(No Model.) 7 Sheets—Sheet 1.

J. WITHINGTON.

MACHINE FOR STRAIGHTENING WIRE.

No. 333,707. Patented Jan. 5, 1886.

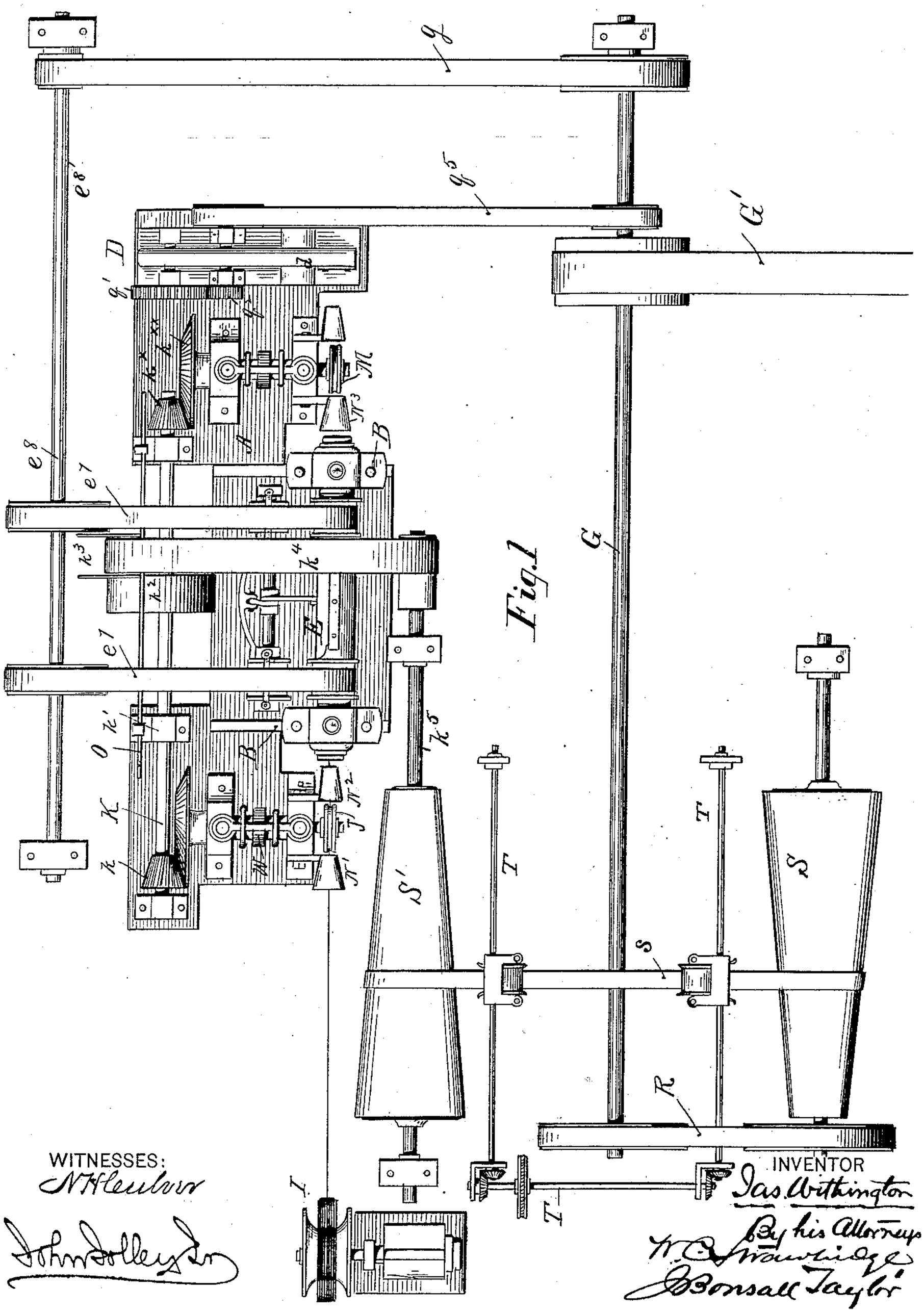

Fig. 1.

WITNESSES:
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W. C. Hamilton
Bonsall Taylor

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J. WITHINGTON.

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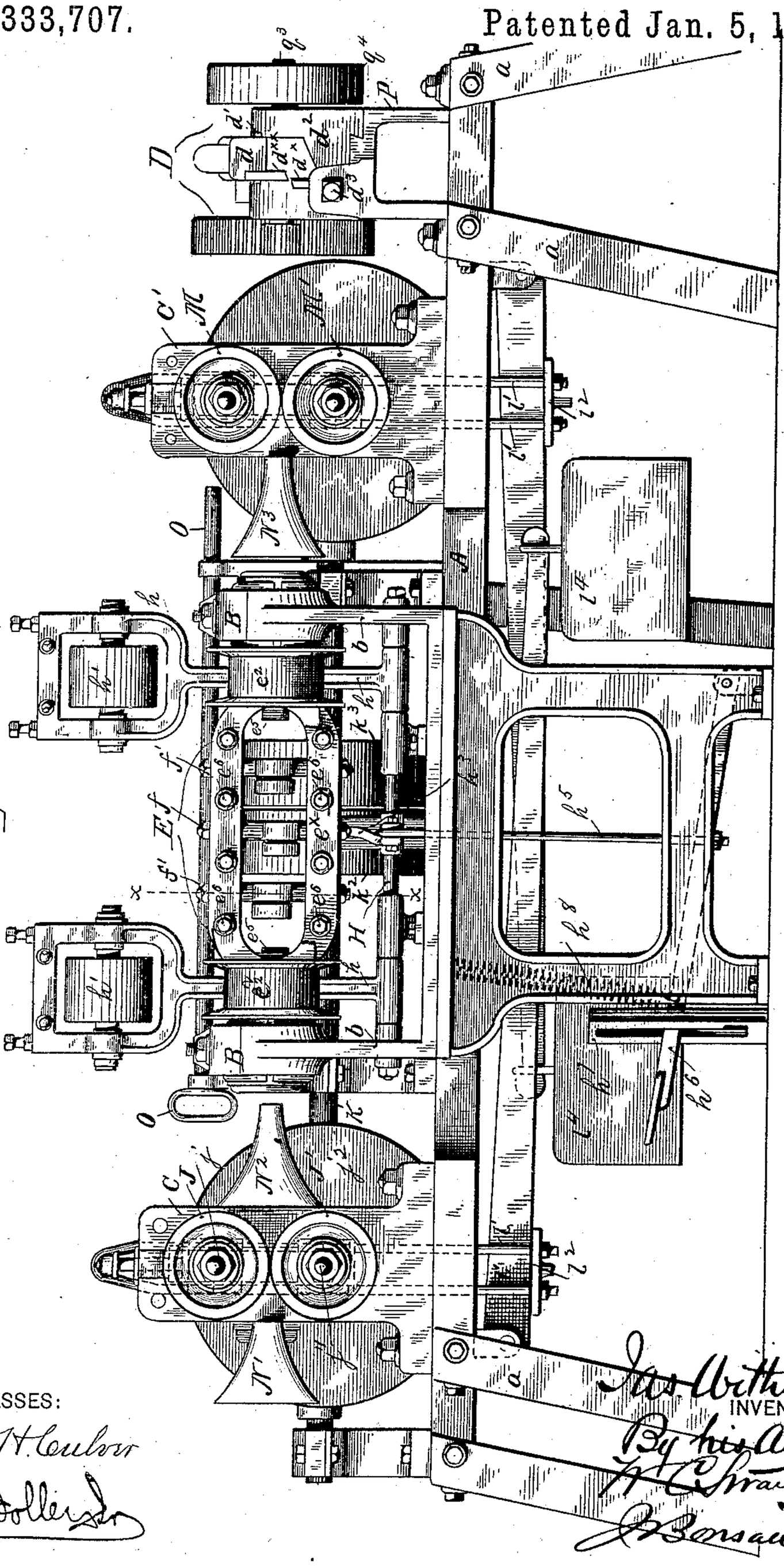

Fig. 2.

WITNESSES:

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(No Model.) 7 Sheets—Sheet 3.

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MACHINE FOR STRAIGHTENING WIRE.

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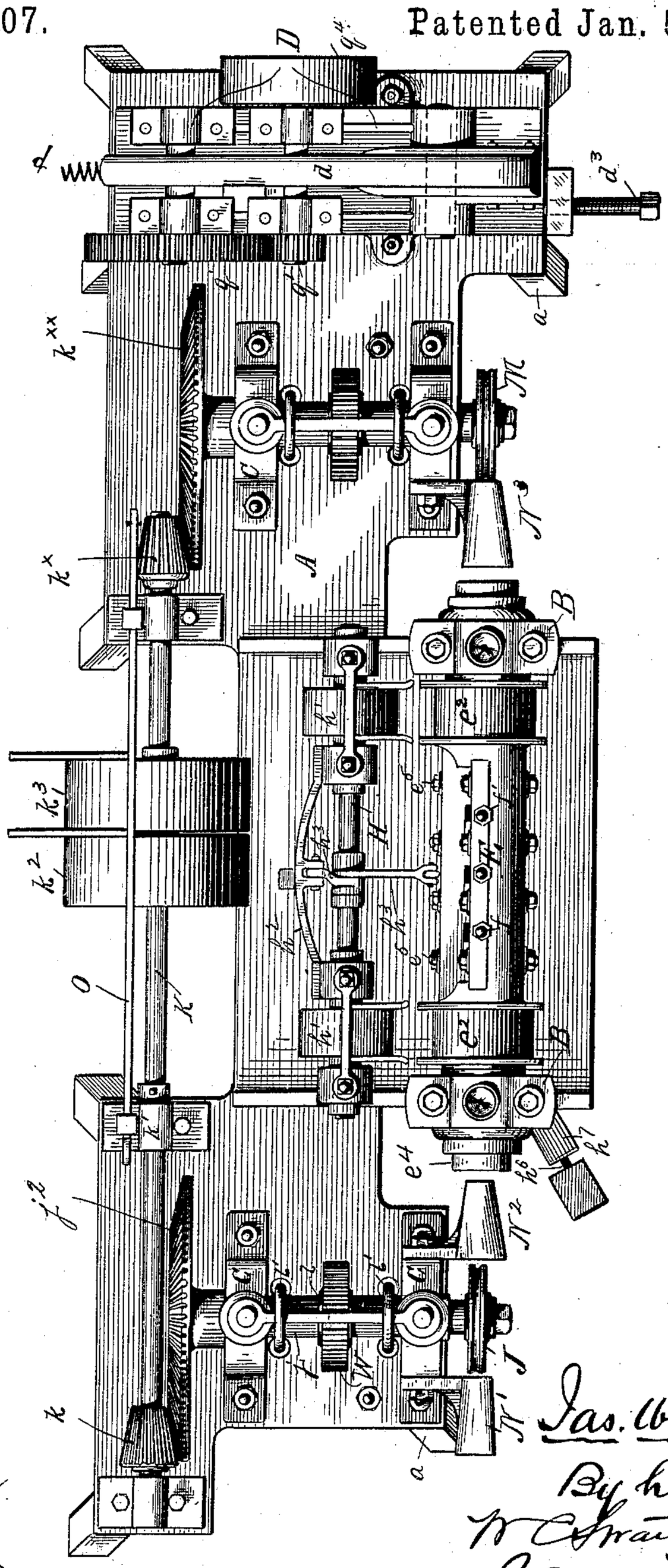

Fig. 3.

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(No Model.) 7 Sheets—Sheet 4.

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MACHINE FOR STRAIGHTENING WIRE.

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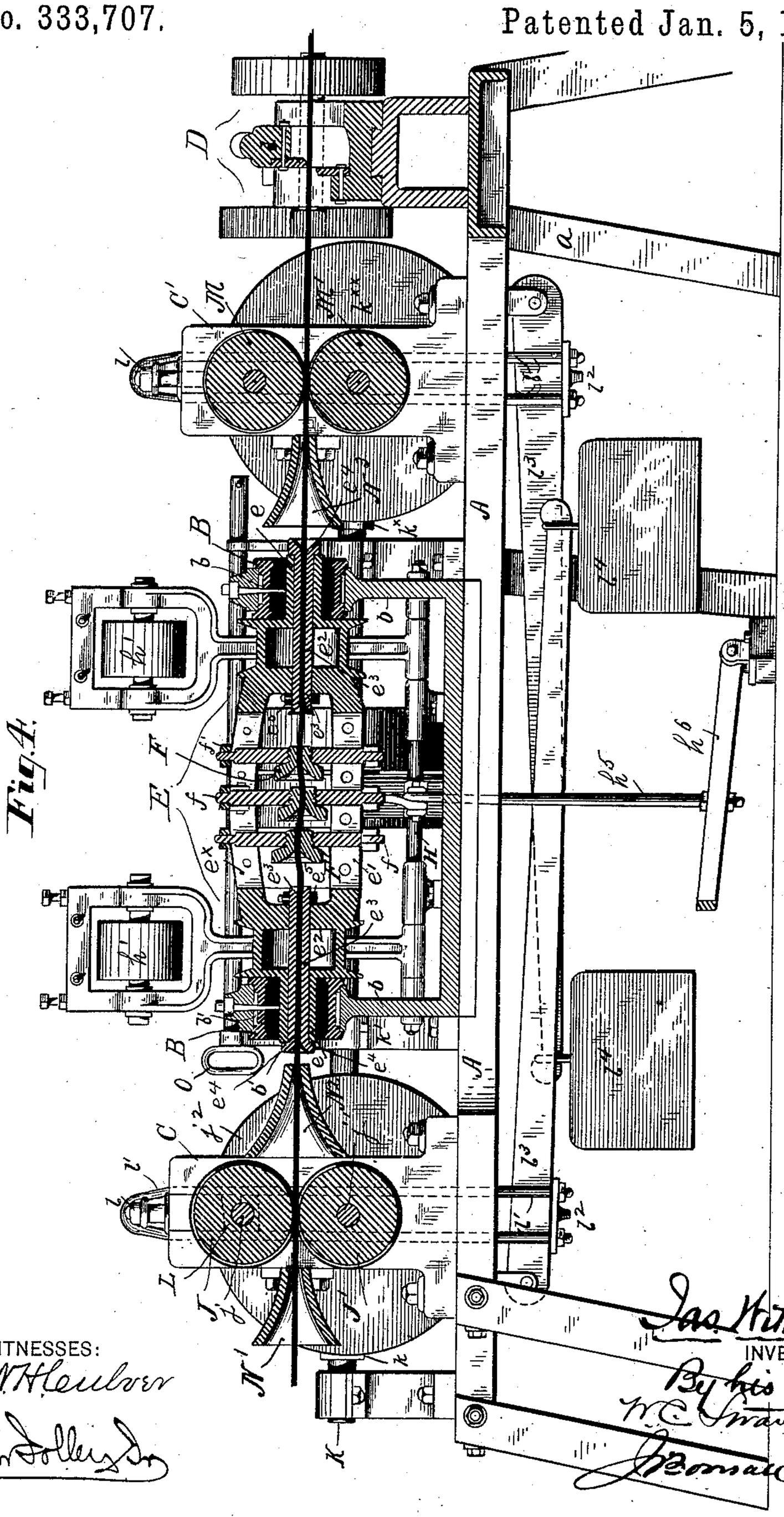

Fig. 4.

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(No Model.) 7 Sheets—Sheet 5.

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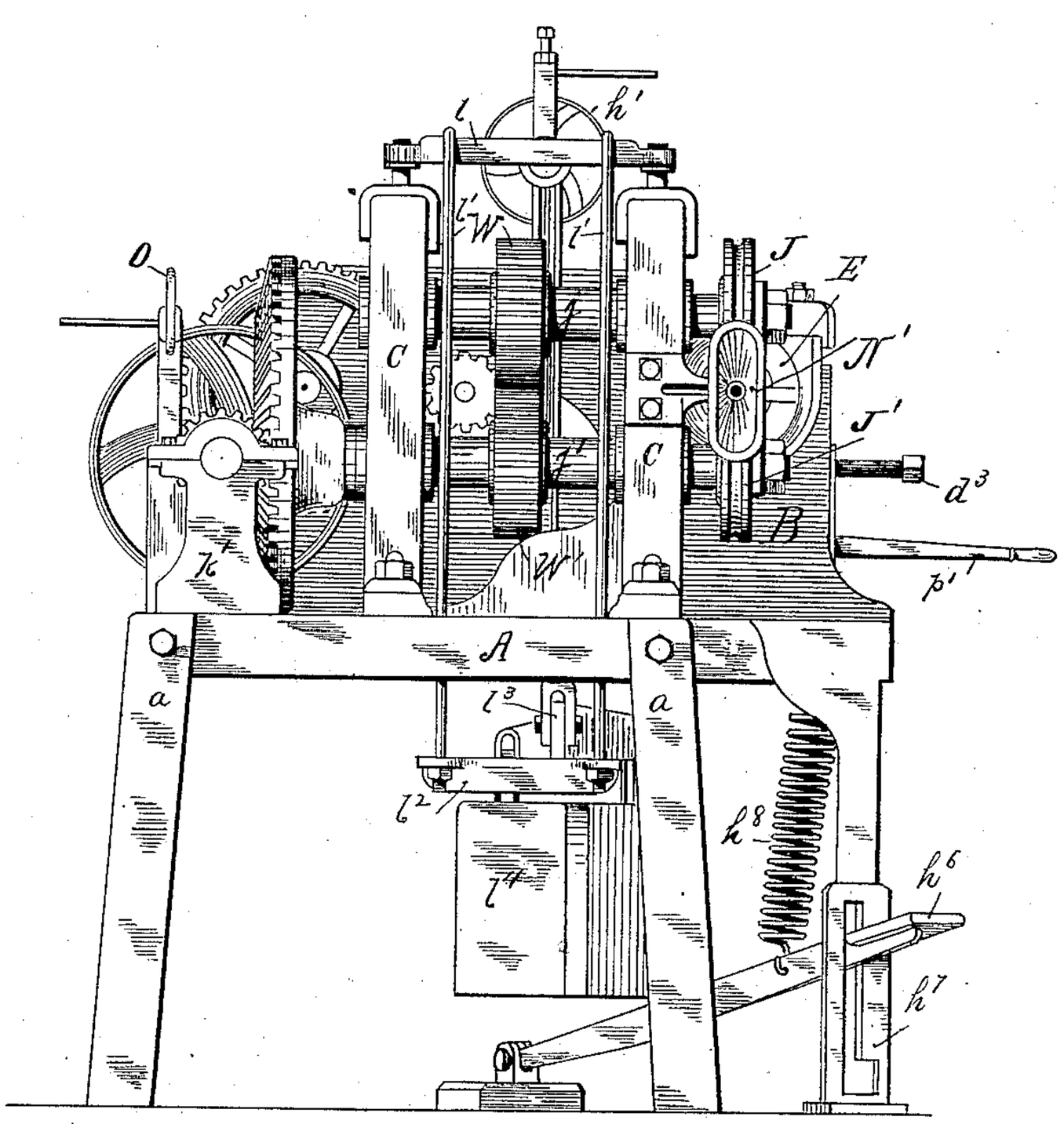
MACHINE FOR STRAIGHTENING WIRE.

No. 333,707. Patented Jan. 5, 1886.

Fig. 5.



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(No Model.) 7 Sheets—Sheet 6.

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MACHINE FOR STRAIGHTENING WIRE.

No. 333,707. Patented Jan. 5, 1886.

Fig. 6.

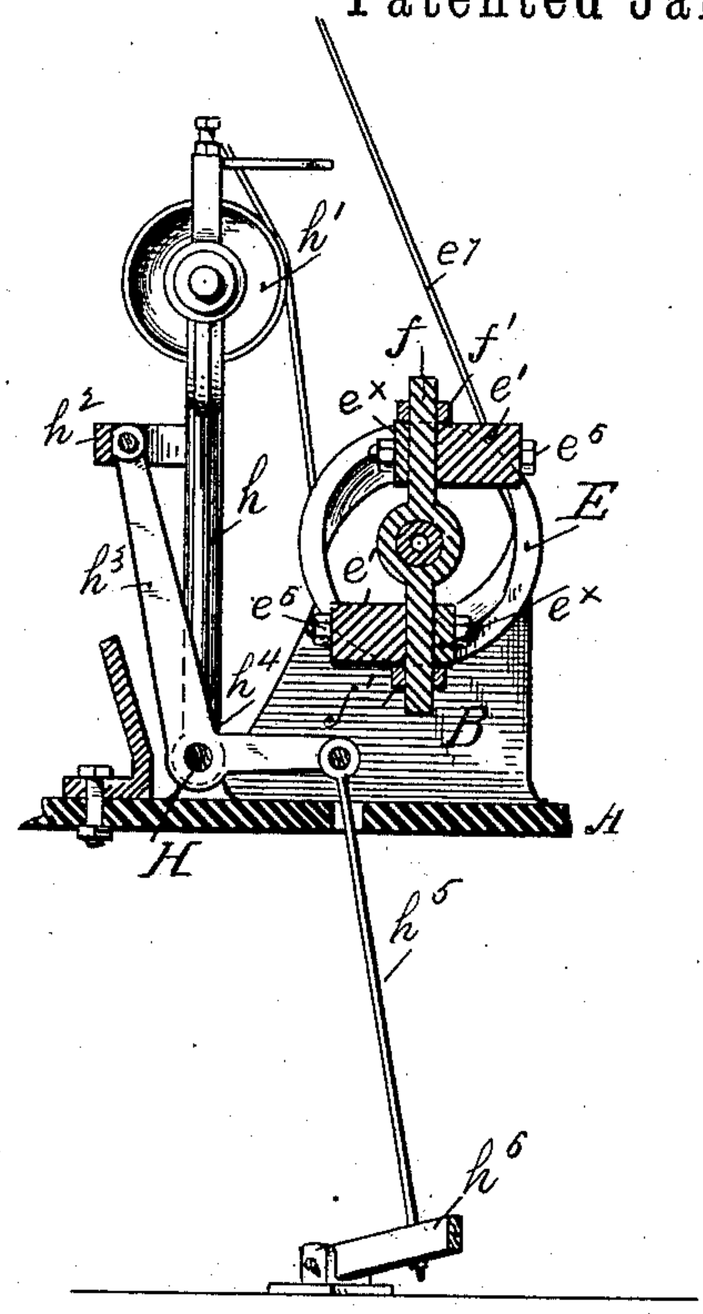
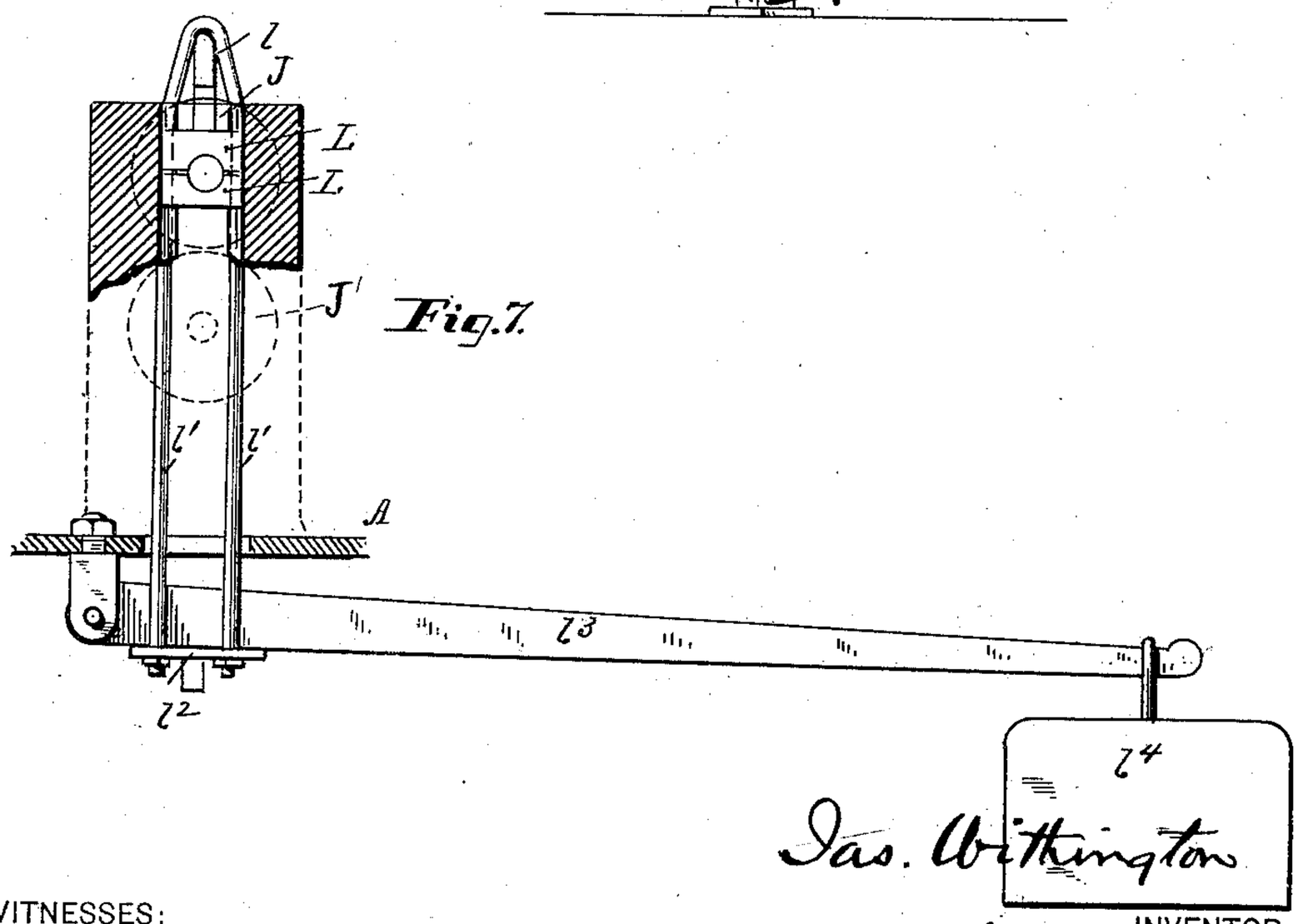


Fig. 7.



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(No Model.) 7 Sheets—Sheet 7.

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MACHINE FOR STRAIGHTENING WIRE.

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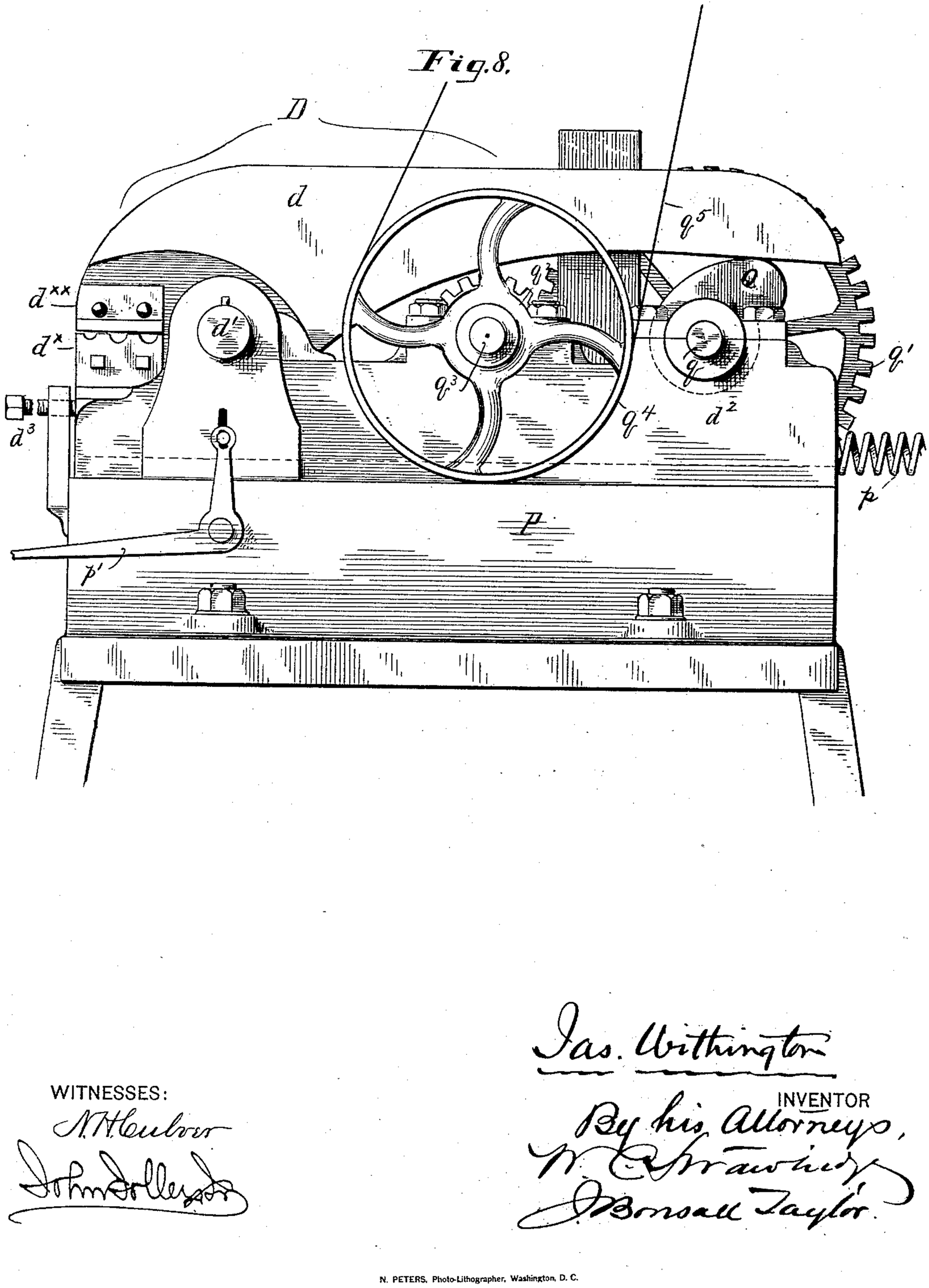
Fig. 8.



WITNESSES:

N. W. Culver

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UNITED STATES PATENT OFFICE.

JAMES WITHINGTON, OF CHAMBERSBURG, ASSIGNOR TO THE TRENTON IRON COMPANY, OF TRENTON, NEW JERSEY.

MACHINE FOR STRAIGHTENING WIRE.

SPECIFICATION forming part of Letters Patent No. 333,707, dated January 5, 1886.

Application filed June 3, 1884. Serial No. 133,714. (No model.)

To all whom it may concern:

Be it known that I, JAMES WITHINGTON, a citizen of the United States, residing in Chambersburg, in the county of Mercer and State of New Jersey, have invented certain new and useful Improvements in Machines for Straightening Wire, Wire Rods, and Kindred Products, of which the following is a specification.

My invention relates to a well-known class of machinery employed for straightening wire, wire or other metal rods, or shafting, in which the principal operative instrumentality is a rapidly-revolving head, straightener-frame, or flier, containing dies or kindred devices set longitudinally within it and eccentrically to its longitudinal axis, through which dies the wire is passed or threaded, and by the rotation of which it is straightened, and its chief object is the provision of a revolving straightening head or flier of a special construction and a particular mode of operation, hereinafter at length set forth.

A further object is the provision of improved means of driving the feeding mechanism and the revolving head independently and at different velocities, and for changing the respective velocities so as the better to adapt the machine to straighten wires of different materials and various sizes.

A preferred form of a convenient embodiment of my invention is represented in the accompanying drawings, and hereinafter described, the special features of invention being particularly specified in the claims.

In the drawings, Figure 1 is a top plan view of the several instrumentalities which in their assembled relation compose my apparatus as an entirety, and which may be briefly enumerated to consist of a wire reel or coil-holding contrivance, feed-rolls, a revolving straightening head or flier of a novel construction, delivery-rolls, a shearing mechanism, and a driving mechanism for driving at separate velocities, first, the feed or the feed and delivery rolls, and, second, the revolving head, and for altering at will the respective velocities of said rolls and said head. Fig 2 is a front elevation of the revolving head, the feed and delivery rolls, and their connected appliances, the shears, the belt-tightening device for the belts of the revolving head, and the bed-plate and housings for supporting the said several devices. Fig. 3 is a top plan view of the devices represented in Fig. 2. Fig. 4 is a view similar to Fig. 2, with the exception that the feed and delivery rolls, the bell-mouthed guides, the flier-housing and the flier itself, and the shears, the shearing contrivances of which are shown advanced into position to act, are represented in central longitudinal vertical sectional elevation. Fig. 5 is an end view of the apparatus represented in Figs. 2 and 3, viewed from the left-hand side of said figures. Fig. 6 is a transverse or end sectional elevation through the flier, section being supposed on the dotted line *x x* of Fig. 2, the belt-tightening devices being also shown. Fig. 7 is a vertical sectional front elevational detail through one standard of the feed-roll housing, especially designed to illustrate the means of adjustment of the shaft of the upper feed-roll. Fig. 8 is a right-hand end elevational view of the shearing mechanism represented in Figs. 1, 2, 3, and 4.

Similar letters of reference indicate corresponding parts.

In the drawings, A is a bed-plate, of suitable outline, supported upon legs *a* or in any preferred manner. The bed-plate supports the flier-housing B, the roll-housings C for the feed and delivery rolls, and the shearing mechanism D. The flier-housing B is a rectangular frame, upon standards *b* of which are supported bearings *b'* for the journal *e* of the revolving head or flier E. The revolving head or flier E is a well-known device, consisting of a rectangular frame composed, essentially, of two transversely-connected yoke-bars, *e'*, spaced apart a given distance and framed into driving-pulleys e^2, from which project the hollow journals *e*, which revolve in the bearings *b'* of the flier-housing.

Fliers or revolving heads of the above construction have been in use for many years in the works of the Trenton Iron Company, as well as in other wire-mills.

The novel features of my flier reside in the wire-straightening devices *per se*, which are applied to and carried by the flier, and hereinafter described.

e^3 are two removable hollow bushings, which are applied within the hollow journals and driving-pulleys of the flier in a position coincident with the axis thereof, and which, being conveniently provided with bell-mouths, are respectively adapted to receive the wire from the feed-rolls and supply it to the thimbles, and to take the wire from the thimbles and supply it to the delivery-rolls, or, when the latter are not used, to receiving tables or troughs. The bell-mouths of these bushings are designated by the letter e^4, and the bushings are retained in place by means of collars e^5, or kindred retaining devices, which are represented in Fig. 4. These bushings are made removable, so that they may be readily renewed when worn out.

The straightening devices proper are a series of bell-mouthed axially-apertured thimbles, F, of any desired material, which are retained in position by being screwed into or otherwise connected to or formed as a part of cross-bars *f*, connected with and carried by the revolving head. Any desired number of these thimbles may be employed, and in the mounting of the head their bell-mouths all face the feed-rolls. The bell-mouth of each thimble is peripherally made of such diameter as to insure contact of the free end of a wire or rod, introduced through the flier when rotating, with its funnel-shaped face so that the said face will necessarily direct the said free end of the wire as the latter is fed into the axial aperture of the thimble-body or die proper; and in this connection I desire to expressly contradistinguish between my bell-mouthed thimbles and such eccentric dies as have been heretofore used for many years in revolving fliers of this class, and in which the axial apertures of the dies have been slightly dressed out, countersunk, chamfered, or reamed out, as the gist of my construction in this regard resides in providing the die or thimble proper with a bell-mouth of such peripheral diameter and flare as to insure the unfailing reception by it of the free end of a wire which has been passed through the preceding eccentric die, and which in the revolution of the head is describing a rotary path of much greater radius than the radius of a mere countersunk extremity of the axial aperture of a succeeding eccentric die.

A type of the flier above referred to, and which, as stated, has been for many years in use, is to be found in English Letters Patent No. 3,009, granted December 4, 1857, to John Rubery. To a flier of the said construction it is proper for me to state that I lay no claim.

The hollow bore and bell-mouth of each thimble is eccentric to the axis of the head; but the degree of eccentricity of the first thimble is preferably greater than that of the last. In other words, each thimble after the first is preferably more nearly coincident or at a less radial distance from the axis of the head than the thimble immediately preceding it, and this is true, notwithstanding that the thimbles are set alternately upon opposite sides of the axis. The cross-bars *f*, which carry the thimbles, extend transversely across the flier and are secured against the proximate faces of the yoke-bars thereof, which faces are disposed in parallel planes on opposite sides of a plane through the axis by means of clamp-plates $e^\times$, which are respectively secured to said opposite faces of the yoke-bars by connecting-bolts e^6. The extremities of the cross-bars project beyond the exterior or peripheral faces of the yoke-bars and clamp-plates, are threaded, and are capable of radial adjustment with respect to said bars and plates by means of adjusting-nuts *f'* upon their threaded extremities, which bear against the peripheral faces of both clamp-plates and yoke-bars.

The above construction permits of the employment of bell-mouthed thimbles, renders the thimbles adjustable both longitudinally or axially and radially, and permits of the application or removal of any particular thimble, as well as the application of any given number of thimbles and their precise adjustment *seriatim* with respect either to axial or radial position.

It is obvious that when the flier is rapidly revolved the wire or rod which is fed to it is caused in its passage through the thimbles to have a preferably decreasing sinuous or serpentine motion, the result of which is that the wire is very accurately straightened before it is delivered to the delivery rolls or troughs.

The bell-mouthed construction of the hollow bushings and thimbles permits of the introduction of the wire to the head while the latter is revolving at its usual speed, and, as already stated, obviates the necessity hitherto existing of stopping the head, first setting the thimbles into line, threading the wire through them by hand, and then adjusting them to a given eccentricity.

The method of application of the thimbles, as in the case of the bushings, permits of their renewal when worn out. The flier is revolved by means of the flier-belts e^7, Figs. 1 and 6, which are driven by pulleys on a flier-shaft, e^8, which is driven by a belt, *g*, driven by a pulley on a counter-shaft, G, itself actuated by a pulley driven by a main belt, G'.

The above arrangement is simply one of many which can be resorted to for imparting to the revolving head a uniform high speed, such, for instance, as from eighteen hundred to three thousand revolutions per minute.

In order to insure the accurate grip of the flier-belts upon the driving-pulleys of the flier, I employ a belt-tightener contrivance, (best represented in Figs. 2, 3, 4, and 6,) which is of the following construction: A rock-shaft, H, journaled parallel with the axis of the flier in suitable bearings, preferably in the standards *b* of the flier-housing, carries two rocker-standards, *h*, so disposed as to be respectively in line back of the driving-pulleys of the flier, which are provided at their upper extremities with housings for idler-pulleys *h'*,

so disposed as to be in line to bear against the flier-belts when actuated so to do. The rocker-standards are connected by a rocker-yoke, h^2, Figs. 3 and 6, to which is pivoted the upper extremity of a bell-crank lever, h^3, the fulcrum of which, h^4, is upon the bed-plate of the machine, or, if desired, upon the rock-shaft, and to the lower arm of which is connected the link h^5, to which in turn is connected the foot-lever h^6, Figs. 2, 3, 4, and 5, which plays through a vertically slotted and notched keeper, h^7, Figs. 2 and 5. A spiral spring, h^8, tends to keep the foot-lever normally up in the position represented in Figs. 2 and 5, and the idler-pulleys away from the belts; but pressure exerted upon the lever so as to depress it and cause its engagement in the notch formed in the slot of its keeper will cause the deflection of the bell-crank lever and the throwing of the rocker standards and pulleys forward against the flier-belts so as to secure the tightening of said belts in the manner represented in Fig. 6.

The above tightening contrivance is one of convenience rather than of absolute necessity, and it may either be dispensed with or, if desired, other contrivances operative to a like result may be substituted in its stead.

I, Fig. 1, represents a reel or device for holding the coil of wire to be straightened, and from which the wire is led to the feed-rolls. The device which I prefer to employ for this purpose constitues the subject-matter of a separate application executed by me contemporaneously with this application.

As any reel or coil-holding device may be employed in conjunction with my present apparatus, a specific description of the particular reel represented is foreign to the purposes of this specification.

J J′ are respectively the upper and lower feed-rolls which I employ to feed the wire into and through the flier. These rolls are particularly represented in Figs. 1, 2, 3, 4, 5, and 7 of the drawings, and consist of two plain iron wheels, preferably from six to eight inches in diameter, formed with concaved or grooved peripheries. These rolls are sustained in vertical alignment in the roll-housing C, which consists of two vertical standards erected at a given distance apart from the bed-plate of the machine in as close propinquity as possible to the flier-housing. The lower feed-roll, J′, is mounted upon the projecting extremity of a fixed roll-shaft, j', journaled in the housing, which roll-shaft, upon its extremity which is opposite to that equipped with the lower feed-roll, is provided with a beveled crown-wheel, j^2, which is driven by a beveled pinion, k, mounted upon a pinion-shaft, K, carried in the journals k', erected from the bed-plate of the machine. This pinion-shaft K is equipped with fast and loose pulleys k^2 k^3, which are driven by a belt, k^4, from what I term a "cone-shaft," k^5, which is represented in Fig. 1. This cone-shaft is adapted to be driven at a fixed, although variable, speed, which is such as to impart to the driving-shaft K a rotation of velocity sufficient to actuate the feed-rolls at a predetermined speed considerably less than the speed of rotation of the flier. The pinion-shaft is also provided with a second driving-pinion, $k^\times$, which gears with a bevel crown-wheel, $k^{\times\times}$, which is adapted to actuate the delivery-rolls at a speed equal to that of the feed-rolls.

W W′ are toothed pinions, respectively mounted upon the upper and the lower roll-shafts, and engaged so as to transmit in a reverse direction the rotation of the lower shaft to the upper. The teeth of these pinions are of sufficient radial depth to permit of a given separation of the pinions without disengagement. The roll-shaft j of the upper feed-roll, J, is carried in slide-bearings L, Fig. 7, adapted to slide vertically in slots in the roll housings, so that the upper feed-roll and its roll-shaft can have a slight vertical movement with respect to the lower feed-roll and its shaft, such movement being necessary to permit the feed-rolls to act upon varying sizes of wires, or wires of slightly varying diameters. The frictional grip of the feed-rolls is secured by providing an upper cross-head, l, Fig. 5, which straddles the housing, bears upon both the slide-bearings of the upper roll-shaft, and is retained down upon them so as to hold the feed-rolls to duty by two suspenders, l' l', connected together below the bed plate of the machine through an opening in which they pass by a lower cross-head, l^2, which serves to receive near its fulcrum and to sustain a lever, l^3, the outer extremity of which is provided with a lever-weight, l^4, and by the tension of which lever the upper feed-roll is retained against the lower feed-roll with a yielding grip.

O is a belt-shifter device for shifting the belt with respect to its position upon either the fast or the loose pulley of the pinion-shaft.

The delivery-rolls M M′, when employed, are constructed, arranged, and operated in a manner precisely similar to the feed-rolls, as will be understood by a reference to the drawings.

Further description of either the feed-rolls or the delivery-rolls is redundant in this specification, especially as said rolls as a mechanical feed device form the subject-matter of a separate application for patent executed by me contemporaneously with this application.

N′ N^2 N^3 are three cast-iron or other metal bell-mouthed guides, respectively placed and supported immediately in front of and to the rear of the feed-rolls, and in front of the delivery-rolls and between the latter and the flier. These bell-mouthed guides are employed to facilitate the introduction without stopping the machine of the wire or rod, respectively, to the feed-rolls, to the flier, and to the delivery rolls or troughs.

D, Fig. 8, is a shearing-machine of a type which I find it convenient to employ in connection with the other devices constituting the

subject-matter of this invention. It consists of a rocking lever-jaw, *d*, pivoted at *d'* to a sliding jaw-frame, d^2, adapted to travel transversely with respect to the bed-frame of the machine in shearways, P, erected upon the bed-frame of the machine.

The cutting devices proper are a notched jaw-plate, $d^\times$, and a shearing-plate, $d^{\times\times}$, respectively connected with the fixed jaw-frame and the rocking lever-jaw of the device, and both being to the front of the pivot of the lever-jaw.

A spiral spring, *p*, connected with the sliding jaw-frame and a fixed support, serves to ordinarily retain the entire shearing mechanism out of the line of travel of the advancing straightened wire as it is fed from the head or delivery rolls to the receiving-trough, upon which is delivered said straightened wire.

When it is desired to advance the shears into position to cause the severance of the wire, a shears-lever, *p'*, Fig. 8, is adapted to be deflected so as to expand the spring and draw forward the shears into a position in which the jaw-plates may sever the wire.

The rocking lever-jaw of the shears is adapted to be continuously vibrated by means of a cam, Q, mounted upon a cam-shaft, *q*, journaled upon the sliding jaw-frame, and actuated by a toothed spur-wheel, *q'*, which takes its rotation from a toothed pinion, q^2, mounted upon what I term a "shears-shaft," q^3, also journaled in the sliding jaw-frame, and equipped with a driving-pulley, q^4, which is driven by a shears-belt, q^5, which latter is actuated to a fixed travel from a pulley on the counter-shaft G. The forward movement of the shears is limited by a stop-screw, d^3, Fig. 8.

Instead of employing a shears-lever, the shears may be moved by any other contrivance operated manually or by power.

In Fig. 1 I have represented a convenient arrangement for respectively driving the flier, the feed and delivery rolls, and the shears, and for altering at will the relative velocities of the feed-rolls and the head.

The provision of positively-operating means by which the relative velocities of the flier or straightening-head and the wire-feeding devices can be controlled at will is of the utmost importance in machines of this class, for when wires of large diameter are to be straightened a very different rate of speed in the flier is required from the speed employed for straightening wires of small diameter, while the rate of feed may be the same for all diameters, and this proposition is true with respect also to wires made from different metals. I have therefore, as stated, provided a suitable mechanical device by which, even when the machine is in operation and without stopping it, the respective velocities may be varied at will. This arrangement consists, as already partially described, of a counter-shaft, G, adapted to be driven by the main belt at a fixed rotation. From pulleys on this counter-shaft are driven the belt q^5, for actuating the shears, and the belt *g*, for actuating the flier-shaft e^8, from belts upon which latter, as already explained, the flier is driven at a fixed high speed. The counter-shaft is also provided with a pulley, from which is driven a belt, R, which drives one of a pair of cone-pulleys, S S', connected by a cone-belt, *s*. The cone-shaft k^5 of the cone-pulley S' carries a pulley, which drives the belt k^4, which actuates the shaft K. The pulleys which carry the belt R being of the same size, and the counter-shaft being driven from the main belt at a fixed speed, it is obvious that the rapidity of the revolution of the belt k^4, which actuates the driving-shaft, can only be governed by the position of the cone-belt *s* upon its cones. This belt *s* is adapted to be shifted in its position upon the cone-pulleys by a belt-shifter contrivance which I have designated by the letter T, and which it is not necessary to further describe here, for the reason that it constitutes the subject-matter of a separate application for patent executed by me contemporaneously with this application. Suffice it to say that the cone-pulleys, belt, and belt-shifting contrivance together form a convenient means whereby the speed of the pinion-shaft K, and consequently of the feed and delivery rolls, can be varied without varying the speed of the flier.

The operation, except as otherwise explained, is as follows: The thimbles of the flier being set to a predetermined adjustment, and the speed of the feed and delivery rolls being accommodated to the size and material of the wire to be straightened, the revolving head is set in motion. The wire, being led from the reel or holding contrivance, is first entered through the first bell-mouthed guide into the grip of the feed-rolls, and is then carried by them through the second bell-mouthed guide to the first bell-mouthed bushing of the head, thence through the thimbles of the head, and through the second bell-mouthed bushing of the head into the third bell-mouthed guide, and thence to the delivery-rolls when employed, by which latter it is gripped, and which co-operate with the feed-rolls in drawing the wire through the flier, and thence in front of the retracted shears into a receiving trough, pipe, or suitable conductor, which will prevent its advance extremity from flying out. When a sufficient amount of wire has been fed through the machine and straightened, the shears are drawn into action and then instantly released, so as to be returned by their spring or counter-weight, an operation, it is to be remarked, which can take place without arresting any of the other motions of the machine.

It is proper to remark that the principle of straightening wire by causing it to take on a sinuous or serpentine motion in passing through a rotating straightening-head is old, and that the novelty of my improvements resides in the peculiar construction and arrangement of the straightening-head itself and in

the assemblage of the other instrumentalities in connection therewith, as hereinafter claimed.

It is obvious that the construction of the device is such that the wire can be fed into it and automatically carried through it while the machine is in operation, and it is very evident that a vastly greater product can be turned out by this machine than by machines heretofore in use.

If desired, the delivery-rolls may be dispensed with, although when employed they co-operate with the feed-rolls in drawing the wire through the thimbles, and are of especial value in drawing the final end of the coil through the flier. The shearing mechanism set forth, or any other automatic shearing mechanism, may also, if desired, be dispensed with and the wire be cut by hand, shears, or by the blow of a chisel or adze. I prefer, however, to employ the automatic shearing mechanism set forth.

As already stated, other contrivances than the specific belt-driving gear represented in Fig. 1, may be substituted in its stead. I, however, prefer to employ the specific gear represented and described.

Having thus described my invention, I claim—

1. The combination, in a wire-staightening machine, with a revolving head or flier, of a series of axially-apertured eccentrically-disposed dies or thimbles, each of which is provided with a bell-mouth the peripheral diameter of whose conical or flaring face is greater than the diameter of the circle described by the free end of a wire or rod passed through one of the said eccentric dies, revolving with the head, and fed toward said bell-mouth, substantially as described.

2. In combination with the yoke-bars of the revolving head arranged on opposite sides of the axis, cross-bars provided with bell-mouthed thimbles or dies, clamp-plates, bolts for securing said clamp-plates to the yoke-bars, and adjusting-nuts upon the projecting threaded extremities of said cross-bars, substantially as set forth.

3. In a wire-straightening machine, the combination of a revolving head or flier provided with straightening dies or thimbles, feeding-rolls in advance of said head adapted to feed wire through it, driving devices for revolving the head at a predetermined speed, driving devices for revolving the feed-rolls at a predetermined speed, and means for at will and without the stoppage of the machine varying the relative speeds of the driving devices respectively of said head and feed-rolls, substantially as set forth.

In testimony whereof I have hereunto signed my name this 22d day of May, A. D. 1884.

JAMES WITHINGTON.

In presence of—
J. BONSALL TAYLOR,
W. C. STRAWBRIDGE.