6 Sheets—Sheet 1.

D. C. BROWN & J. ASHWORTH.

MACHINE FOR MAKING WIRE HEDDLES FOR LOOM HARNESS.

No. 77,713. Patented May 12, 1868.

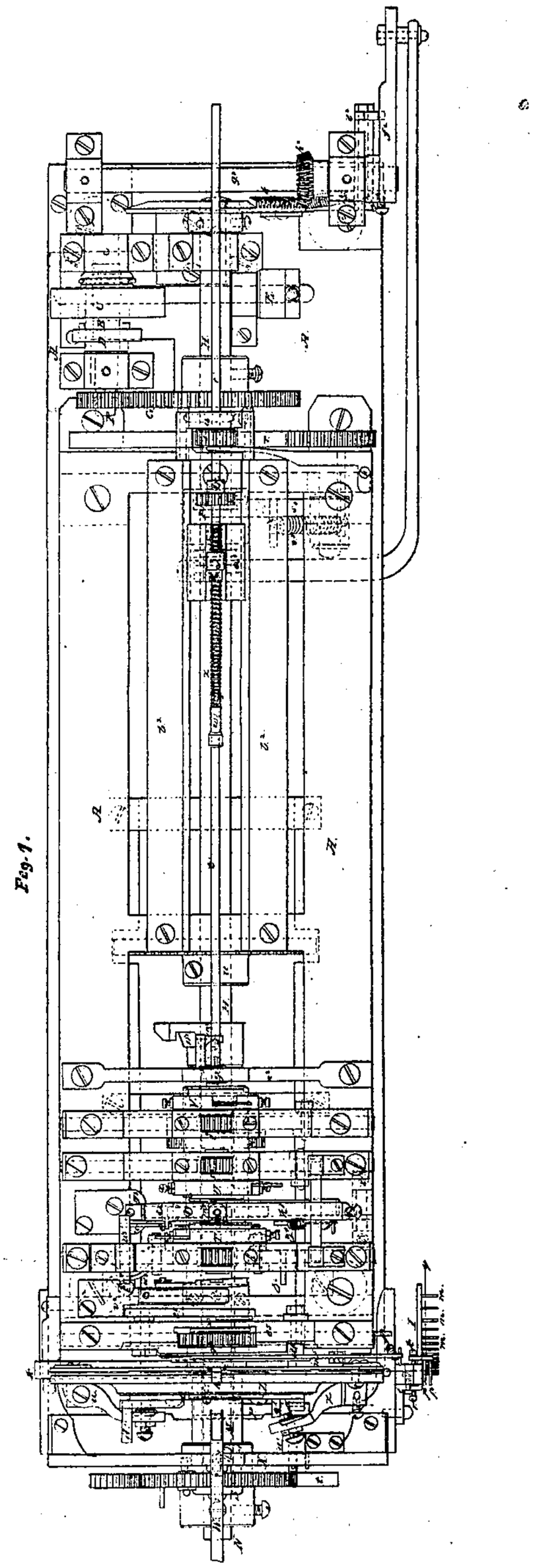

Fig. 1.

Witnesses:
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G. H. Andrews.

Inventors:
D. C. Brown & J. Ashworth
by their attorney
R. H. Eddy

6 Sheets—Sheet 2.

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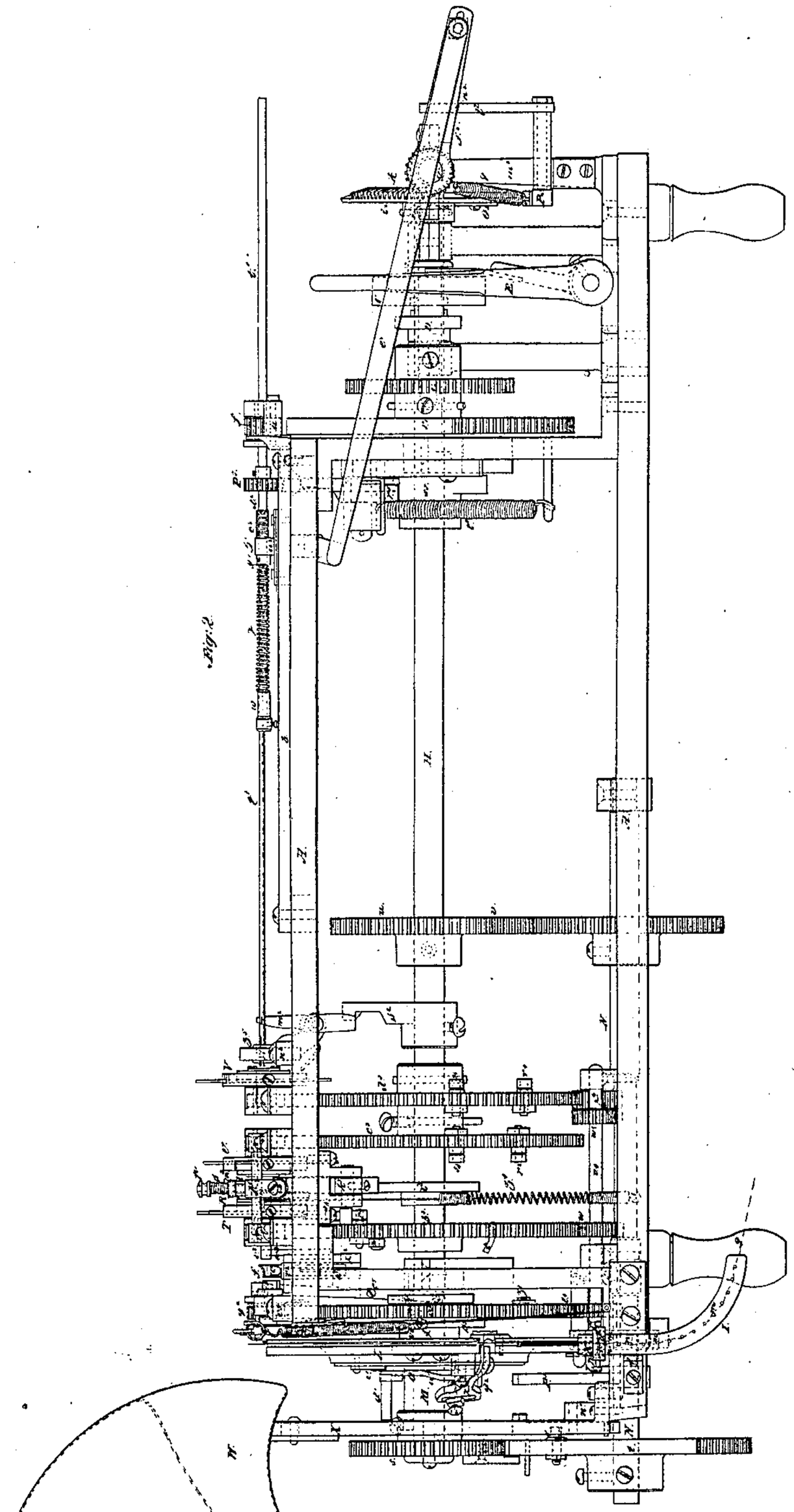

Fig. 2.

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6 Sheets—Sheet 3.

D. C. BROWN & J. ASHWORTH.

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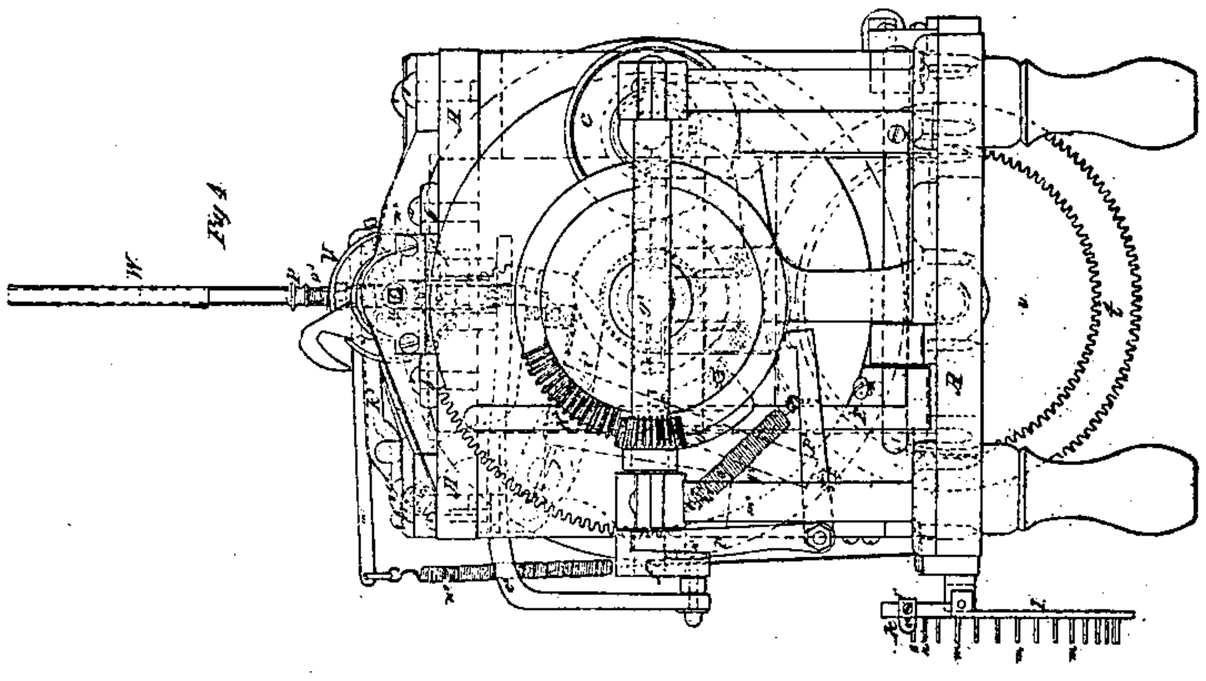
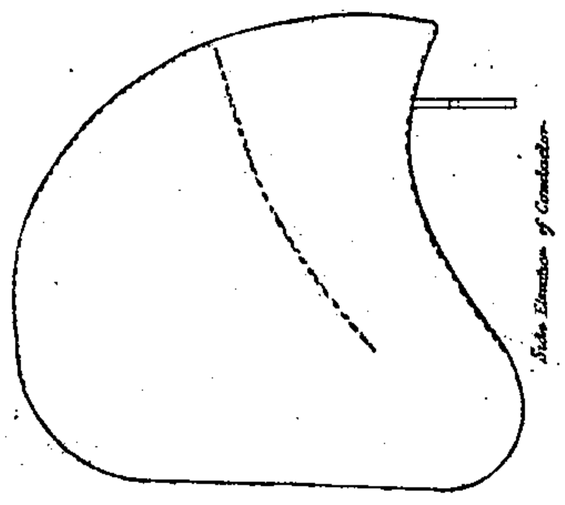


Fig 4



Side Elevation of Condenser

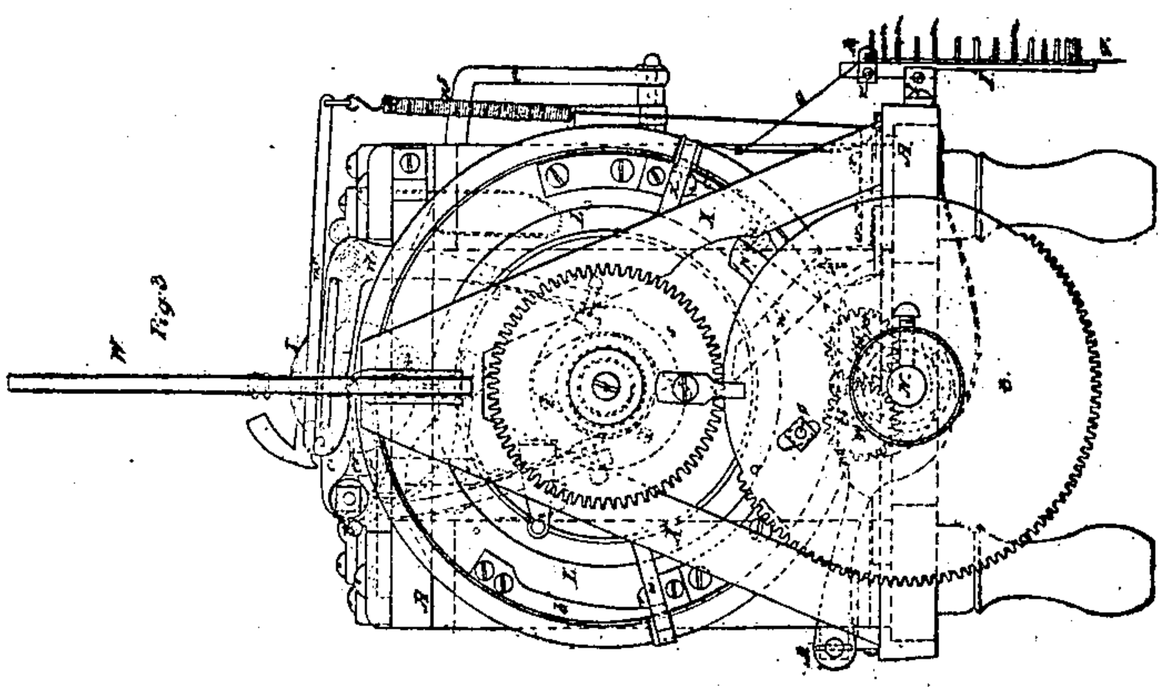


Fig 3

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6 Sheets—Sheet 4.

D. C. BROWN & J. ASHWORTH.

MACHINE FOR MAKING WIRE HEDDLES FOR LOOM HARNESS.

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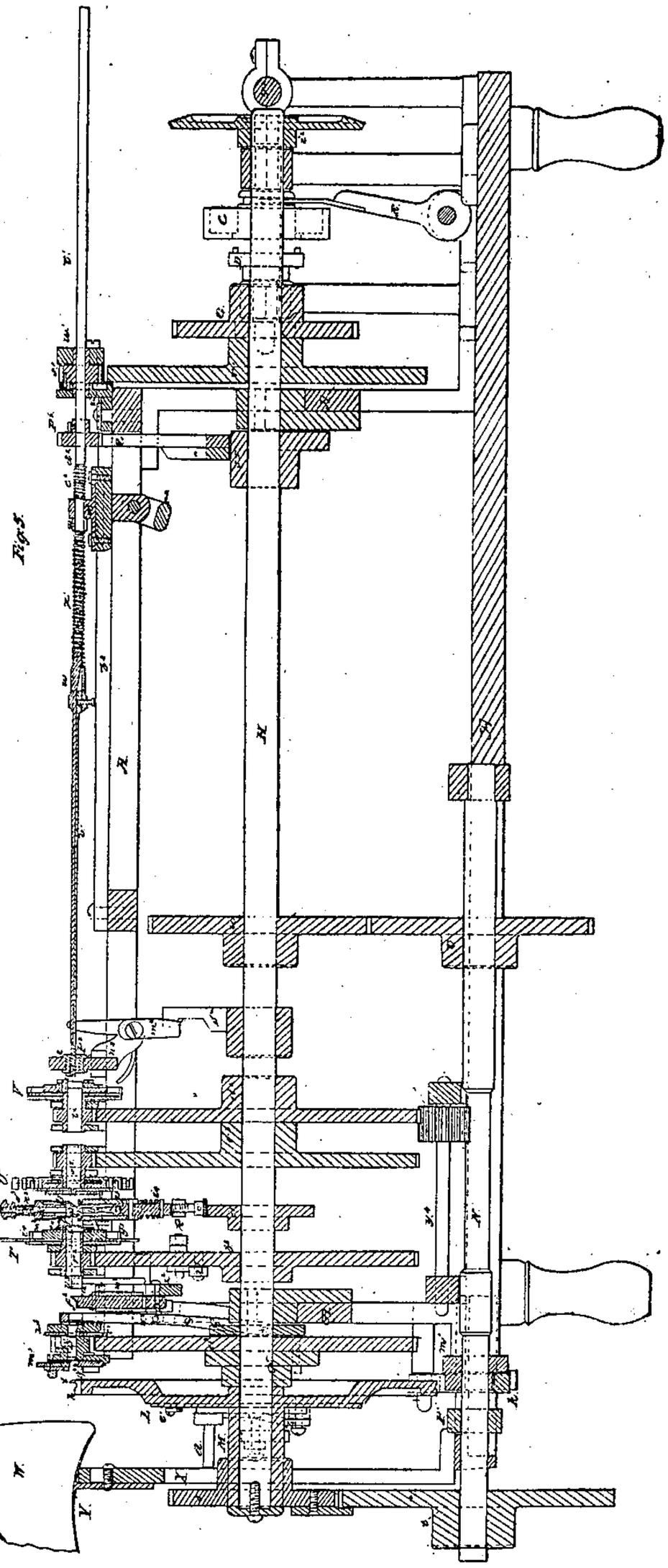
Fig. 5.



Witnesses:
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6 Sheets—Sheet 5.

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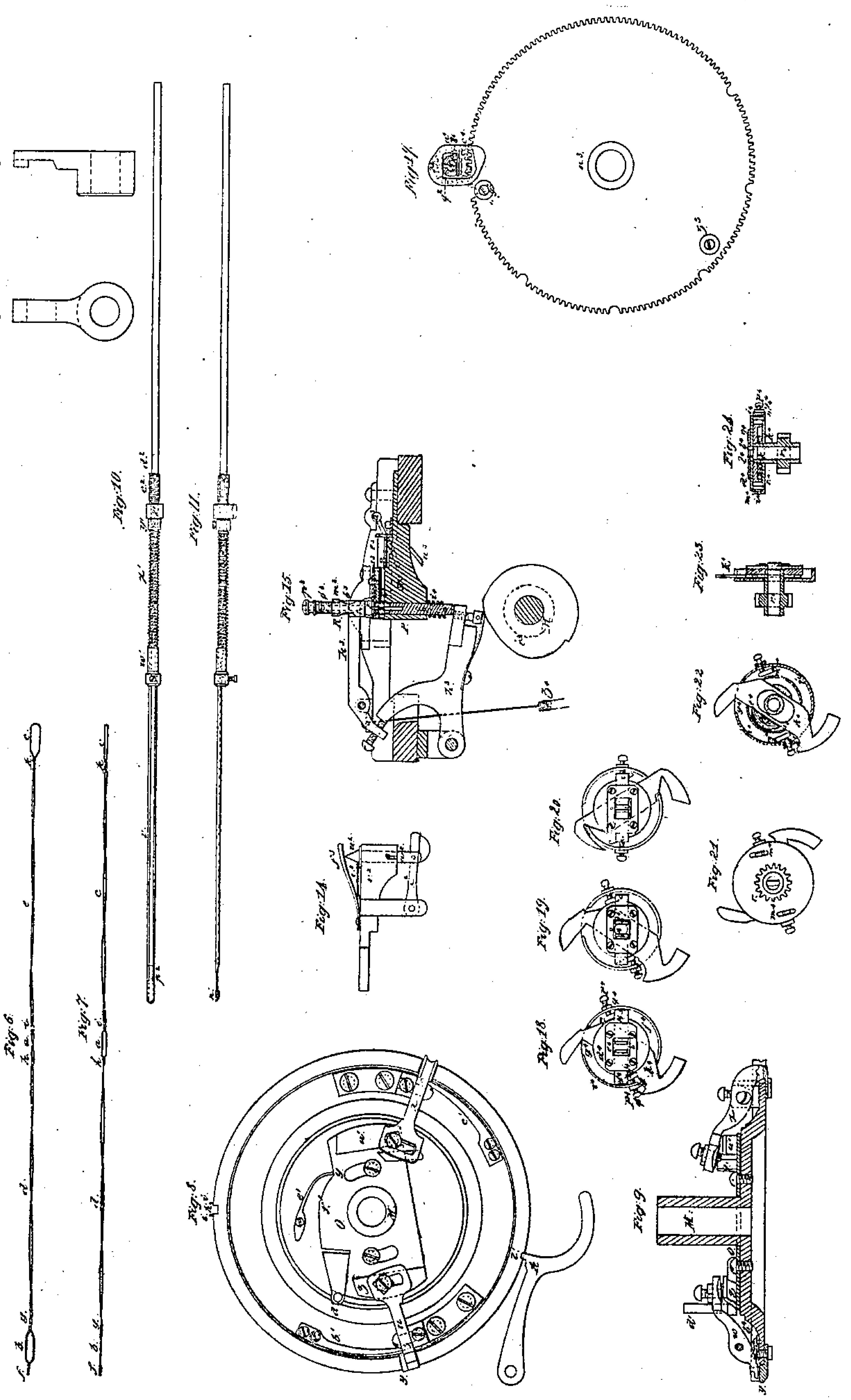

Witnesses:
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6 Sheets—Sheet 6.

D. C. BROWN & J. ASHWORTH.

MACHINE FOR MAKING WIRE HEDDLES FOR LOOM HARNESS.

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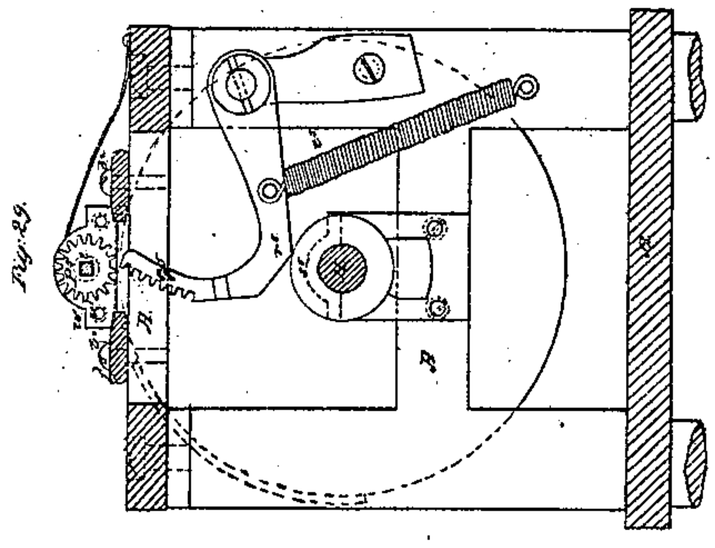

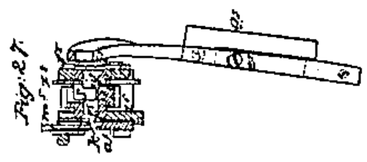

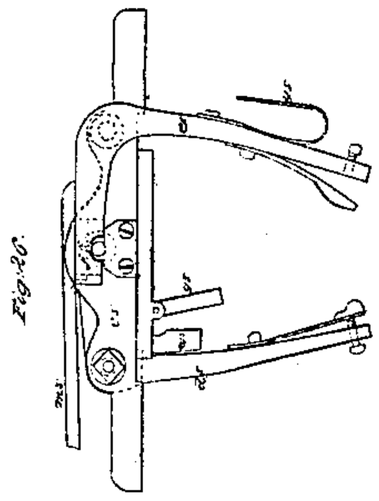

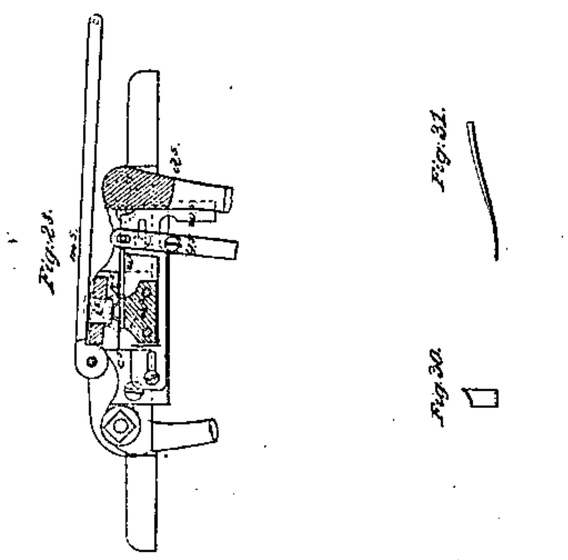

Witnesses:
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United States Patent Office.

DARIUS C. BROWN, OF LOWELL, AND JOHN ASHWORTH, OF NORTH ANDOVER, ASSIGNORS TO D. C. BROWN, OF LOWELL, MASSACHUSETTS.

Letters Patent No. 77,713, *dated May* 12, 1868.

IMPROVEMENT IN MACHINE FOR MAKING WIRE HEDDLES FOR LOOM-HARNESSES.

The Schedule referred to in these Letters Patent and making part of the same.

TO ALL PERSONS TO WHOM THESE PRESENTS SHALL COME:

Be it known that we, DARIUS C. BROWN, of Lowell, in the county of Middlesex, and JOHN ASHWORTH, of North Andover, in the county of Essex, and State of Massachusetts, have invented a new and useful Machine for Making Wire Heddles for Loom-Harnesses; and we do hereby declare the same to be fully described in the following specification, and represented in the accompanying drawings, of which—

Figure 1 is a top view.

Figure 2, a front elevation.

Figure 3, an elevation of the left, and

Figure 4 an elevation of the right end; and

Figure 5 a longitudinal and vertical section of it.

Figures 6 and 7 are side views of a heddle as made by the machine, the eye *a* of such heddle being arranged in a plane at right angles with that of the two loops, *b c*.

In the said figs. 6 and 7, *d* and *e* exhibit the longer twists, and *f*, *g*, *h*, *i*, and *k*, represent the shorter twists, as effected by the machine.

Such other figures as may be necessary to further delineate the said machine will be hereinafter referred to and described.

The principal constituents of the said machine may be thus defined:

First, the mechanism for straightening the wire during its passage into the machine.

Second, the mechanism for seizing the wire near its end, and drawing it into a position for it to be properly presented to the doubling-mechanism.

Third, the doubling-mechanism, or that which, after a piece of wire may have been severed from the coil, seizes it at its middle and draws it into the mechanism for subsequently twisting it.

Fourth, the mechanism for separating the legs of the doubled piece of wire, so that the dog can enter between them.

Fifth, the device or mechanism which enters between the legs of the piece of wire in order to aid in the formation of the eye of the heddle.

Sixth, the dog or mechanism which passes between the legs of the wire, and aids in the formation of the loop near the ends of the wire, the other loop being formed by the mechanism which seizes the wire at its middle.

Seventh, the mechanism for putting the two longer twists in the doubled wire.

Eighth, the mechanism for putting the shorter twists into the doubled wire.

Ninth, the mechanism for adjusting the loops, or turning them into positions where their planes will be at or about at right angles with that of the eye.

Tenth, the mechanism for finishing the heddle or cutting off the surplus wire.

Eleventh, the mechanism for discharging the heddle or effecting the expulsion of it from the machine.

There are also certain auxiliary mechanisms, which will be hereinafter described, among which may be mentioned a mechanism for spreading the eye lengthwise; also, mechanism for discharging from the machine the surplus wire cut off prior to the discharge of the heddle.

In the drawings, A denotes the frame for supporting the main operative parts. B is the driving-shaft, there being on such shaft a pulley, C, and also a clutch, D, for engaging the pulley with the shaft, as occasion may require. The pulley slides on the shaft, and is provided with a shipper, E, for moving it either into or out of engagement with the clutch.

In order to put the shaft in revolution, a belt, from a suitable motor, is to run around the said pulley C, so as to revolve it.

A pinion, F, on shaft B, engages with a spur-gear, G, fixed on the main shaft H, which runs lengthwise through the frame, such shaft H being revolved by means of such pinion and gear.

The mechanism for receiving the wire, and straightening it during its passage into the machine, may be thus described:

I is a curved arm or lever, which is supported on a fulcrum, *l*, so as to be movable in a plane transversely of the machine. A row of pins, *m m m*, projects from the front face of the arm, and below two other pins, *n n*, extending therefrom.

A small slider, K, is arranged on the upper part of the arm, and so as to be capable of being moved transversely of the arm, the slider being provided with adjusting-screws *r r*, by which it may be moved so as to adjust two pins, *o o*, extending from it, with reference to the pins *n n*.

The slider K also has two other pins, *p p*, arranged parallel to each other, and extending from it over and at right angles with the two pins, *o o*.

The wire, *q*, in passing into the machine, is led against and between the several pins *m m m*, in a serpentine form, in manner as represented by a red line; thence it is passed between the pins of each pair, *n n*, *o o*, and *p p*.

As the wire is drawn from a coil of it, it necessarily becomes bent, more or less, but by drawing it through the straightening-mechanism it may be perfectly straightened, the lever of such mechanism being tipped, more or less, on its fulcrum, and the slides being adjusted laterally, as occasion may require, in order to effect the straightening.

From the arm I, the wire passes to the grooved periphery of a wheel, L, composing part of the next portion of the machine, viz, that for seizing the wire near its end, and drawing it into a position for its proper presentation to the doubling-mechanism.

This second portion of the machine is as follows, or may be thus described:

The wheel L is fixed to a tubular hub or shaft, M, which turns in and is concentric with the main shaft H, and carries at its outer end a spur-gear, *s*, which engages with another gear, *t*, whose teeth extend only around an arc of its circumference.

The gear *t* is fastened to a shaft, N, arranged underneath and parallel with the shaft H.

Two gears, *u v*, on the two shafts H and N, serve to transmit rotary motion from the former to the latter of such shafts.

Figure 8 is an outer side view of the wheel L with its appliances.

Figure 9 is a cross-section of the wheel, taken through its axis, and the cutter and nipper levers.

This wheel L has applied to its outer face two levers, *w x*, the shorter arm of one of which, viz, that marked *w*, is intended to act against a jaw or part, *y*, of the wheel, so as to nip or catch the wire in order to draw it into the machine or over upon the periphery of the wheel during a rotary movement of the said wheel. The other lever, *x*, carries a knife or blade for severing from the wire the portion drawn over upon the wheel, and in the groove of the periphery. A lever-plate, O, carrying two cams, *z* a^1, is arranged against the outer face of the wheel L, and so as to turn on its hub as a fulcrum.

The cams *z* a^1 are for operating the two levers, so as to move their shorter arms towards the wheel, opposite movements of such arms being effected by springs b^1 c^1, fixed to the wheel.

There is a stud, d^1, projecting from the lever-plate O, and there is also a spring-latch, e^1, fixed to the wheel, and so as to catch into either of two notches, f^1 g^1, in the edge of the lever-plate, the latch being to retain the lever-plate in either of two positions.

The wheel L also has a notch, h^1, made in its periphery, such being flanked by two short studs i^1 i^1, extended from the periphery of the wheel. The said notch is arranged midway between the cutter and the nipper-levers, and when the wire is drawn into the machine, and is ready to be cut, this notch is brought up to the highest part of the wheel, so as to be in a position to move the device, by which the wire at its middle is seized and drawn away from the wheel in a direction horizontally and at right angles to it, and is doubled.

When the notch h^1 of the wheel L has once attained the said position, the wheel is locked or held stationary for awhile by a latch-lever, k^1, shown in fig. 8, such latch taking into a notch, *l'*, made in the wheel. A cam, m^1, fixed on the shaft N, throws the latch out of action with the wheel L, just previous to the said wheel being put in revolution.

During the revolution of the wheel *l*, the stud d^1 of the lever-plate O, will be carried against the longer arm of a movable lever, n^1, shown in dotted lines in fig. 3, such lever at such time being held stationary by means of a stud, o^1, projecting from the gear *t*.

In consequence of the stud d^1 being so carried against the lever n^1, the lever-plate O will be moved on its fulcrum, and by its cams will close the nipper-lever and "open" the cutter-lever.

The nipper-lever, with its jaw on the wheel, will thus be made to seize the wire, and such wire will be drawn in with the wheel as the latter may continue to be revolved.

The stud o^1 we so apply to its gear as to be capable of being adjusted radially thereof, and fixed to the gear nearer to or further from its axis, as occasion may require.

This application of the stud to the gear is to enable the stud to be adjusted so as to cause the nipper-lever to seize the wire at the right time, in order that the wire drawn in may be of the proper length.

The mechanism which severs the wire from the coil is brought into action after the wire has been drawn in by and over the wheel L. This mechanism is the cutter-lever *x* and its actuating-devices.

At the proper time an arm, p^1, projecting from the shaft N, will be carried against a stud, q^1, projecting from the plate O, and will move the said plate O so as to cause the cutter-lever to operate and sever the wire. At the same time the nipper-lever will be moved so as to release the end of the wire previously severed by it.

The next portion of the machine to be described is what we term the doubling-mechanism, or that which, after the piece of wire has been so drawn into the machine and severed from the rest of the coil of wire, is seized at its middle and drawn longitudinally through certain mechanism for twisting the wire whereby such piece

of wire will be bent at its middle in a manner to cause one-half or leg of it, to be folded back upon the other half or leg of it.

On the main shaft H is a gear, r^1, having teeth only on a portion of its circumference. This gear engages with a pinion, s^1, on a square rod, t^1, and arranged within a bracket, u^1, projecting from the frame A. The pinion s^1 should be so applied to the said rod t^1 as to enable the rod, when moved lengthwise, to slide freely through the pinion, the said pinion serving, under other circumstances, to revolve the rod. The rod t^1 is the retractor or device for seizing the wire at its middle and drawing it back to effect the doubling of it.

The said retractor t^1, at its front or left end, has a short loop-former, w^1, applied to it, such being more particularly exhibited in Figures 10 and 11, one of which is an under side, and the other a side view of the retractor, as it appears without its tongue, v^1. The said retractor is grooved lengthwise on its under side, to receive a sliding tongue, v^1, which is fixed to a tubular slider, w^1, that slides freely on the retractor and against a helical spring, x^1, arranged thereon as represented.

The spring x^1 rests against a collar, y^1, fixed on the retractor, and so as to bear against a standard, z^1, of a carriage, a^2, which is supported by and between parallel and horizontal rails or ways, b^2 b^2, arranged on the frame A in manner as represented in the drawings.

In rear of said standard there is another helical spring, c^2, one end of which rests against the standard, while the other end is borne against a shoulder, d^2, at the inner termination of that part of the retractor which is square in section. The retractor, for some distance in advance of the shoulder d^2, is cylindrical, but thence to or near to its front or left end is semicircular in section, but grooved on its flat side, to receive the tongue v^1.

The carriage a^2 has a bent rod, e^2, jointed to it, and extended to and being jointed to the wrist of a crank or arm, f^2, that is fixed on a transverse shaft, g^2, (see figs. 1 and 4.) A bevelled pinion, h^2, fixed on the shaft g^2, engages with a bevel-gear, i^2, fixed on the right end of the main shaft H. There are teeth only on an arc of the gear i^2, as shown at k^2. The object of the carriage a^2, the connecting-rod e^2, the arm f^2, the shaft g^2, the pinion h^2, and the gear i^2, is to effect the advance and retreat of the retractor at the proper times.

A bent-lever latch, l^2, applied to a post, m^2, and formed as represented in figs. 2 and 4, serves to support the crank or arm f^2 when the retractor is in its rearmost position, the arm then resting on a shoulder, n^2, of the latch. There is a cam, o^2, projecting from the gear h^2. This cam is for the purpose of disengaging the latch l_2 from the arm f^2 at the proper time, which it will do by its action against the arm p^2 of the latch. A spring, q^2, serves to draw the arm p^2 up to the periphery of the cam and its wheel.

The retractor t^1, when advanced, enters into the notch h^1 of the wheel L, but the tongue v^1 will not then fully enter the notch, but will be held back by a lever, m^2, supported by a bar, n^2, extended across the frame A, the lower arm of the lever resting against a cammed arm, o^2, projecting from the main shaft H.

An end view of the said arm is given in Figure 12, and a side view of it in Figure 13. The hook or loop-former w^1 of the retractor having passed over and beyond the wire in the notch h^1, such loop-former then projecting downward from the part of the retractor from which it extends, the tongue v^1 will next be driven forward underneath the wire, and against the loop-former w^1. The forward movement of the tongue will be effected by the spring x^1, after the passage of the cammed arm o^2 beyond the lever m^2. A small shoulder, p^2, on the tongue, brings up against the wire, and holds it closely against the heel of the loop-former. After the wire may have thus been seized by the retractor, the latter will be drawn backward so as to draw the wire through the several pairs of twisting-jaws or devices whose operative pin-irons are represented at q^2, r^2, s^2, and t^2, (see figs. 1 and 5.)

The next part of the machine to be explained is the mechanism for separating the legs of the doubled piece of wire, in order that the "dog," to be hereinafter explained, may enter between them. A wedge, u^2, slides vertically in an arm, v^2, (see Figure 14, which is a side view of the said wedge and its operative mechanism,) and has its shank, w^2, jointed to a lever, x^2, whose fulcrum, y^2, projects from the arm v^2. At a proper time, a pin, z^2, extending from the gear b^3, to be hereinafter described, will by the gear be carried under and against the lever x^2, and will raise the lever so as to force the wedge u^2 up between the legs of the wire, in order to press them apart during descent of the said lever. A spring, c^3, fixed to the arm v^2, and underneath another spring, f^3, also fixed to the said arm and extended over the wedge, will depress the wedge.

The next part of the machine is the device or mechanism which enters between the legs of the wire, in order to aid in the formation of the eye a (see figs. 6 and 7) of the heddle.

Figure 15 is a transverse section of the machine, taken through this device, which is shown at P in fig. 5. The said eye-former P slides vertically in a stationary arm, g^3, rests on a lever, h^3, and has a spring, i^1, applied to it for depressing it. A cam, i^3, fixed on the shaft H, by its action against the lever h^3, serves to elevate the eye-former P so as to cause its upper part to enter between the legs of the wire and hold them apart, while they may be in the act of being twisted, so as to form the eye on the said former.

At the same time the lever h^3 is forced upward, it is made to act against and press upward the shorter arm of another lever, k^4, arranged and having a spring, z^4, applied to it, as represented. The said lever k^3 carries on its longer arm a presser, R, which consists of two springs, l^3 l^3, united by a cross-piece, m^3, which slides vertically on a screw, n^3, that projects upward from the lever k^3. There are on the screw a helical spring, o^3, and a nut, p^3. The spring o^3 rests on the cross-piece m^3. The lower ends of the springs l^3 l^3 of the presser R rest on the legs of the wire and hold them down against the top of the arm g^3 while they may be in the act of being twisted.

The eye-former P is of a peculiar construction, and, after an eye may have been formed on it, it is made to operate so as to spread the said eye lengthwise, in order to impart to each end of the eye a semicircular or semi-elliptical form, or an approximation thereto; that is, the wires, where they form an acute angle at their junction, are spread so as to make their angle greater, and at the same time elongate the eye and contract the

twist, the object being to so close the twist as to prevent a warp or any knot thereof while running through the eye from being caught in the twist.

In order to accomplish the spreading of the eye by the former P, such former, at its upper part, is composed of two separate portions or fingers, q^3 q^3, which are hinged or so connected with the stick r^3 of the said frame as to allow of the said fingers being spread apart against the springs, l^3 l^3, of the presser. A shaft, s^3, by entering between the fingers q^3 q^3, and being turned, presses them apart, the said shaft, when between the fingers, being rectangular in section.

The said shaft is supported by the arm v^2 in bearings applied thereto. A stud, t^3, projects from the shaft, over an arm, w^3, extended from another shaft, v^3, (see figs. 1 and 15.) Another arm, w^3, projects from the shaft v^3, and at a proper time will be raised by a stud or roller, x^3, applied to the left side of the gear-wheel b^3.

The mechanism, therefore, for spreading the heddle-eye, consists of the fingers q^3 q^3, the shaft s^3, stud t^3, arm w^3, shaft v^3, arm w^3, and the stud or roller x^3, extended from the gear b^3, as described.

The next part of the machine to be explained is the dog S, or mechanism which passes between the legs of the wire, and aids in the formation of that loop which is next to the two ends of the wire, the other loop being formed by the loop-former of the retractor.

The said dog S is represented as projecting into the shaft or eye of the pinion q^2, and forms a cam-plate, x^3, arranged alongside of such pinion.

Figure 17 is a vertical section, taken through the plate x^3, and transversely of the machine, such also showing the gear a^3, and the two studs or rollers y^3 z^3 applied thereto for elevating and depressing the cam-plate x^3, so as to force the dog S upward and downward, as occasion may require.

The said cam-plate x^3 is actuated or moved on the hub of the pinion q^2 by the studs y^3 z^3 during a revolution of the gear a^3.

There is a spring-bolt, a^4, applied to the side of the pinion q^2, and so as to operate with either of two notches b^4 c^4 in the plate x^3, so as to hold the plate in either of its positions relatively to the pinion.

The next portions of the machine to be explained are the mechanisms for putting the two longer twists in the doubled wire.

The dog S, when between the legs of the wire, and rotated with and by the pinion q^2, will put one of the longer twists in the said legs, that is, will twist such legs together. The rotary motion of the pinion q^2 is effected by the gear a^3, which engages with such pinion.

The other longer twist is effected by revolving the retractor, such being accomplished by the segment-gear r^1 and the pinion s^1, as hereinbefore described.

The next portions of the machine are the mechanisms for putting the shorter twists into the doubled wire.

Each of these mechanisms, shown at T, U, and V, and termed the twisters, is connected to the hub of one of the pinions r^2, s^2, and t^2, which pinions gear respectively into the gears b^3, c^3, and d^3.

Figures 18, 19, and 20 are side elevations of each of the said mechanisms, they being alike in principle, although changed in some particulars in the forms of their slide-plates. They are arranged in the machine, and with respect to their pinions r^2, s^2, and t^2, in manner as represented in figs. 1 and 5.

Figure 21 is an opposite side elevation of the twister T,

Figure 22 is a vertical section of it, and

Figures 23 and 24 are transverse sections of it.

The part d^4 of it is a cylindrical head or block fastened to the journal or hub of the pinion r^2. Within the head d^4 are two jaws or slides l^4 l^4, capable of moving diametrically on the head, they being kept in place by a cap-plate, e^4. A flanged wheel, f^4, turns freely on the hub of the pinion, there being two notches, g^4 h^4, made in the flange, i^4, of such wheel. These notches receive a cammed lever or slider, k^4, which slides lengthwise in the head d^4. From each of the jaw-slides l^4 l^4, a stud or pin, m^4, projects, and enters one of two inclined slots, n^4 o^4, made in the body of the flanged wheel f^4.

Screws p^4 p^4 screw through the flange i^4, near one terminus of each of the slots n^4 o^4, and are provided with check-nuts, q^4 q^4, the whole being as represented in figs. 21, 22, 23, and 24.

When the slider k^4 is moved lengthwise in either direction, it, by acting against the flange i^4, will turn the wheel f^4 on the hub of its pinion, and so as to cause the jaw-slides to be either moved toward or away from one another, the slide-plate at the termination of either movement being held in position by a spring-latch, r^4, which is arranged in the head, and so as to operate with either of two notches, s^4 t^4, made in the slide-plate.

For effecting the sliding movements of each of the slide-plates at the proper times, each of the gears b^3 c^3 d^3 is provided with two studs to project from it, as shown at r^4 s^4. Such studs, by being moved in succession against the end of the arms of the slide-plate, produce the movements requisite to open and close the jaws of the twister.

The two gears c^3 d^3 are fastened to the shaft H, so as to be revolved by it, but the other two gears a^3 b^3 turn freely on the shaft H, and engage with two pinions, t^4 w^4, fixed on another or short horizontal shaft, v^4.

Another pinion, w^4, on the shaft v^4, engages with a pinion, x^4, which, in turn, engages with and revolves the gear d^3, the pinion x^4 being fixed on another shaft, y^4.

After each set of jaws of the twisters may have been closed upon the wire, their twister, by continuing to revolve, will twist the two legs of the wire together, so as to form therein the three shorter twists, viz, those on the flanks of the eye, and that next the loop which is formed on the retractor.

The two remaining shorter twists, *i* *k*, (see figs. 6 and 7,) are put into the wire by the revolution of the pinion *q* and the dog S, the wire in the mean time being grasped between two sets of jaws, which are arranged at opposite ends of the hub of the pinion, or, in other words, are applied to the cross-bar, which supports the pinion.

There are stationary jaws or plates, a^5 or b^5, fixed to the opposite sides of the cross-bar c^5, on which the pinion q is supported.

Figures 25 and 26 are elevations of opposite sides of the bar c^5, with the stationary and movable jaws and other parts applied to such bar.

Figure 27 is a transverse and central section of such bar and the pinion, q^2.

Figure 28 is a longitudinal section, taken through the outermost jaws and the presser-lever of the upper of such jaws.

Two bent levers, d^5 e^5, are applied to the bar c^5. The shorter arms of the lever e^5, or a projection, f^5, thereof, constitute one of the movable jaws, or that which operates with the stationary jaw b^5. A spring, g^5, projecting from the bar c^5, and against the longer arm of the lever e^5, serves to effect the elevation of the jaw f^5, the depression of such jaw being effected by a cam, h^5, fixed on the main shaft H.

~~The other movable~~ jaw ~~is shown at i^5~~. ~~It sl~~ides in a vertical direction through the shorter arm of the lever d^5, or against or in close proximity with a cutter, k^5, carried by such lever, and so as to operate with another or stationary cutter, l^5, arranged between the stationary jaw a^5 and the end of the hub of the gear q^2, such end of such hub being made concave to receive the said cutter l^5.

A lever, m^5, jointed at one end to the lever d^5, bears on the jaw i^5, and is pressed down thereupon by a spring, n^5. A cam, o^5, fixed on the outer side of the gear a^3, serves to move the lever d^5.

The pinion q^2 and the dog s, after having formed with the jaws a loop, leave such loop standing on a plane at right angles with that of the eye, the same being as shown in figs. 6 and 7, where the loop c is exhibited as at right angles with the eye a.

The other loop, b, is turned or set at right angles to the eye a by means of the retractor t^1.

Figure 29 is a transverse section of the machine, taken near the right-hand end of the frame, and so as to exhibit the mechanism for turning the retractor, in order to cause it, while grasping the wire, to turn the loop b into a plane at right angles with that of the eye a.

This mechanism may be thus described: A pinion, p^5, is fixed on the retractor t^1. This pinion, at the proper time, is engaged with and revolved by a curved rack, q^5, projecting from a lever, r^5, which rests on a cam, s^5, affixed on the main shaft H. A spring, t^5, draws the lever towards the periphery of the cam.

When it may be necessary to revolve the retractor ninety degrees of a circle, in order to effect the setting of the loop as mentioned, the rack will be elevated. By its arrangement with and action upon the pinion p^5, the retractor will be revolved the requisite distance.

We have next to describe the mechanism for furnishing the heddle or cutting off the surplus wire, and discharging such surplus from the machine.

The separation of the surplus metal from the heddle is effected by the two cutters k^5 and l^5, as before described, and such surplus is crowded or pushed laterally away from the lower cutter by means of a discharger, u^5, that is so applied to the bar c^5 as to be capable of being moved thereon horizontally back and forth. The forward movement of the discharger is effected by a stud, v^5, projecting from the gear a^3. During the revolution of the gear a^3, this stud will be forced against an arm, w^5, projecting from the discharger, and thereby will impel the discharger forward. The retraction of the discharger is effected in a similar manner, by another stud, x^5, being made to act against the tail of a lever, y^5, connected with the bar c^5, suitably jointed to the discharger. Each of the studs, after having effected the proper movements of the discharger, passes by the part against which it may act directly.

Within the bar n^2 is a rotary bearing, z^5, for supporting the retractor during its longitudinal and rotary movements. In order that the loop of wire held by the retractor may be kept in a right line with the rest of the heddle, it becomes necessary to arrange the axis of this bearing a little eccentric with respect to the axis of the retractor, the amount of eccentricity being equal to the thickness of the tongue of the retractor and half the diameter of the wire of which the heddle is made. In other words, the bearing z^5 should be so arranged that, while revolving, it will cause the retractor, where hold of the wire, to revolve the loop, so that its axis shall be in the same straight line with the axis of the heddle; otherwise the loop would be bent more or less with respect to the rest of the heddle, which would be a serious disadvantage.

We have next to explain the mechanism for discharging the heddle, or effecting its expulsion from the machine.

In order that the outer end of the finished heddle, while the heddle may be in the act of being expelled from the machine, may not be driven against the wire just previously drawn in upon the periphery of the wheel L, and intended for the formation of the next succeeding heddle, the spring f^3, hereinbefore mentioned, is employed to press upon the heddle as it rests on the inner stationary part, and bend it down a little, so as to cause its outer end to be thrown up in a manner to enable such end to pass over the wire on the wheel L during the discharge of the heddle. The spring f^3 should be curved or bent on its lower surface transversely, in order to enable the retractor to pass and repass it without doing injury to the spring. This form of the spring is represented in Figure 30, which is a front end view of the spring, and also in Figure 31, which is a side view of it.

As the heddle is discharged from the machine, it enters and passes through a conductor, W, erected on a standard, X. A vertical and transverse section of this conductor is given in Figure 32, it being formed of two plates, arranged vertically, and at a short distance apart, and extending up from a bottom-piece, Y, curved as represented in fig. 5. A guard or spring, Z, also extends through the conductor, and over the piece Y, in manner as represented.

The floor or curved bottom Y of the conductor, by its form, causes the heddle, as it passes over it, to be elevated and discharged from the loop-former of the retractor, the heddle, by its own gravity, and by the action of the spring Z, being caused to fall out of the conductor.

The machine, although very complicated in its construction, has been found to operate with great success, and to require very little attention. It will continue in operation and in the manufacture of the heddles so long as the coil of wire may not be exhausted.

The heddles are made with great perfection, and in a state to be used at once in a loom.

We are aware that automatic machines for the manufacture of heddles from wire are not new, but such machines have never, to our knowledge, been provided with mechanisms for spreading the heddle-eye lengthwise, in manner as hereinbefore described.

Therefore, what we claim as our invention in the above-specified machine, is as follows:

We claim the combination or machinery for spreading the heddle-eye lengthwise, as described, and we also claim the combination of machinery for spreading the heddle-eye lengthwise, as specified, with mechanism for forming such eye from wire, in manner substantially as explained, such mechanism for spreading the eye consisting of the fingers q^3 q^3, and mechanism for operating them, as set forth.

We also claim the presser R, as constructed, and provided with mechanism for operating it, substantially as described.

We also claim the combination of such presser R (provided with mechanism for operating it, as described,) with the eye-former P, made substantially as described, so as to form and spread the eye of the heddle as specified, and with the next adjacent twisters, T U, to form the twists of the eye, as explained.

We also claim the mechanism or combination for straightening the wire during its passage into the machine, the same consisting of the curved arm I, and its pins m n, and the slider K, and its pins o o, the whole being arranged and applied together and to the frame of the machine, substantially in manner and so as to operate as specified.

We also claim the arrangement of the latch-lever k^1 and the cam m^1 with the wheel L, its notch l^1, and the shaft N, such latch-lever k^1 being for estopping the wheel L, as set forth.

We also claim the combination as well as the arrangement of the nipping and cutting-levers w x, and their operative mechanism, with the wheel L, such operative mechanism being the plate O, and its cams z a^1, and the springs b^1 c^1, the stud d^1, the latch e^1, notches f^1 g^1, the lever n^1, stud o^1, arm p^1, and stud q^1.

We also claim the combination for operating the dog S, or moving it lengthwise on the pinion q^2, such consisting of the cam-plate x^3, and the studs y^3 z^3 of the gear a^3, and in combination with the cam-plate x^3 and its dog S, we claim the spring-bolt a^4 and the notches b^4 c^4, arranged as explained.

We also claim the combination of the pinion p^5, the curved rack q^5, the lever r^5, the cam s^5, and the spring t^5, or their equivalents, with the retractor t^1, combined with mechanism for twisting wire, and having mechanism for operating such retractor in other respects substantially as set forth.

We also claim the combination of the auxiliary twister V (provided with mechanism for operating it as described) with the two twisters T U, to operate together and with the retractor, and provided with mechanism for operating them, as specified.

We also claim the twister T, as composed of the head d^4, the jaws or slides l^4 l^4, the flanged wheel f, the cammed lever or slider K^4, the studs m^4 m^4, and slots n^4 n^4, the whole being arranged substantially as described.

We also claim the combination of the screws p^4 p^4 with the twister T, made substantially as described, the purpose of such screws being to adapt the twister to operate on wire of different sizes.

We also claim the application or arrangement of the slide-jaw v^5, the lever m^5, and its spring n^5, with the lever d^5, applied to the bar c^5, as and for the purpose specified.

We also claim the combination and arrangement of the spring f^3, or its equivalent, with the mechanism for making the heddle, such spring, when the heddle may be resting on the inner stationary jaw of the bar c^5, being used to press the heddle down a little, as and for the purpose hereinbefore mentioned.

We also claim the combination of the discharger w^5 (provided with mechanism for operating it as described) with mechanism for making the heddle, as specified.

We also claim the conductor W, made substantially as described.

We also claim the combination for actuating the tongue v^1 of the retractor t^1, in order to enable a heddle to be removed from the retractor, and the tongue to close upon the next succeeding piece of wire introduced into the retractor, such combination consisting of the slider w^1, the spring x^1, the lever m^2, and the cam o^2; also their combination with the retractor and its tongue.

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Witnesses:
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