposite direction its ratchet-shaped teeth will simply lift the faller, and the latter will not lock the bar until it commences its return movement. It will therefore be understood that when the bar H has such ratchet-shaped teeth or notches a short interval may elapse between the breaking of a thread and the stopping of the machine.

In order to insure the instantaneous stopping of the machine, no matter in which direction the bar H may be moving, when the faller h^3 drops upon it, we may make the bar H with square or spur shaped teeth or notches, as shown in Fig. 33, and in such case the rock-shaft J′ and the rod i^2 (shown in Fig. 2) should be replaced by a T-shaped lever, J^2, which is fulcrumed at j similarly to the bell-crank lever J′, before described, and as shown in Fig. 32. The rod d^4 is connected with one arm of the T-lever J^2, and with its other and opposite arm are connected rods i^{14} i^{15}, which both lead to the lower end of the lever I, and are connected therewith at the same point. In this modification the rods i^{14} i^{15} slide through sockets i^{16}, which are swiveled or pivoted to opposite ends of the T-lever J^2, and the rods i^{14} i^{15} are provided with stop-collars i^{17}, which come against opposite ends of the pivoted sockets i^{16}. The stop-collars i^{17} preferably consist of nuts, so as to be capable of adjustment upon the rods i^{14} i^{15}. With this arrangement, if a faller, h^3, drop into engagement with the spur-teeth of the bar H when the bar H is moving in one direction, a pull will be exerted through the rod i^{14}, and by its stop-collar i^{17} bearing against the socket i^{16} at one end of the lever J^2 said lever will be tilted and the rod d^4 will be drawn downward to throw off the trigger or pivoted stop D^2. If the faller thus engages with the bar H when it is moving in the other direction, a push will be transmitted through the rod i^{15}, and its stop-collar, by its action on the socket i^{16} at the lower end of the lever J^2, will tilt the lever in the same direction as before, and through the rod d^4 will pull down the trigger or pivoted stop D^2 and stop the machine. By this latter arrangement of mechanism it will therefore be seen that the machine will be instantly stopped, whether the bar H be moving in one or other direction, when the faller h^3 drops into engagement with its spur-shaped teeth.

Whenever the trigger or pivoted stop D^2 is relieved of downward pull it will be raised, so as to bring its shoulder d^2 into engagement with the pin or stop projection d', by the action of the spring d^5, which may be attached to any fixed portion of the framing of the machine.

In Figs. 2, 5, and 6 we have represented a spring, i^{21}, as extending between the arm i^{22}, formed upon the crank-arm h^{22}, and an arm, i^{23}, extending from the lever I, and this spring also serves to increase the resistance which is opposed to the swinging movement of the lever I upon the wrist-pin i, and therefore aids in holding the rod i^2 and the point at which it connects with the lower end of the lever I

stationary during the normal operation of the machine. This spring is not, however, an essential element of the mechanism and is entirely omitted from Fig. 32.

The handle D′, which is at the upper end of the lever D, has a limited movement independently of the lever in a direction to throw off the clutch c^{12} from the pulley C′. In this example of our invention the handle D′ is pivoted at d^7 to the lever D, as shown in Figs. 13 and 14, and is connected by a rod, d^8, with the trigger or pivoted stop D². The handle D′ is forked or socketed to receive the upper end of the lever D, and its movement in a direction to throw off the lever D and the clutch c^{12} is limited by the shoulder or surface d^9 upon the handle coming in contact with the side of the lever, as is illustrated in Fig. 14, and after such throwing-off operation of the handle D′ it will be returned to normal position, as shown in Fig. 13, by the action of the spring d^{10}. If it be desired to throw off the driving mechanism by hand, the handle D′ is to be taken hold of and moved in the direction of the arrow in Fig. 13. Its first movement will therefore be independent of the lever D, causing it to exert a downward push upon the rod d^8 and to throw down the trigger or pivoted stop D² out of engagement with the pin or stop projection d' before the shoulder d^9 comes against the side of the lever D. When the independent movement of the handle D′ is terminated by the shoulder d^9 striking the side of the lever D, the movement of the lever D to throw off the clutch c^{12} will be performed by the spring d^5, or by a further pressure upon the handle D′ in the same direction as before. It is also desirable to provide means whereby the driving mechanism may be thrown off by the foot of the operator when on either side of the machine.

Near opposite ends of the machine are levers J³, which are pivoted at their upper ends, j' and extend downward to near the floor, and one of these levers has a laterally-extending arm, j^2, which is connected by a rod, j^3, with an arm, J⁴, fulcrumed upon the same pivot, d, as the lever D, and having an upward projection, j^4, provided with an adjustable stop consisting of a screw, j^5, bearing upon the lever D. The two depending foot-levers J³ are shown as connected by a rod, j^6, so that the operator by moving the lever, which is at either side of the machine, may transmit motion to the rod j^3 and so move the arm J⁴. Upon the rod j^3 is a lateral projection, j^7, which is connected by a rod, j^8, with the trigger or pivoted stop D², and through which said stop may be moved to withdraw it from engagement with the pin or stop projection d' and throw off the driving mechanism. Whenever it is desired to throw off the mechanism by the operator standing near either end of the machine, the corresponding lever, J³, is moved by the foot, and the downward movement of the rod j^3, thereby produced, acts through the rod j^8 to draw down the trigger or movable stop D², and at the same time the arm J⁴ and the stop-projection j^5 are moved away from the lever D, so as to permit the movement of said lever by the spring d^5 as soon as the trigger or movable stop D² is thrown off. We have provided lost motion in the connection between the arm j^7 and the trigger or movable stop D², so as to permit the throwing off of the trigger or movable stop by the handle D′, or by means of an indicator hereinafter described, without imposing on the handle or on the indicator the additional resistance due to the weight of the foot-levers J³ and their connections j^3 j^6. As here represented, this slack or lost motion is provided for by slotting the end of the rod j^8, as shown at j^9, and providing therein a set-screw, j^{10}, which bears against the under side of the pin on the arm j^7. Consequently, when the foot-levers J³ are operated to throw off the trigger or movable stop D², the arm j^7 transmits motion through the screw j^{10} to the rod j^8; but when the trigger D² is thrown off by the handle D′, or by the indicator hereinafter described, the rod j^8 moves downward to the length of its slot j^9 without imparting any motion to the rod j^3 and the levers J³, and trigger D² is therefore relieved of the resistance due to the weight of these parts.

It is advantageous to have the eccentric i^6, which operates the stop-motion, loose upon the shaft C′, because then the clutch which operates the eccentric i^6 will be thrown off when turning the machine backward by hand, and the stop-motion will, during such turning back by hand, remain inoperative. This clutch also provides for a turning movement of the reel when the machine is first started, before any motion is transmitted to the stop-motion, and hence this turning motion of the reel serves, by tightening the threads s, to lift all the fallers h^3 before any motion is transmitted to the notched or toothed bar H.

As best shown in Figs. 13 and 14, the rod i^{13}, which controls the clutch for connecting the eccentric i^6 with the shaft C′, is connected with the lever D, said lever having at its side a pivoted socket, i^{18}, through which the rod i^{13} plays, and the rod i^{13} having collars i^{19} and a spring, i^{20}, through which the lever D acts upon the rod i^{13} to throw the stop-motion clutch into gear. When the lever D is moved to throw off the clutch c^{12}, the pivoted socket i^{18} acts directly upon one of the collars i^{19} to throw off the stop-motion clutch; but when the lever D is moved in the opposite direction to start the machine, it acts upon the rod i^{13}, through the spring i^{20}, and this spring will yield in case the pin i^{10} should strike against the end of the pin i^9 at the moment of engagement, and will, by its resilience, complete the movement of the rod i^{13} as soon as the pin i^{10} is carried out of line with the pin i^9 by the rotation of the clutch-collar i^7.

In order to automatically throw off the driving mechanism and stop the machine when a definite and predetermined quantity of warp has been wound upon the reel, we employ a ro-

tary indicator which, at a predetermined time, serves to throw off the trigger or movable stop D^2, and thus release the shipper-lever D and the clutch e^{12}. This indicator is best shown in Figs. 25 to 30, inclusive, and is applied upon the end of the shaft E adjacent to the driving-clutch e^{12}. As shown in Fig. 26, the bearing e' for the shaft E has extending from it a stationary sleeve, e^{20}, which surrounds the shaft E, and the shaft has a portion, e^{21}, of reduced diameter, extending beyond said sleeve. The indicator comprises as essential elements two rotary disks or members, K K', which are graduated upon their peripheries, as is best shown in Fig. 25, and which we term, respectively, "first" and "second" disks or members. The first disk or member, K, is locked to turn with the shaft, as we shall presently describe, and through suitable gearing imparts a step-by-step motion to the second disk, K', which latter is free to turn upon the fixed sleeve or hub e^{20}. As here represented, a washer, k, is interposed between the central hub of the first disk, K, and the shoulder of the shaft E which is at the extremity of the fixed sleeve or hub e^{20}; and this washer may be locked to the shaft by a tooth or projection, k', (shown in Fig. 26,) so as to turn with the shaft. Upon the outer extremity of the shaft E is fitted a clamping or binding nut, k^2, which when set up or tightened clamps the first disk, K, between it and the washer k, which turns positively with the shaft, and thereby the disk K is held so as to turn in unison with the shaft. The disk K may have its periphery graduated in meters or other divisions of measure, and in this example of the invention the periphery of the disk is supposed to represent five meters in its circumference, and is graduated to meters and fourths of a meter, while the second disk, K', is graduated to indicate five hundred meters, and its spaces each indicate five meters. Upon the hub or sleeve e^{20}, outside the second disk, K', is an arm or cross-bar, k^3, which may be secured upon the hub or sleeve by a set-screw, k^4, and which carries at one end a short shaft or axle, k^5, and at the other end a bell and bell-hammer, k^6. This bell does not constitute an essential part of the invention, but it may be employed for convenience. The short shaft or axle k^5 has upon it a star-wheel or a trip-wheel, k^7, having radial projections, and at the other end is provided with a pinion, k^8, which engages a circular series of teeth constituting a spur-wheel, k^9, on the second disk, K'. Upon the first disk, K, is secured a tripper or tripping device, k^{10}, which at each rotation of the disk K acts upon the star or tripping wheel k^7, as shown in Fig. 29, and turns it a fractional portion of a revolution or one tooth, thereby imparting a slight turning movement to the pinion k^8 and through it advancing the second disk, K', to the extent of one of the spaces between its graduations, which represent five meters.

k^{11} designates a roller, which is mounted upon an arm, k^{12}, and which bears upon the face of the star or tripping wheel k^7, said roller being pressed against the wheel by a spring, k^{13}. This wheel k^{11} therefore serves to hold the tripping-wheel k^7 and the second disk, K', which it controls, in proper position, and insures the turning of said disk to the exact extent required by each rotation of the disk K.

The disk K' may be provided on its interior with toes or projections k^{14}, which, by acting upon the toe or arm k^{15} of the bell-hammer, serve to sound the bell at intervals of time as the disk K' is turned step by step.

We have represented in connection with the trigger or movable stop D^2 an arm, D^3, which is mounted upon the same fulcrum, d^3, and which is connected with the trigger or stop by a pin, m, so that the trigger or stop D^2 and the arm D^3 swing together as one piece upon the fulcrum d^3, as will be best understood from Fig. 30. This arm D^3 may be considered as a part of the trigger or movable stop. Upon the pin m are secured two arms, m' m^2, which we term, respectively, the "setting-arm" and the "throwing-off pawl." This setting-arm m' and throwing-off pawl m^2 are both fast upon the pin or short rock-shaft m, so that any movement imparted to the setting-arm m' produces a like movement of the throwing-off pawl m^2. The setting-arm m' and the throwing-off pawl m^2 are acted upon, respectively, by a setting-cam, n, and a throwing-off cam n', the cam n being movable by and with the disk K', and the cam n' being movable with the disk K. During the normal operation of the machine, and until the required quantity of warp is wound, the throwing-off pawl m^2 is held out of range of the throwing-off cam n' by means of a spring, m^3, which may be applied as shown in Figs. 28, 29, and 30, and which holds the throwing-off pawl m^2 down upon a stop-pin, m^4, as shown in Fig. 29.

In order to provide for setting the indicator to automatically stop the machine when any predetermined quantity of warp is reeled, it is necessary to adjust the cams n n' circumferentially relatively to the disks K' K, in unison with which they move, and to this end we have represented the cams n n' as not supported directly by the disks K' K, but as supported by and directly secured upon plates or cam-carriers K^2 K^3, which fit against the outer sides or faces of the disks K K' and are adjustable circumferentially relatively to the said disks. As best shown in Fig. 28, the cam-carriers K^2 K^3 have each a segmental slot, l, which receives a clamping-bolt, l', inserted in the disk K or K', and this slot and bolt provide for turning and setting either cam-carrier relatively to the disk with which it is connected. We have represented by dotted circles in Fig. 28 a circular series of holes, o, as formed in the disk K or K', in any one of which the bolt l' may be inserted, and such circular series of holes o, in connection with the segmental slot l, having greater length than the space between any two holes, provides for adjusting the cams n n' to any point

throughout the circumference of the two disks K K′. Upon the disks K K′ are stop-pins or projections o' o^2, and upon the cam-carriers K^2 K^3 are notches or other marks or indications o^3 o^4. These stop-pins and marks or indications are made to register, as may be desired, in setting the indicator, by means of pawls or pivoted stops p p'. (Best shown in Figs. 25 and 28.)

The manner of setting the indicator will be best understood from Fig. 25, it being understood that the cams n n' are located on the cam-carriers K^3 K^2 at points diametrically opposite the indications or notches o^4 o^3. To set the indicator, the disks K K′ are both turned back until the stop-pins o' o^2 strike the pawls p, and the cam-carriers K^2 K^3 are turned until their notches o^3 o^4 coincide with the desired graduations on the disks K K′, and are then secured immovably to the said disks by the clamping-screws l'.

Suppose, for example, that it be desired to stop the machine after reeling four hundred and sixty and one-half meters. The cam-carrier K^3 is turned until its notch o^4 coincides with the 460 mark on the disk K′ and is there secured, and the cam-carrier K^2 is turned until its notch o^3 coincides with the half-meter mark on the disk K and is there secured. The disks K K′ are then turned till their stop-pins o' o^2 come against the pawls p and the indicator is set for operation. The pawl or gage p' is to facilitate the reading of the indicator at any time during the operation of the machine. As here shown, the pawls p are weighted at their rear ends, so that their edges or ends will normally be raised sufficiently from the disks K K′ to enable the stop-pins o' o^2 to pass under them. When the pawls are to be used for setting the indicator, they may be pressed down by the fingers upon the disks, so that by engaging with the pins o' o^2 they will arrest the turning of the disks. The indicator having been properly set, as above described, the machine is started, and at each rotation of the first disk, K, the trip k^{10}, by its action upon the star-wheel or trip-wheel k^7, turns it forward one tooth and thereby imparts to the second disk, K′, a rotary motion equal in extent to the distance or space between its graduations. The cam n' has meanwhile no action upon the throwing-off pawl m^2, because said pawl is held down out of the way of the cam by the spring m^3, and the operation continues until finally the setting-cam n of the second and slowly-moving disk, K′, comes in contact with the setting-arm m', as shown in Fig. 28, and by its action on this setting-arm it lifts the throwing-off pawl m^2 until the throwing-off cam n' is brought around by the rotation of the disk K against said throwing-off pawl m^2, and as soon as this occurs the trigger or movable stop D^2 will be instantly thrown down or depressed out of engagement with the pin or stop projection d', and will thereby permit the spring d^5 to draw back the shipper-lever D and the clutch c^{12} and stop the machine.

It will be observed that the trigger or movable stop D^2 is provided in rear of the shoulder d^2 with an incline, d^{20}. The incline d^{20} performs an important function in the readjustment of the stop-motion after it has stopped the machine by the breaking of a thread. As before described, the bar H, when stopped by a faller, h^3, dropping into it, reacts through the mechanism which ordinarily reciprocates it (the shaft h^8 h^9 and crank-arm h^{22}) and holds the crank-arm against motion, thereby throwing the shoulders d^2 of the trigger D^2 out of engagement with the stop-pin or projection d' on the lever D. This operation, in the absence of some means to prevent, would leave the faller h^3 jammed hard over by the tooth of the bar H against the adjacent rib of the channeled guide h^7 and would render it difficult to lift the faller. By the action of the pin d' on the incline d^{20}, as the lever D is thrown off by the spring, the trigger D^2 is pushed farther down, and, acting through the rod d^4, the rock-shaft or bell-crank J′, rod i^2, and lever I, produces a slight reverse movement of the bar H, which is sufficient to free its tooth from pressure against the faller h^3 which stopped it, and permits said faller to be readily lifted.

It is desirable to have the lost motion in the connection j^8 between the trigger or movable stop D^2 and the rod j^3, through which the foot-levers J^3 control the machine, because such lost motion enables the trigger or movable stop D^2 to be moved through the agency of the automatic stop-motion, or by the indicator before described, without encumbering it with the resistance due to the weight of the foot-levers and their connecting parts.

What we claim as our invention, and desire to secure by Letters Patent, is—

1. The combination, with a traversing carriage, of a worm or screw and mechanism, substantially as described, for operating it, a worm-wheel and a drum journaled concentrically on the carriage, means, as nut f^3, whereby the drum and wheel may be clamped in frictional engagement, and a cable or cord coiled on the drum and along which the carriage moves as the drum turns, substantially as herein described.

2. The combination, with a traversing carriage, of a worm or screw and mechanism, substantially as described, for driving it, a worm-wheel and a combined drum and hand-wheel journaled concentrically on the carriage, means, as nut f^3, for clamping the combined drum and hand-wheel in frictional engagement with the worm-wheel, and a cable or cord coiled around the drum and along which the carriage moves as the drum turns, substantially as herein set forth.

3. The combination, with a traversing carriage, of a worm or screw and mechanism, substantially as described, for driving it, a worm-wheel and a drum journaled concentrically on the carriage, a cable or cord coiled around the drum and extending thence in op-

posite directions to points of attachment, and an adjustable connection, substantially as described, for one end of the cable or cord, whereby provision is afforded for taking up slack therein, substantially as herein set forth.

4. The combination, with a traversing carriage, of a worm or screw and mechanism, substantially as described, for driving it, a worm-wheel and a drum journaled concentrically on the carriage, a cable or cord coiled around the drum and extending thence in opposite directions to points of attachment, a lever with which one end of the cable or cord is connected, a spring for straining the cable or cord, means, substantially as described, for adjusting the fulcrum of the lever, and means, as nut f^3, for clamping said drum in frictional engagement with said worm-wheel, substantially as herein set forth.

5. The combination, with a traversing carriage, of a splined shaft and means, substantially as described, for operating it, a worm locked to turn with and sliding on the shaft, a worm-wheel and drum journaled concentrically on the carriage, a cable or cord which is coiled on the drum and along which the carriage moves as the drum turns, and means, as nut f^3, for clamping the drum and worm-wheel together, substantially as herein described.

6. The combination, with the splined shaft E and the worm E^2, fitted thereto, and mechanism, substantially as described, for driving the shaft, of a traversing carriage hung upon said shaft E, the wheel and rod f^8 f^9, for supporting and steadying said carriage, the worm-wheel, drum, and clamping-nut E^3 E^4 f^3, concentrically supported on the carriage, and the cable or cord F, coiled around the drum and along which the carriage moves as the drum turns, substantially as herein set forth.

7. The combination, with a reel and driving mechanism therefor and a shipper for controlling the driving mechanism, of fallers through which the threads pass, a toothed or notched bar movable transversely to the plane of movement of the fallers, and mechanism, substantially as described, including a telescopic shaft, whereby said bar is reciprocated and by which the shipper is thrown off when the reciprocating bar is locked by a faller dropping thereinto, substantially as herein set forth.

8. The combination, with a reel and driving mechanism therefor, substantially as described, having a shipper, a movable trigger or stop for holding the shipper in operative position, and a device, as spring d^5, for moving the shipper when released, of fallers through which the threads pass, a toothed or notched bar movable transversely to the planes of movement of the fallers, and mechanism, substantially as described, and including a telescopic shaft, whereby said bar is reciprocated and through which the trigger or movable stop is thrown off when the said reciprocating bar is locked by a faller dropping thereinto, substantially as herein described.

9. The combination, with a reel and shifting driving mechanism therefor, of fallers through which the threads pass, a toothed or notched bar movable transversely to the planes of movement of the fallers, a shaft for reciprocating said bar and provided with a crank-arm, a lever fulcrumed upon said crank-arm, mechanism, substantially as described, whereby said lever may be swung to reciprocate said bar until locked by the dropping of a faller, and connections, substantially as described, through which the said lever acts to throw off the driving mechanism when said bar is locked by a faller, substantially as herein set forth.

10. The combination, with a reel and driving mechanism, substantially as described, and having a shipper, a trigger or movable stop, whereby the shipper is held in operative position, and a device, as spring d^5, for moving the shipper when released, of fallers and a reciprocating toothed or notched bar movable transversely to the plane of movement of said fallers, a shaft for reciprocating said bar, provided with a crank arm, a lever fulcrumed upon said crank-arm, connections, substantially as described, between said lever and the trigger or movable stop, and mechanism, substantially as described, whereby said lever may be swung to reciprocate said toothed or notched bar until it is locked by a dropping faller, and thereafter to throw off the trigger or movable stop, substantially as herein set forth.

11. The combination, with a reel and driving mechanism therefor, substantially as described, and having a shipper, a trigger or movable stop for holding the shipper in operative position, and a device, as spring d^5, for moving the shipper when released, of a toothed or notched bar movable transversely to the planes of movement of the fallers, a shaft for reciprocating said bar and having a crank-arm, a lever fulcrumed on said crank-arm, mechanism, substantially as described, for operating said lever, a three-armed lever, J^2, connected with the said trigger or movable stop, and rods i^{14} i^{15}, one operating with a push and the other with a pull on the said three-armed lever and having a common connection with the lever on said crank-arm, substantially as herein set forth.

12. The combination, with a reel and driving mechanism, substantially as described, and having a shipper, a trigger or movable stop for holding the shipper in operative position, and a device, as spring d^5, for moving the shipper when released, of fallers, and a reciprocating toothed or notched bar movable transversely to the planes of the fallers, a shaft for reciprocating said toothed or notched bar and having a crank-arm, a lever fulcrumed on said crank-arm, a rock-shaft, eccentric, and rod for operating said lever, and a connection, substantially as described, between said lever and the trigger or movable stop through which

motion will be transmitted to throw off the stop when the said reciprocating bar is locked by a faller or faller-wire dropping into it, substantially as herein set forth.

13. The combination of pivoted fallers or faller-wires *h*, having thread-eyes at their free ends, the fixed channeled guide h^7, in which the free ends of the fallers or faller-wires may rise and fall, a toothed or notched bar movable transversely to the fallers or faller-wires and adjacent to said channeled guide, and mechanism, substantially as described, for reciprocating said toothed or notched bar, substantially as herein set forth.

14. In a machine for reeling silk and other threads, the combination, with a creel or support, of fallers or faller-wires, a pivoted frame for the fallers or faller-wires, which may be raised to bring the fallers or faller-wires into a nearly-upright position for relieving the threads of the strain due to their weight, and means, substantially as described, for holding said frame in position after adjustment, substantially as herein set forth.

15. The combination, with a reel and driving mechanism therefor, substantially as described, and having a shipper-lever, of a movable stop or trigger for holding the shipper-lever in operative position, and a handle upon the lever having a limited movement relatively thereto, and also having a connection with the trigger or movable stop, whereby the first movement of the handle will throw off the trigger or movable stop, while its further movement will actuate the lever to throw off the driving mechanism, substantially as herein set forth.

16. The combination, with a reel and driving mechanism therefor, substantially as described, and having a shipper-lever, D, of the trigger or movable stop D^2, the handle D′, pivoted on the lever and having a limited independent movement, and the rod d^8 between the handle and trigger, substantially as herein set forth.

17. The combination, with a reel and driving mechanism, substantially as described, and having a shipper-lever, and a trigger or movable stop for holding the lever in operative position, of an automatic stop-motion and connections, substantially as described, for throwing off the trigger or movable stop, a foot-lever and connections, substantially as described, for also throwing off the trigger or stop when desired, and a rod through which the foot-lever acts upon the trigger or stop and which has lost motion in its connections, so that the stop-motion will be free to act without resistance from the foot-lever, substantially as herein set forth.

18. The combination, with a reel and driving mechanism, substantially as described, and having a shipper-lever, of a trigger or movable stop for holding the shipper-lever in operative position, an automatic stop-motion and connections, substantially as described, for throwing off the trigger or movable stop, the foot-lever J^3 and rod j^3, and the rod j^8, extending to the trigger or movable stop, and having the slot and adjusting-screw j^9 j^{10} at one end, substantially as herein set forth.

19. The combination, with a reel and driving mechanism therefor, substantially as described, and having a shipper-lever, of a trigger or movable stop for holding the lever in operative position, an arm movable independently of the shipper-lever in one direction, but acting to move the lever when moved in the other direction, and a foot-lever connected with said movable arm and with the trigger or movable stop, substantially as herein set forth.

20. The combination, with a reel and driving mechanism therefor, having a shipper-lever, a trigger or movable stop for holding the shipper in operative position, and a device, as spring d^5, for moving the shipper when released, of the throwing-off pawl and a setting-arm on said trigger or movable stop, a shaft geared with the reel, an indicator on said shaft composed of two graduated disks, the first of which turns continuously with the shaft and comprising a trip, a trip-wheel, and gearing for operating the second disk with a step-by-step motion from the first, and cams upon said two disks, that upon the second disk serving to operate said setting-arm and that on the first disk serving to act on said throwing-off pawl to throw off said trigger or movable stop, substantially as herein described.

21. The combination, with a reel and driving mechanism therefor, substantially as described, and having a clutch, a trigger or movable stop for holding the clutch in operative position, and a device, as spring d^5, for throwing the clutch out of operative position when released, of a throwing-off pawl, m^2, and a setting-arm, m', on the trigger, the shaft E, geared with the reel, the indicator composed of the first and second graduated disks, K K′, and mechanism, substantially as described, for imparting a step-by-step rotation to the second disk from the continuous motion of the first disk, setting and throwing-off cams n n' for acting, respectively, on the setting-arm m' and throwing-off pawl m^2, and means, as plates or cam-carriers K^3 K^2 and screws, whereby said cams are adjustably secured, respectively, to the disks K′ and K, substantially as herein described.

22. The combination, with a reel and reed-carriage of a warping-machine, of the two end shafts, C C′, provided with reversely-set cone-pulleys, and the shaft C, having driving-pulleys, the belt C^2, the bevel pinion and wheel c^4 C^5, and the spur pinion and wheel C^6 B^5, connecting the shaft C′ and the reel-shaft, the worm-shaft E, the worm and worm-wheel c^{13} e, connecting the shaft C′ and the worm-shaft E, and gearing through which the reed-carriage is operated from the shaft E, substantially as herein described.

23. The combination, with a frame portion having the opening e^4 and a loose ring with a

concave face, of a shaft, as E, extending through said opening, the bearing e', convex or rounded in the direction of its length, and the concave retaining-clamp e^2, holding the bearing in place, substantially as herein described.

24. The combination, with a frame portion having a concave seat, c^9, for a bearing, and the slots c^8 on opposite sides thereof, and a shaft, as C, extending parallel with the frame portion, of the bearing c^2, convex or rounded in the direction of its length, and the divided retaining-clamp c^5, having hooked ends c^7 engaging the slots c^8, and having a concave inner surface fitting the bearing, substantially as herein described.

25. The combination, with a reel-head having the forked or bifurcated flanges b^9, of the slotted bars or lags B^3 and the elevating blades or bevels B^4, having their free ends guided in said flanges, and means, substantially as described, for moving the blades or bevels, substantially as herein set forth.

26. The combination, with a reel-head having the flanges b^3 and the forked or bifurcated flanges b^9, of the slotted bars or lags, B^3, bolted to the flanges b^3, and the elevating blades or bevels B^4, having their free or outer ends guided in the forked or bifurcated flanges b^9, and means, substantially as described, for elevating the blades or bevels, substantially as herein set forth.

27. The combination, with the slotted reel bar or lag b^3, of the elevating blade or bevel connected with the bar or lag by a joint having its center of motion coincident with the point at which the outer face of the blade or bevel intersects the face of the bar or lag, substantially as herein described.

28. The combination of the slotted reel bar or lag B^3 and the elevating blade or bevel B^4, connected by a joint consisting of the female knuckle b^{11} on one part and the male knuckle or tongue b^{12} on the other part, substantially as herein described.

29. The combination, with the reel-heads, of bars or lags secured at the ends to the heads and bevels or elevating-blades pivoted each at one end in a bar or lag, the circular rim bearing against the side of the reel-head and having an outwardly-projecting flange with oblique slots for receiving the free ends of the bevels, and bolts inserted through the reel-head or circular rim parallel with the axis of the reel and fitting slots in one of said parts, substantially as herein described.

30. The combination of a reel-head and a rim having an outwardly-projecting flange, the meeting faces of the two parts being in a plane transverse to the axis, and bolts inserted in a direction approximately parallel with the axis through slots in one part and entering the other part, substantially as herein described.

31. The combination, with a reel and driving mechanism for operating it, a shipper for controlling its operation, and a device, as spring d^5, for throwing off the shipper, of an automatic stop-motion having fallers and a notched or toothed bar with which said fallers engage on the breaking of a thread, a clutch and mechanism, substantially as described, through which said bar is reciprocated, and a connection, substantially as described, for throwing off the stop-motion and clutch simultaneously with the throwing-off movement of the shipper, substantially as herein set forth.

VERNON ROYLE.
JOHN ROYLE, JR.

Witnesses:
C. F. MAGER,
SIDNEY FAWCET.