

(No Model.)

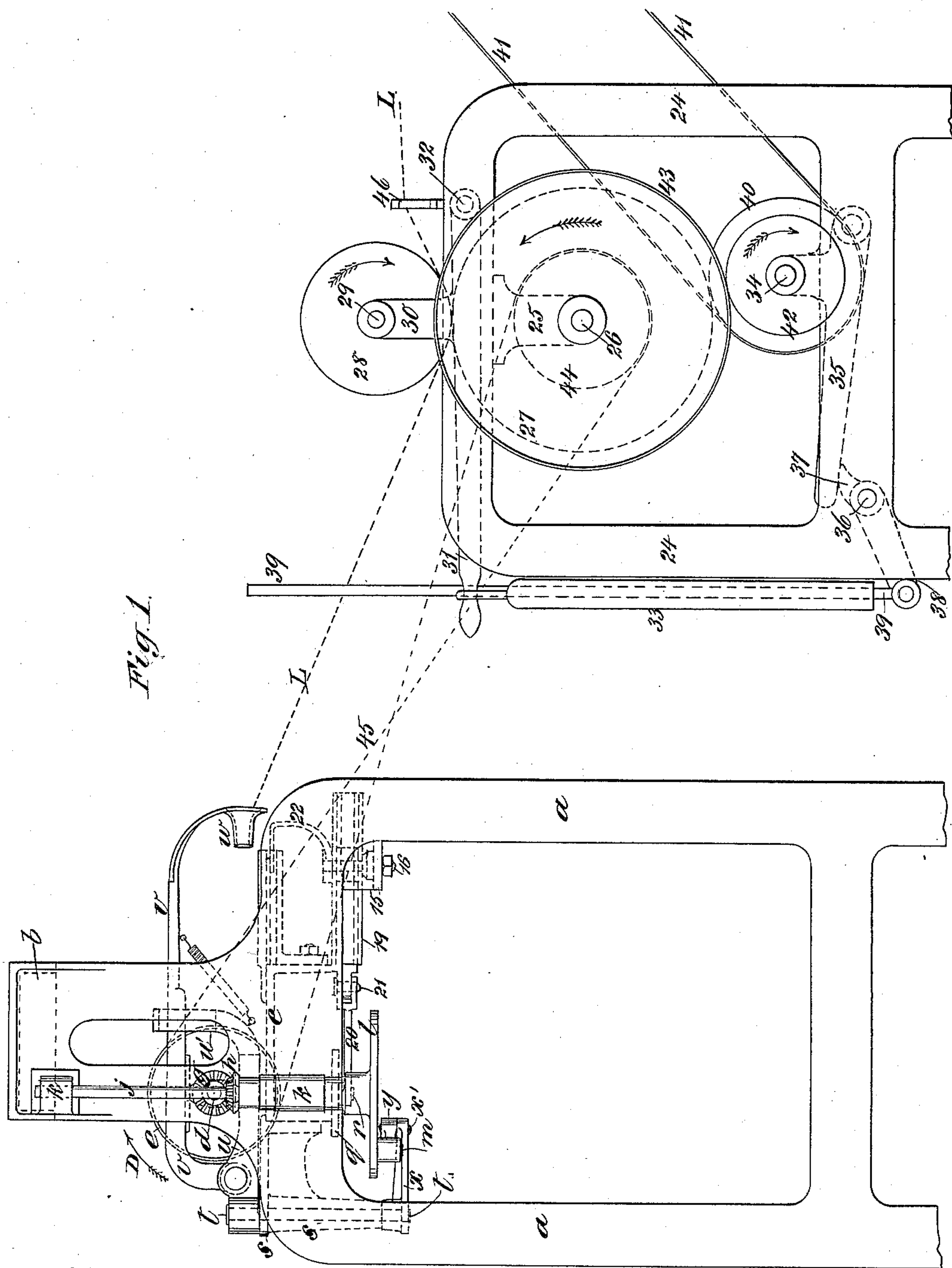
8 Sheets—Sheet 1.

W. HURST.

MACHINE FOR LINKING WARPS.

No. 387,165.

Patented July 31, 1888.



Witnesses:

O. Sundgren.
Joseph W. Roe.

Inventor:

William Hurst.
by attorneys
Brown & Hall.

(No Model.)

8 Sheets—Sheet 2.

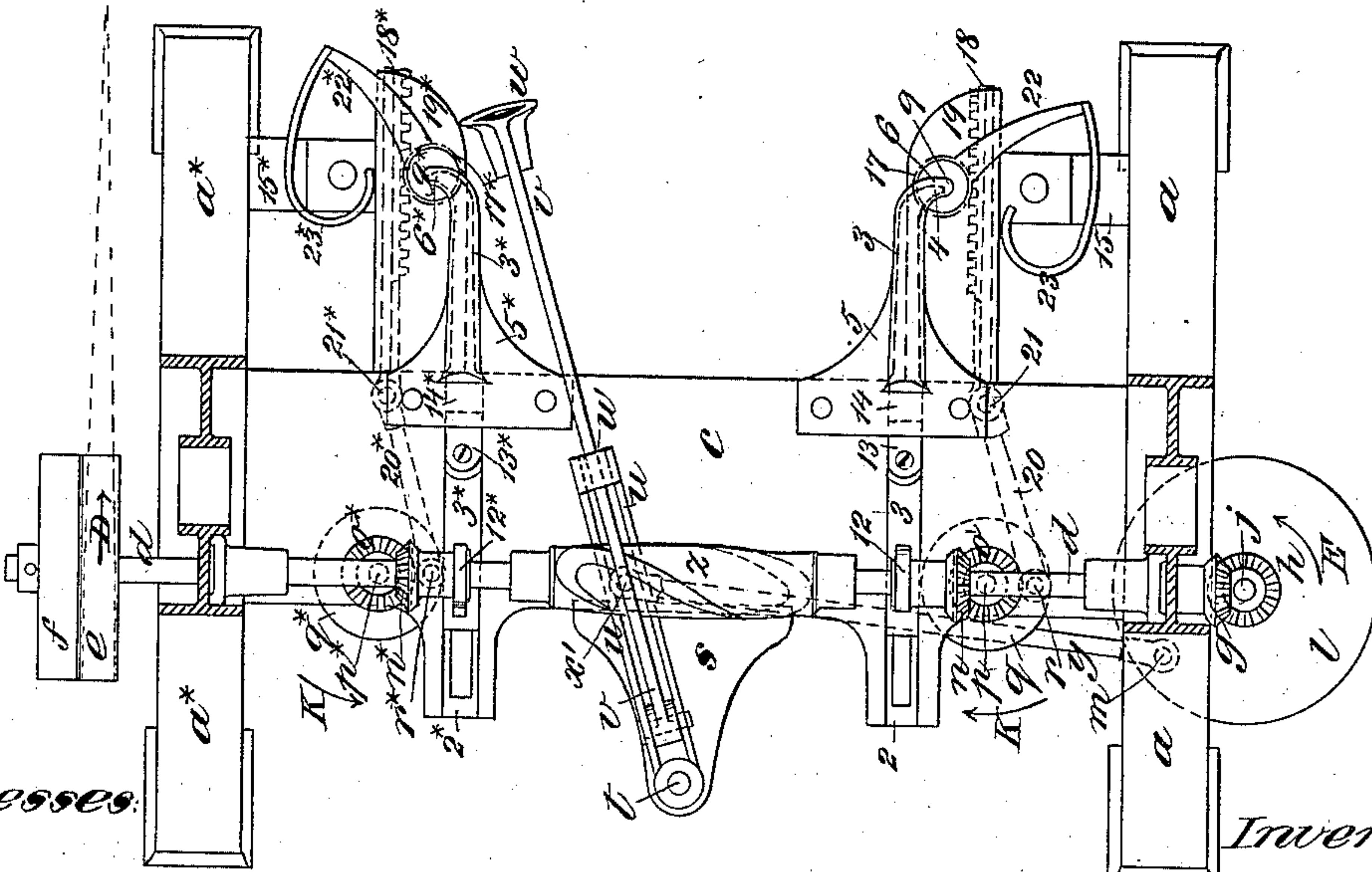
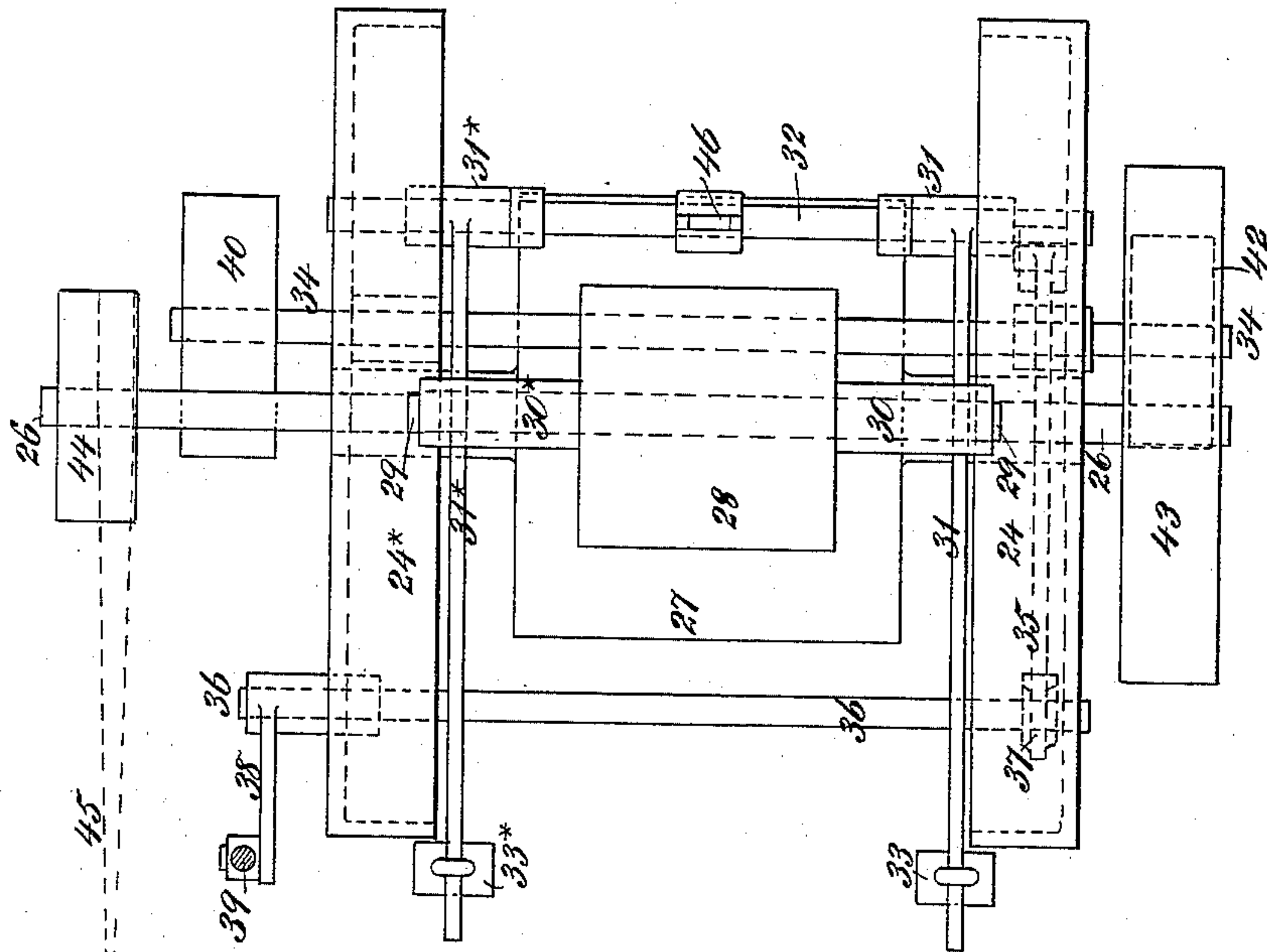
W. HURST.

MACHINE FOR LINKING WARPS.

No. 387,165.

Patented July 31, 1888.

Fig. 2.



Witnesses:

O. Sundgren.
Joseph W. Roe.

Inventor,

William Hurst.
By attorneys
Brown & Hall

W. HURST.

MACHINE FOR LINKING WARPS.

No. 387,165.

Patented July 31, 1888.

Fig. 3.

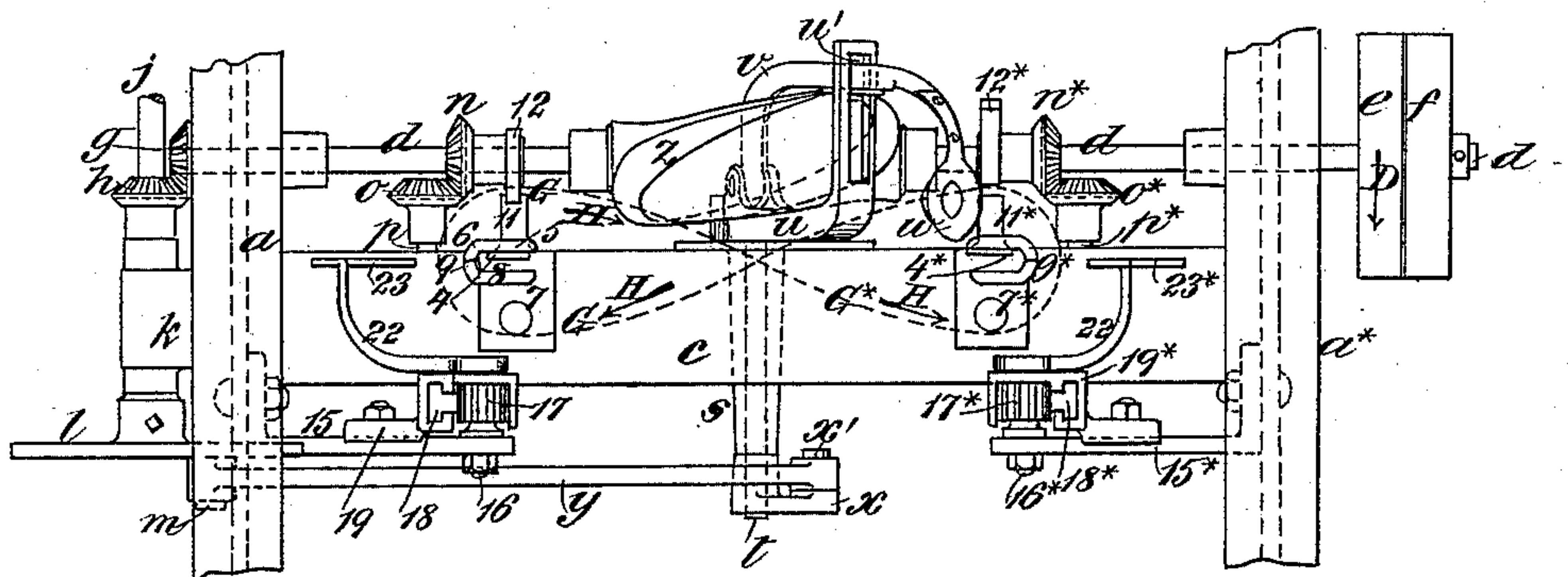


Fig. 6.

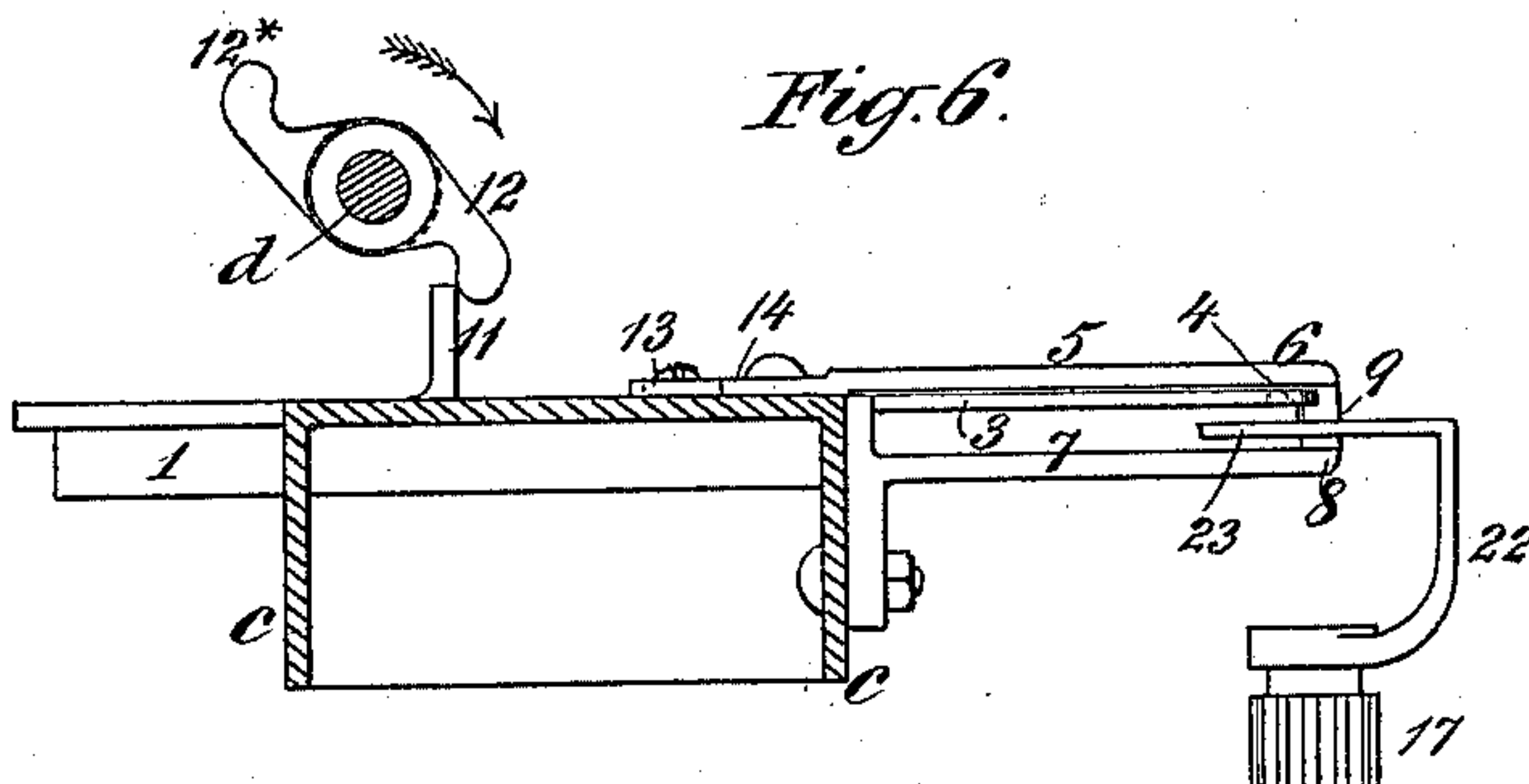


Fig. 8.

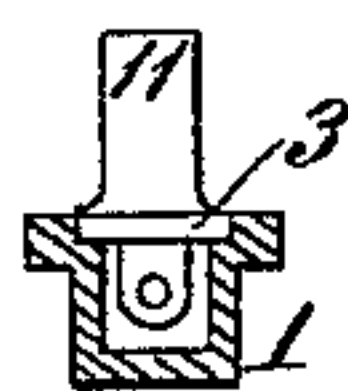


Fig. 7.

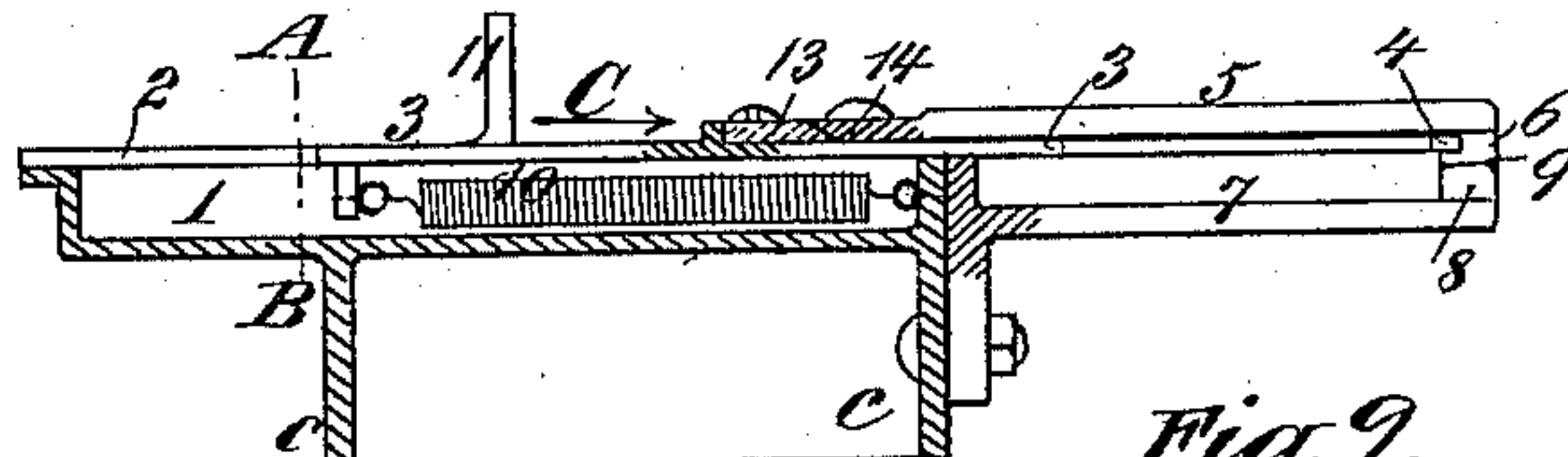


Fig. 9.



Witnesses:

*Cl. Sundgren,
Joseph W. Roe.*

Inventor:

*William Hurst,
by attorneys
Brown & Hall*

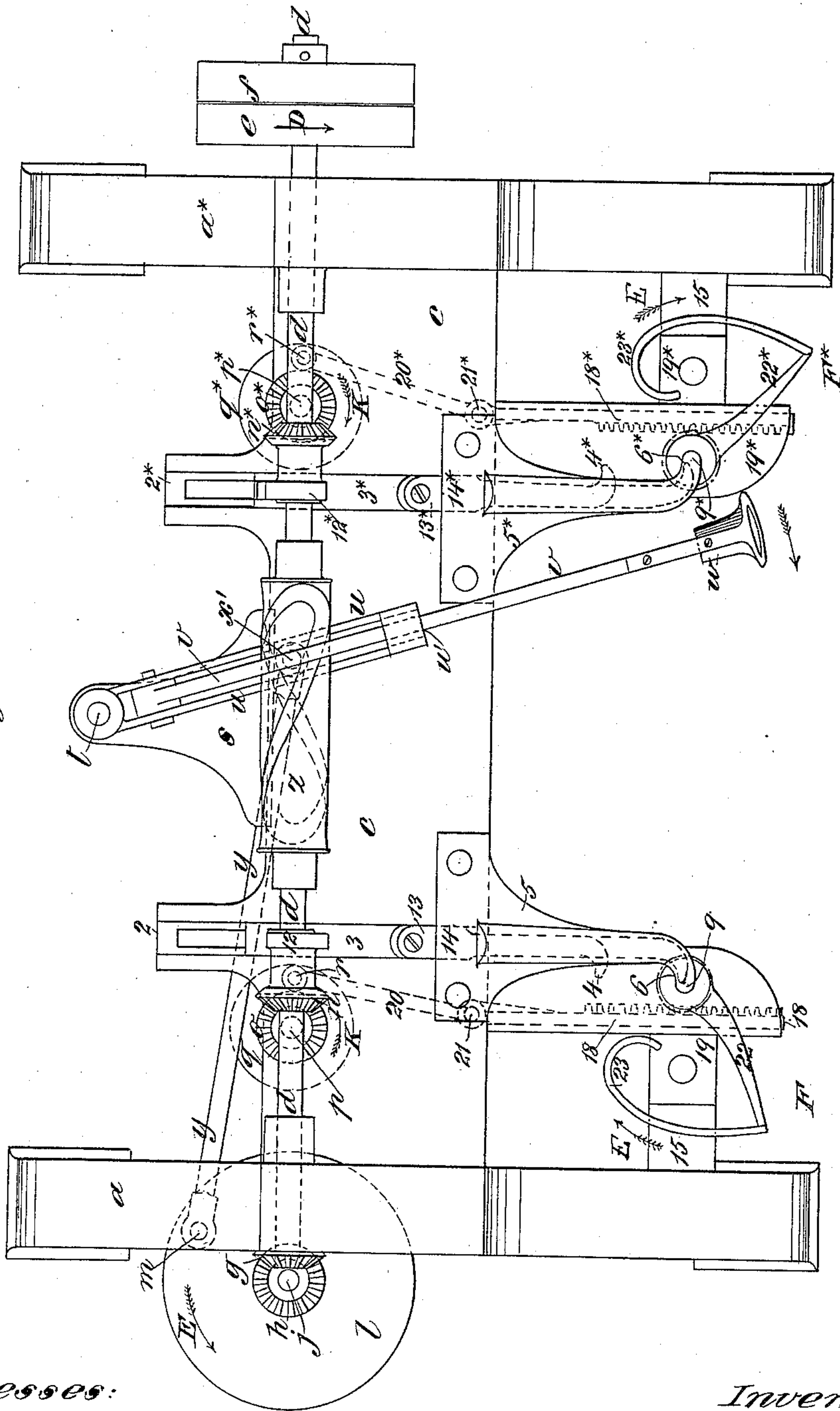
W. HURST.

MACHINE FOR LINKING WARPS.

No. 387,165.

Patented July 31, 1888.

Fig. 4.



Witnesses:

C. Sundgren
Joseph W. Roe.

Inventor:

William Hurst,
by attorneys
Brown & Ball.

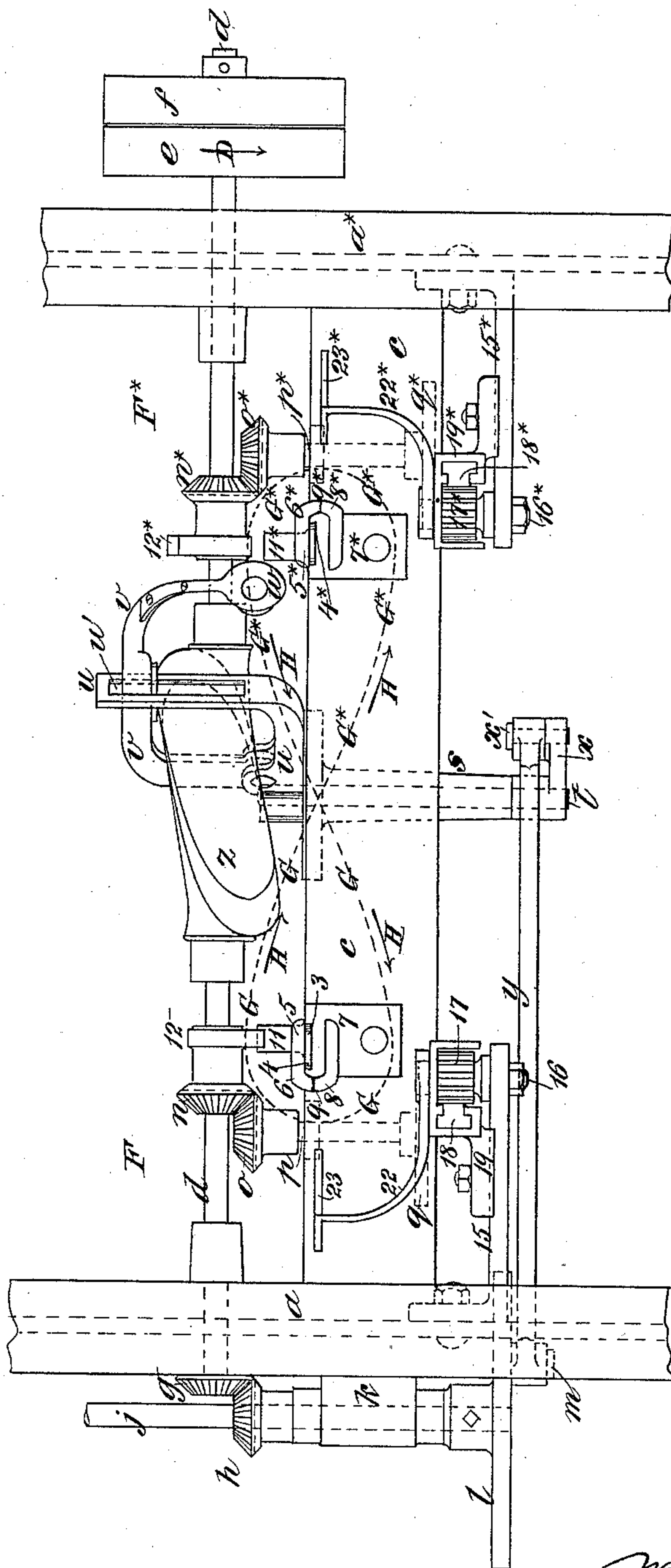
W. HURST.

MACHINE FOR LINKING WARPS.

No. 387,165.

Patented July 31, 1888.

Fig. 5.



Witnesses:

O. Sundgren,
Joseph H. Roe.

Inventor:

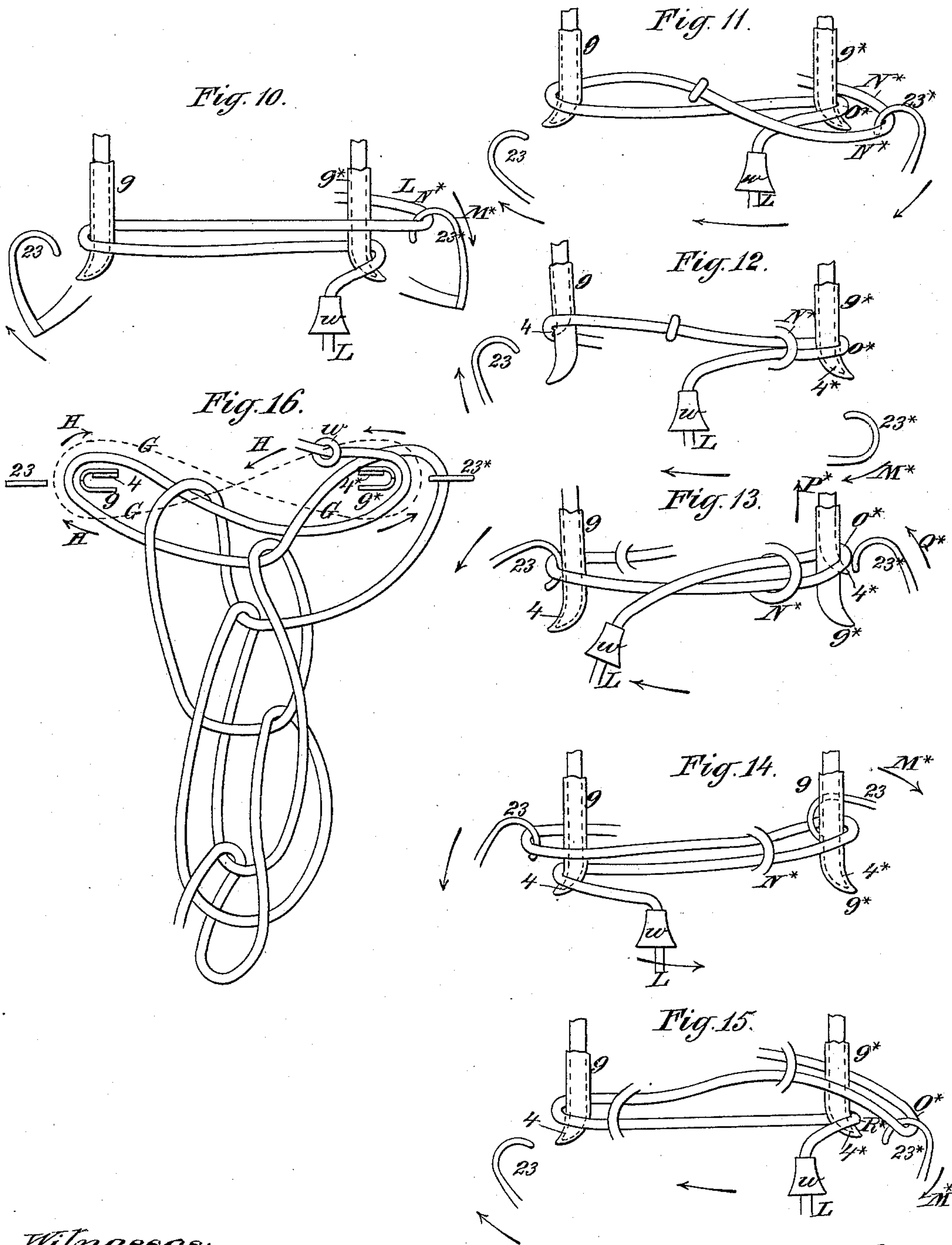
William Hurst,
by attorneys.
Pronmt Hall.

W. HURST.

MACHINE FOR LINKING WARPS.

No. 387,165.

Patented July 31, 1888.



Witnesses:

O. Sundgren.
Joseph W. Roe.

Inventor:
William Hurst.
By attorneys
Brown & Hall.

(No Model.)

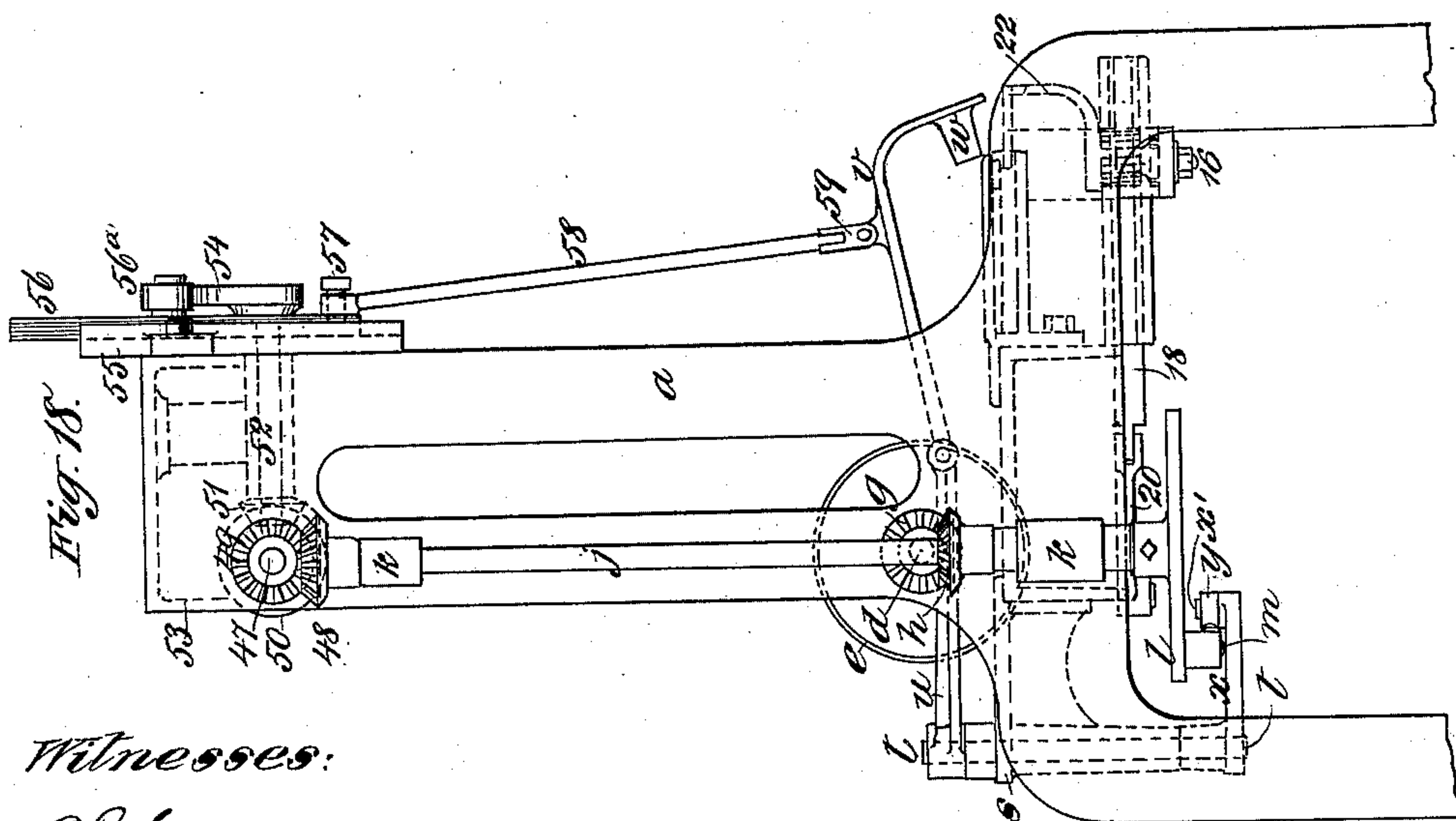
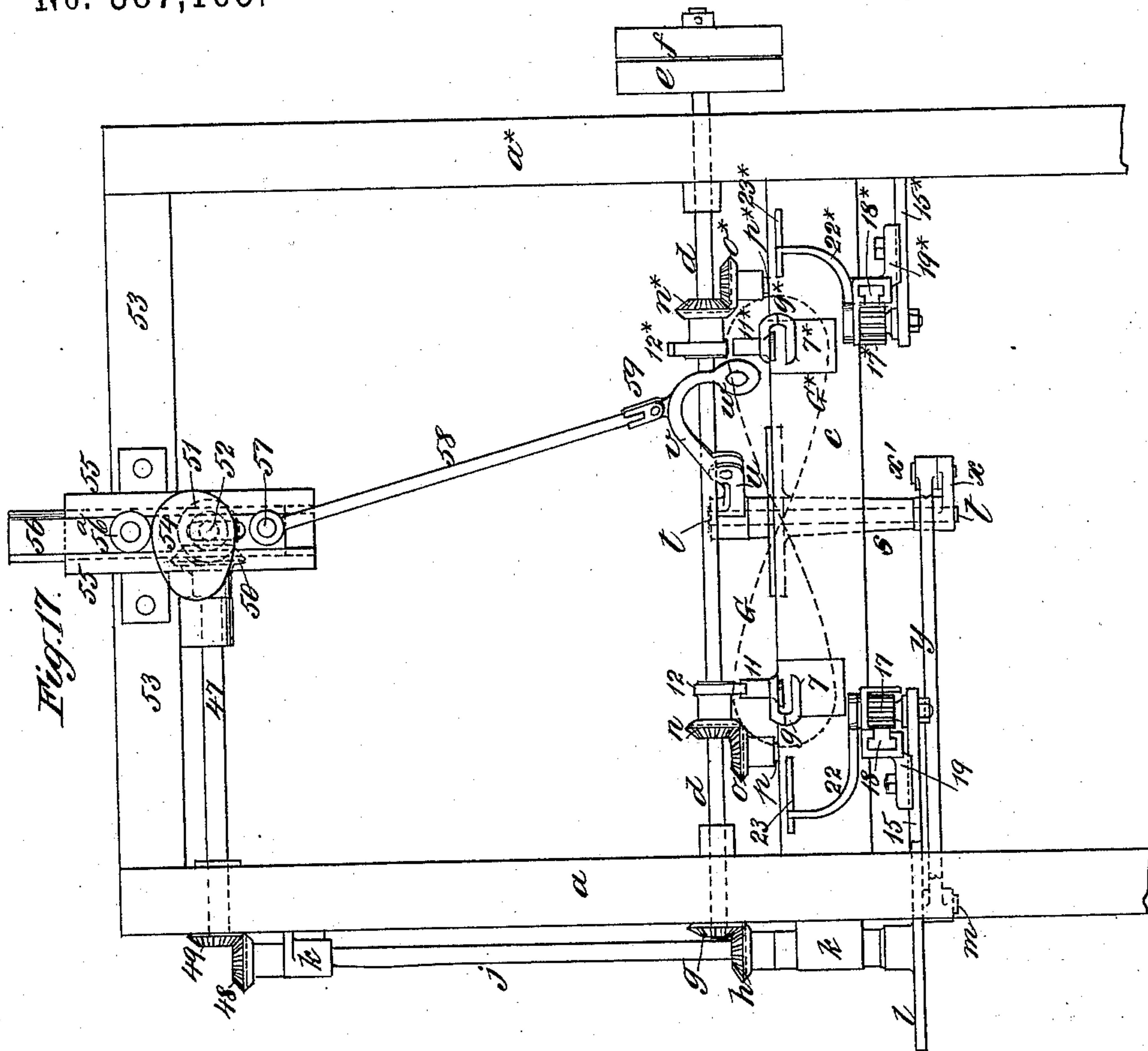
8 Sheets—Sheet 7.

W. HURST.

MACHINE FOR LINKING WARPS.

No. 387,165.

Patented July 31, 1888.



Witnesses:

O. Sundgren.
Joseph W. Roe.

Inventor: William Hurst }
By attorneys }
Brom & Hall.

(No Model.)

8 Sheets—Sheet 8.

W. HURST.

MACHINE FOR LINKING WARPS.

No. 387,165.

Patented July 31, 1888.

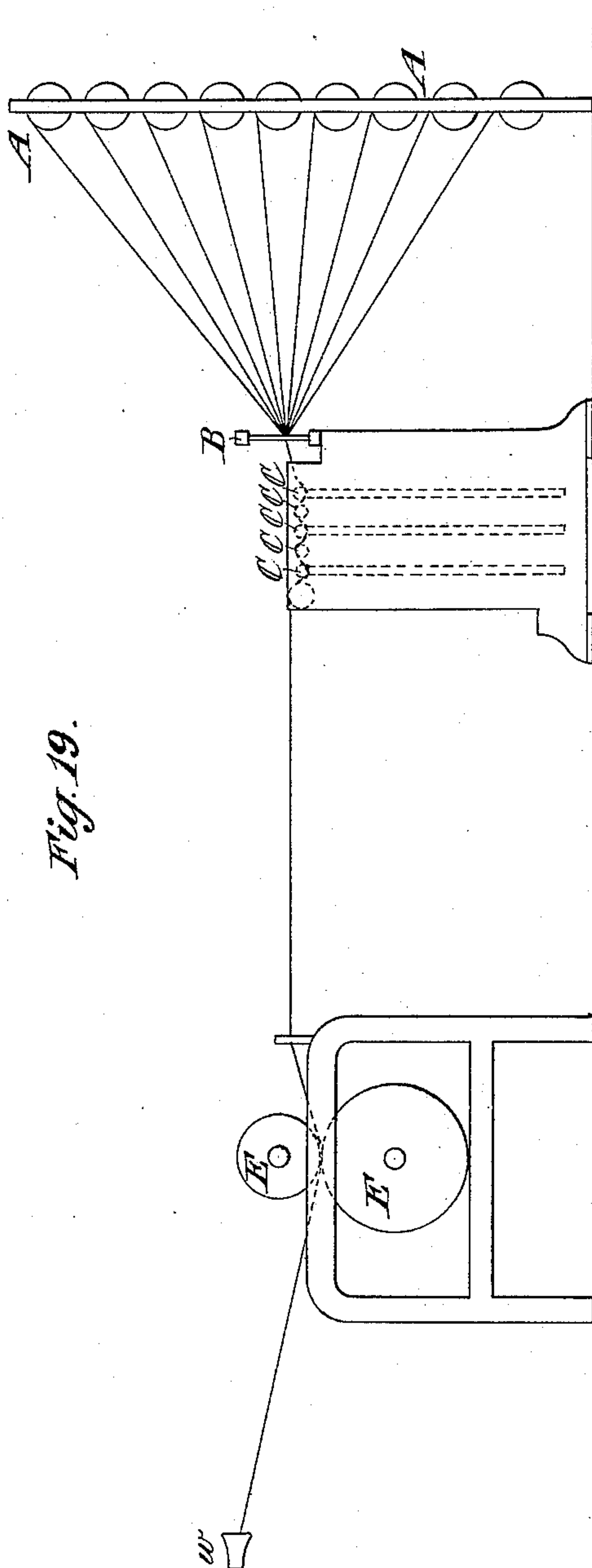


Fig. 19.

Witnesses:

Olundgren.
Joseph W. Roe,

Inventor:
William Hurst,
by attorneys
Rum Hall.

UNITED STATES PATENT OFFICE.

WILLIAM HURST, OF ROCHDALE, COUNTY OF LANCASTER, ENGLAND.

MACHINE FOR LINKING WARPS.

SPECIFICATION forming part of Letters Patent No. 387,165, dated July 31, 1888.

Application filed December 22, 1887. Serial No. 258,668. (No model.) Patented in England October 24, 1883, No. 5,059.

To all whom it may concern:

Be it known that I, WILLIAM HURST, of Rochdale, in the county of Lancaster, England, (cotton-spinner,) have invented a new and useful Improvement in Machines for Linking Warps, (for which I have obtained Letters Patent of the United Kingdom of Great Britain and Ireland, No. 5,059, dated October 24, 1883,) of which the following is a specification.

My invention relates to machinery or apparatus for forming what are commonly called "chained" or "linked" warps. By means of my invention I am enabled to chain or link warps more quickly and with greater certainty and regularity than heretofore, and by my invention the yarn being linked or chained is subjected to less strain and injury than it has hitherto been while being chained or linked by machines hitherto in use.

My invention consists in the mechanism hereinafter described and claimed for effecting the chaining and linking operations.

In the accompanying drawings, Figure 1 is a side elevation of a machine constructed according to my invention. Fig. 2 is a sectional plan of the same; Fig. 3, a partial front view; Fig. 4, a plan upon a larger scale; and Fig. 5 a front view, also upon a larger scale. Figs. 6, 7, 8, and 9 are views showing portions detached, and Figs. 10, 11, 12, 13, 14, 15, and 16 illustrate the formation of the chains or links. Fig. 17 is a front view, and Fig. 18 a side view representing a modified mechanism for actuating the trumpet through which the warp to be chained or linked is passed. Fig. 19 is a diagram representing an apparatus by means of which the threads forming the chained or linked warp are drawn direct from the bobbins.

The same letters of reference are applied to corresponding parts throughout the whole series of figures.

In the accompanying drawings, a a^* are end frames connected at the top by a cross-frame or cross-beam, b . Extending between the end frames, a a^* , and secured thereto, is a cross-frame or cross-beam, c .

d is a shaft supported in bearings, secured to the end frames, a a^* , respectively. Upon the shaft d are a fast pulley, e , and a loose pulley, f . The shaft d is provided with collars, by which such shaft d is prevented from

moving longitudinally. Fast upon one end of the shaft d is a bevel-wheel, g , gearing into a bevel-wheel, h , fast upon a vertical shaft, j . The vertical shaft j is supported in bearings k . Fast upon the lower end of the vertical shaft j is a plate, l , to which is secured a crank-pin, m . The shaft j is prevented from moving longitudinally by means of the boss of the bevel-wheel h and the boss of the plate l . Fast upon the shaft d are bevel-wheels n n^* . The bevel-wheel n gears into a bevel-wheel, o , fast upon a vertical shaft, p , carried by a bracket secured to the cross-frame or cross-beam c .

Fast upon the lower end of the shaft p is a plate, q , provided with a crank-pin, r . The shaft p is prevented from moving longitudinally by means of the boss of the wheel o and the boss of the plate q . The bevel-wheel n^* gears into a bevel-wheel, o^* , fast upon a vertical shaft, p^* , carried by a bracket secured to the cross-frame or cross-beam c .

Fast upon the shaft p^* is a plate, q^* , provided with a crank-pin, r^* . The shaft p^* is prevented from moving longitudinally by the bosses of the wheel o^* and of the plate q^* . Projecting from the cross-frame or cross-beam c is a bracket, s , supporting a vertical shaft, t . Fast upon the upper end of the shaft t is an arm, u , to which is jointed an arm, v , provided with a trumpet, w . The arm u is formed with a slot, u' , in which the arm v is capable of being moved vertically upward and downward. Upon the lower end of the shaft t , and fast therewith, is an arm, x , provided with a pin, x' , embraced by one end of a connecting-rod, y , the other end of which embraces the crank-pin m , carried by the plate l .

Secured upon the shaft d is a cam, z , which, as the shaft d rotates, causes the arm v to be raised and lowered while the said arm v is being moved lengthwise of the cam z , as will be hereinafter more particularly described.

As some of the parts to be hereinafter described are repeated upon both sides of the machine, I shall describe such of the said parts as are situate at one side of the machine and affix to corresponding parts situate at the other side of the machine the same letters of reference, with the addition of an asterisk, thus (*).

Secured to the cross-frame or cross-beam c is a bracket, l , (shown more clearly in the de-

tached views, Figs. 6, 7, 8, and 9,) Fig. 6 being
 a side view; Fig. 7, a side view, partly in sec-
 tion; Fig. 8, a cross-section taken on the line
 A B of Fig. 7, and Fig. 9 a view showing a
 5 portion detached. The bracket *l* is provided
 with a recess, 2, formed therein, and along a
 portion of the upper edge thereof are formed
 ledges which support a bar, 3, capable of be-
 ing slid longitudinally upon the said ledges.
 10 The end of the bar 3 is extended, as indicated
 by the dotted lines in Fig. 2, and curved side-
 wise at its extremity, so as to form a hook, 4,
 such bar 3, with its hook 4, being more clearly
 shown in the detached view, Fig. 9. 5 is a
 15 plate secured to the cross-frame or cross-beam
c by screws, a projecting part of which plate
 5 is curved at its extremity, so as to form a
 hook, 6, and an extended part of a bracket, 7,
 is also curved sidewise at its extremity, so as
 20 to form a hook, 8. The end of the hook 6 is
 curved downward, and the end of the hook 8
 is curved upward, the said two ends being in
 contact and forming a hollow hook, 9, which,
 for convenience, I will hereinafter refer to as
 25 the hook 9. Within such hollow hook 9 the
 extended end of the bar 3 is capable of being
 slid backward and forward, as will be here-
 inafter pointed out. To a part of the bar 3 is
 attached one end of a spring, 10, the other end
 30 of which is secured to a projecting part of the
 cross-frame or cross-beam *c*. The spring 10
 tends constantly to draw the bar 3 in the di-
 rection indicated by the arrow C. Secured
 to the bar 3 is a bracket, 11, part of which is
 35 situate within the path of a revolving cam, 12,
 so as to be capable of being moved thereby in
 a direction opposite to that indicated by the
 arrow C, the movement of the bar 3 in the di-
 rection indicated by the arrow C being lim-
 40 ited by a stop, 13, on the bar 3, and a stop, 14,
 secured to the cross-frame or cross-beam *c*.
 The cam 12 is mounted fast upon the shaft *d*.
 Secured to the end frame, *a*, is a bracket,
 15, to which a stud, 16, is secured. Mounted
 45 upon the stud 16, so as to be capable of being
 rotated thereon, is a wheel, 17, the teeth of
 which gear into the teeth of a rack, 18, pro-
 vided with projecting parts, which are em-
 braced by a bracket, 19, secured to the bracket
 50 15, in which bracket 19 the rack 18 is capable
 of being slid longitudinally while its teeth are
 in gear with those of the wheel 17. The teeth
 of the wheel 17 and the teeth of the rack 18
 are indicated by dotted lines. To one end of
 55 the rack 18 a connecting-rod, 20, is connected
 by means of a pin, 21, the other end of the
 connecting-rod 20 embracing the crank-pin *r*,
 secured to the plate *q*. Fast with the wheel
 17 is an arm, 22, provided with a curved part,
 60 which constitutes a hook, 23. Upon rotary
 motion being imparted to the pulley *e*, so that
 such pulley *e* rotates in the direction indicated
 by the arrow D, the plate *l* and crank-pin *m*
 will be rotated in the direction indicated by
 65 the arrow E. The rotation of the crank-pin
m will, by means of the connecting-rod *y*, pin
x', arm *x*, shaft *t*, arm *u*, and arm *v*, cause the

trumpet *w* to be oscillated sidewise. The cam
z being rotated in the direction indicated by
 the arrow D, the rotation of such cam *z* will
 cause the arm *v* and trumpet *w* to be raised 70
 and lowered twice during each revolution of
 the cam *z*. The rotation of the plate *l* will
 cause the trumpet *w* to be oscillated sidewise
 to the points F and F* alternately, and while 75
 the trumpet *w* is being so oscillated the cam *z*
 will cause such trumpet *w* to be carried along
 the line G G* in the direction indicated by
 the arrows H, the said trumpet *w* first passing
 below and around the hook 9 and then be- 80
 low and around the hook 9*. Upon rotary
 motion being imparted to the plate *q*, so that
 such plate *q* is rotated in the direction indi-
 cated by the arrow K, the rack 18 will, by
 means of the connecting-rod 20, be caused to 85
 traverse longitudinally first in one direction
 and then in the other. The traversing of the
 rack 18 will, by means of the wheel 17, cause
 the hook 23 to be turned first in one direction
 and then in the other, the said hook 23 at cer- 90
 tain times passing between the hook 6 and
 bracket 7 and beneath the hook 4. To feed
 the warp to be chained or linked to the chain-
 ing or linking machine at such rate that little
 or no tension is produced upon the warp while 95
 such warp is being chained or linked, I em-
 ploy the apparatus to be next described.

24 24* are end frames, to which are respect-
 ively secured brackets 25 25*, supporting a
 shaft, 26, fast upon which is mounted a drum 100
 or roller, 27. The shaft 26 is prevented from
 moving longitudinally by collars formed there-
 on or secured thereto. Resting upon the drum
 or roller 27 is a roller, 28, having an axle, 29,
 which axle 29 is supported by brackets 30 30*, 105
 in which it may be rotated. The brackets 30
 30* are respectively secured to levers 31 31*,
 one end of each of which turns upon a bar, 32,
 the ends of which pass into openings formed
 through the end frames, 24 24*. Depending 110
 from the ends of the levers 31 31* are weights
 33 33*, respectively, such weights 33 33* press-
 ing the roller 28 into contact with the roller
 or drum 27.

34 is a shaft, one end of which shaft 34 re- 115
 volves in a bracket secured to the end frame,
 24*, while the other end of such shaft 34 is ca-
 pable of being rotated in a bracket carried by
 a lever, 35. The lever 35 is capable of being
 turned at one end upon a stud secured to the 120
 end frame, 24. The shaft 34 is prevented from
 moving longitudinally by means of collars.

36 is a shaft passing through and capable of
 being revolved in holes formed through the
 end frames, 24 24*. Upon the shaft 36 is se- 125
 cured a cam, 37, which is situate beneath the
 lever 35. Fast upon the shaft 36 is an arm,
 38, provided with a stud which passes into a
 hole formed through the end of a rod, 39, by
 means of which the machine may be started or 130
 stopped. Fast upon the shaft 34 is a pulley,
 40, around which passes an endless belt, 41,
 which communicates rotary motion to the pul-
 ley 40 from any convenient source of power.

Fast upon the shaft 34 is a pulley, 42, the circumference of which is preferably covered with leather. The pulley 42 is shown as being in contact with a pulley, 43, fast upon the shaft 26. Fast upon the shaft 26 is a pulley, 44, around which and around the pulley *e* passes an endless crossed belt, 45, such belt 45 transmitting motion from the pulley 44 to the pulley *e* and shaft *d*. Secured to the bar 32 is an eye, 46.

Having thus described the various parts of the machine, I will proceed to show in what manner they operate when forming a warp into a chain or links.

The warp *L* to be chained or linked is passed through the eye 46 and between the drum or roller 27 and roller 28, after which such warp *L* is passed through the trumpet *w* and around one of the hooks 9*. During this time the rod 39 has been raised, so as to allow the pulley 42 to pass out of contact with the pulley 43. Upon the rod 39 being lowered the pulley 42 will be pressed against the pulley 43 and the drum or roller 27 and roller 28 will draw forward the warp *L* and deliver it to the trumpet *w*. I cause the drum or roller 27 and roller 28 to rotate at such circumferential speed that the warp *L* is delivered to the chaining or linking apparatus at such speed that little or no tension is produced in the warp *L* while such warp *L* is being chained or linked. The diagrams, Figs. 10 to 16, inclusive, show the manner in which the parts hereinbefore described operate in order to form the warp *L* into a chain.

In Fig. 10 the trumpet *w* has passed beneath and around the hook 9*, leaving the warp *L* passed around such hook 9*, and by a continued movement has passed beneath and around the hook 9, and again beneath and around the hook 9*, until it arrives in the position in which it is indicated in Fig. 10. The hook 23*, turning in the direction indicated by the arrow *M**, as will be hereinafter described, brings forward a loop, *N**, of warp previously passed around the hook 9*. A continued movement of the hook 23* in the direction indicated by the arrow *M** will carry the loop *N** of warp clear of the hook 9* and allow the said loop *N** of warp to pass upon the loop *O** of warp, which is around the hook 9*, as shown in Fig. 12. The sliding hook 4* is then drawn in the direction indicated by the arrow *P** by the rotation of the cam 12*, and draws along with it the loop *O** of warp until it arrives in the position in which it is indicated in Fig. 13, and while the sliding hook 4* is in such position the revolving hook 23* passes in the direction indicated by the arrow *Q**, beneath the hook 4*, and through the hook 9*, after which the hook 23* is rotated in the direction indicated by the arrow *M**, after which the sliding hook 4* will be liberated by the rotation of the cam 12* and be drawn by the spring 10* into the position in which it is indicated in Fig. 14. A loop, *R**, of warp is then passed around the hook

9* by the trumpet *w*, and a repeated movement of the hook 23* in the direction indicated by the arrow *M** will carry the loop *O** of warp clear of the hook 9* and be about to pass it upon the loop *R**, and the parts will arrive in the positions in which they are indicated in Fig. 15, when the cycle of motions for forming one link of the chain will have been completed.

I have confined my description to forming the chain at one side only of the machine, and the motion and action of the parts at the opposite side of the machine being similar to and alternate with those above described, a further description thereof will be unnecessary. A portion of warp, chained or linked, as above described, is shown by Fig. 16, which is a diagram of a portion of warp when chained or linked. The warp to be chained or linked by the machine above described may be formed upon a "warping-mill" or "beaming-machine," by which threads are usually formed into a warp.

Another method of actuating the trumpet *w* is shown by Figs. 17 and 18, Fig. 17 being a front view and Fig. 18 a side view. To parts which are similar to parts previously referred to I shall affix the same letters of reference as I have affixed to similar parts above mentioned.

j is a vertical shaft, which imparts rotary motion to the shaft 47 by means of the bevel-wheels 48 49. Fast upon the shaft 47 is a bevel-wheel, 50, which gears into another bevel-wheel, 51, fast upon a shaft, 52, mounted and capable of being rotated in brackets secured to the cross-frame or cross-beam 53. Fast upon the shaft 52 is a cam, 54. To the cross-frame 53 are secured *V*-guides 55, within which and capable of being slid therein is a plate, 56. Upon the plate 56 is mounted a stud, upon which is mounted a bowl or roller, 56^a.

Secured to the plate 56 is a stud, 57, from which depends a rod, 58, the lower end of which is connected by the universal joint 59 to the arm *v*, jointed to the arm *u* fast upon the shaft *t*. To the arm *v* is secured the trumpet *w*. The rotation of the cam 54 will cause the arm *v* and the trumpet *w* to be raised and lowered in a manner similar to that previously described.

In some cases I propose to form a chained or linked warp by means of the above-described chaining or linking apparatus or machine by taking the yarns or threads from which the warp is to be formed direct from the bobbins upon which such yarn or thread has been spun or wound. For this purpose I pass the threads or yarns between or around rollers, which, by means of their revolving surfaces, draw off the yarns or threads from the bobbins aforesaid, and deliver the said yarns or threads to the linking or chaining apparatus or machine. The yarns or threads aforesaid, in their passage from the bobbins previously mentioned to the chaining or linking machine or apparatus, pass through a "heck"

or similar apparatus for arranging the yarns or threads in an order suitable for weaving. After the warp has been chained or linked by the machine or apparatus above described, it
 5 may either fall upon the floor or other surface beneath the chaining or linking machine or apparatus to be subsequently removed, or the said warp may be passed over suitable pulleys or guides to be conveyed thereby to any con-
 10 venient place. The said pulleys may have rotary motion imparted thereto, if desired. This arrangement of apparatus is shown by Fig. 19. A is the creel, in which are placed the bobbins containing the yarns from which the
 15 warp is to be made. B is a heck, and C C are rollers or rods, such as are ordinarily employed for taking up the slack yarn or thread in beaming-machines. The yarns or threads are passed through the heck B, then over and
 20 under the rollers or rods C to the rollers E E, and thence to the trumpet *w* of the chaining or linking machine.

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

25 1. In a machine for chaining or linking warps, the combination, with the stationary hollow hooks 9 9*, the hooks 4 4*, and means, substantially as described, for reciprocating
 30 said hooks, the hooks 23 23*, and means, substantially as described, for operating the same, of a warp-guiding trumpet, *w*, and means, substantially as described, for imparting the combined lateral and vertical motions to said trumpet, as set forth.

2. In a machine for chaining or linking 35 warps, the combination, with the stationary hollow hooks 9 9*, the hooks 4 4*, and the longitudinally-sliding bars 3 3*, carrying the same, the cams 12 12*, and springs 10 10*, for
 40 actuating said bars, the hooks 23 23*, the racks 18 18*, and means, substantially as described, for operating said racks and pinions 17 17* for oscillating the said hooks, of the warp-guiding trumpet *w*, and means, substantially as
 45 herein described, for imparting the combined lateral and horizontal movements to said trumpet, as set forth.

3. In a machine for chaining or linking warps, the combination, with the stationary hollow hooks 9 9*, the hooks 4 4*, and means, 50 substantially as described, for reciprocating said hooks, the hooks 23 23*, and means, substantially as described, for operating the same, of a warp-guiding trumpet, *w*, the arm *v*, carrying said trumpet, the arm *u*, to which arm *v* 55 is jointed, the vertical shaft *t*, carrying the arm *v*, means, substantially as described, for vibrating the shaft *t*, the cam *z*, and means, substantially as described, for revolving the same, all substantially as herein set forth.

WILLIAM HURST.

Witnesses:

ARTHUR C. HALL,

ALBERT E. HALL,

9 Mount Street, Manchester, England.