2 Sheets—Sheet 1.

J. S. ATKINSON.

STRAIGHTENING MACHINE.

No. 170,461. Patented Nov. 30, 1875.

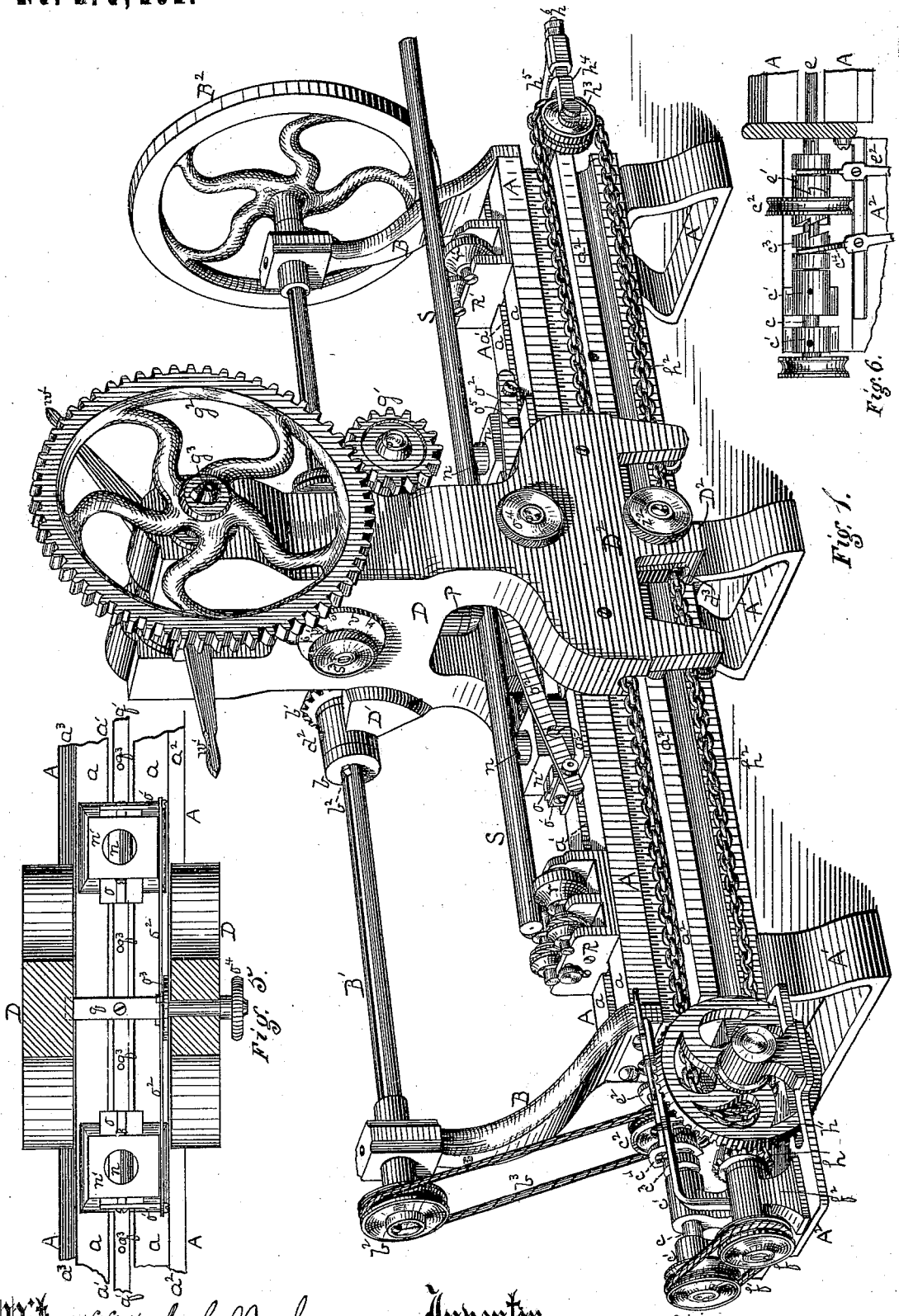

Fig. 1.

Fig. 6.

Fig. 3.

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2 Sheets—Sheet 2.

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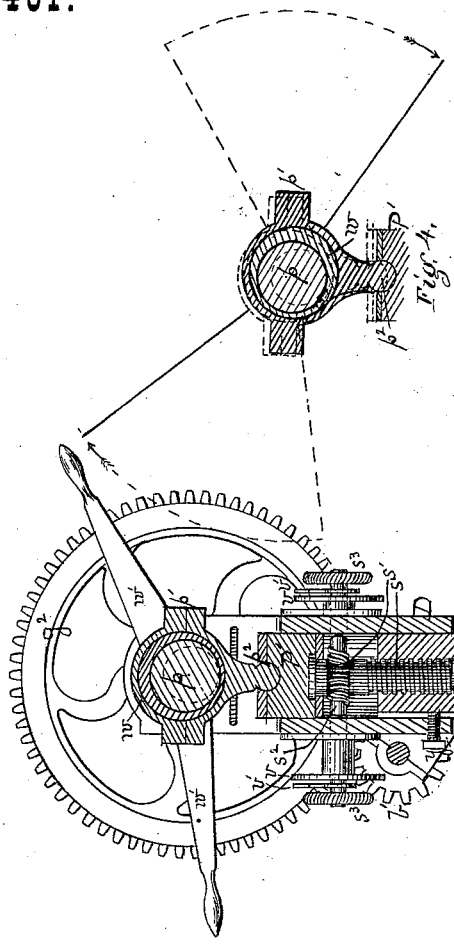

Fig. 4.

Fig. 3.

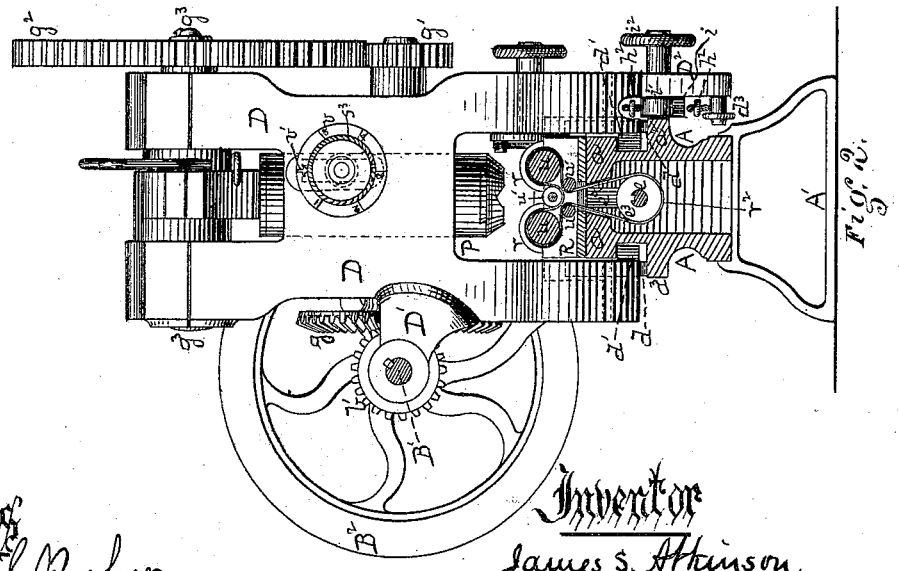

Fig. 2.

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UNITED STATES PATENT OFFICE.

JAMES S. ATKINSON, OF PITTSBURG, ASSIGNOR TO BENJAMIN F. JONES, OF ALLEGHENY, PENNSYLVANIA.

IMPROVEMENT IN STRAIGHTENING-MACHINES.

Specification forming part of Letters Patent No. **170,461**, dated November 30, 1875; application filed August 2, 1875.

To all whom it may concern:

Be it known that I, JAMES S. ATKINSON, of Pittsburg, county of Allegheny, State of Pennsylvania, have invented or discovered a new and useful Improvement in Straightening-Machine; and I do hereby declare the following to be a full, clear, concise, and exact description thereof, reference being had to the accompanying drawing, making a part of this specification, in which—like letters indicating like parts—

Figure 1, Sheet 1, is a perspective view of my improved machine. Fig. 2, Sheet 2, shows a transverse vertical section through the driving-gear of the bearing-rolls near one end of the machine. Fig. 3 is, for the most part, a longitudinal sectional elevation, some parts being broken away to show devices situate in other than the general vertical plane of the section. Fig. 4, by a sectional view of the double eccentric, shown in the upper part of Fig. 3, further illustrates its operation. Fig. 5, Sheet 1, is a detached sectional plan view through *x x*, Fig. 3, and Fig. 6 is a detached plan view of the double clutch and band-wheel of Fig. 1.

This machine, while applicable to straightening and bending metallic rods, shafts, bars, and tubes generally, has been gotten up with particular reference to its use in the straightening of what is known in the trade as cold-rolled iron. Rods, shafts, and bars are produced by this process of considerable size in cross-section as well as of considerable length, and as for the purposes for which they are designed they must be almost perfectly true it is a matter of no small difficulty to straighten them perfectly except by the use of machinery capable of acting with great accuracy, delicacy, capacity, and strength, and also without injury to the highly-polished surface which is ordinarily produced in the cold-rolling operation.

The frame-work A of the machine, supported on any suitable rests, A^1, consists of two longitudinal beams, having each a T-head, *a*, at a little distance apart, so as to form a longitudinal slot, a^1, and on the outer face of each beam, a little below the T-head, is a flange, on one beam marked a^2 and on the other a^3. These beams are suitably connected at their ends and by the rests A^1 or otherwise so as to preserve a fixed relation to each other, and form a single rigid frame. A bracket-arm, B, rises from each end and carries a main driving-shaft, B^1, to which motion is communicated by a band-wheel, B^2, or in any other suitable way. A sliding head, D, is mounted on the frame A by means of rollers *d*, which rest and roll on the flanges a^2 a^3, and it is steadied in position by means of lugs d^1, which pass under the outer flanges of the T-heads *a*, as represented in Fig. 2. From the head D an arm, D^1, extends out and by a collar or sleeve, d^2, engages a bearing, *b*, to which is affixed a bevel-gear wheel, b^1, which latter meshes into and drives a bevel-gear wheel, *g*, the shaft of which extends transversely across the head D, and at its other end carries a pinion-wheel, g^1, which, in turn, meshes into and drives the wheel g^2, and through it the shaft g^3. The main driving-shaft B^1, the bearing *b*, and bevel-gear wheel b^1 are fitted with a groove and key, b^2, or other like means, so that, as the head D is moved back and forth on the frame A, for purposes presently to be explained, it will, by the arm D^1, carry the bevel-wheel b^1 with it, and the connections of gearing described will at all times be perfect.

For the purpose, now, of moving the head D to any desired place on the frame A I use devices more particularly shown in Figs. 1 and 6. The frame A has an extension, A^2, of any suitable form. On this extension I arrange a shaft, *c*, supported by plummer-blocks c^1, and with the right-hand end entering, but not passing through, the hub of the pulley c^2. Another shaft, *e*, Figs. 2 and 6, enters the other end of the hub, for purposes presently to be explained. The pulley-wheel c^2 revolves loosely on the shafts *c c*, but each end of its hub is made of a clutch form, so that by a sliding clutch collar, c^3, keyed to the shaft *c* and a forked shifting-lever, c^4, it may be connected at pleasure with the shaft *c*, so as to cause its rotation. The power for this purpose is taken from the main driving-shaft B^1 by a pulley-wheel, b^2, band b^3, and further transmitted by the band-wheels and band $f f^1$, and shaft in the plummer-blocks f^2, to the

bevel-gear wheel h, which meshes into the larger wheel h^1. An endless chain, h^2, plays over a chain wheel or drum on the shaft of the wheel h^1 and over a pulley, h^3, at the other end of the frame A, and the requisite tension of the chain, to effect its operation, is secured by arranging the pulley h^3 in a stirrup, h^4, attached to a bracket, h^5, and adjusted by a nut, h^6.

The endless chain, it will be seen, passes along the front of the frame A, as represented in Figs. 1 and 2. As shown, it passes under one leg of the head D, and back of an extension, D^2, on such leg, and from such extension a flange, d^3, passes under the lower fold or length of the chain. Just inside the extension D^2, and between the upper and lower folds or lengths of the chain, I arrange a griping-block, i, and in it an eccentric or cam, i^1, operated by a hand-wheel, i^2, in such manner that when, by the revolution of the eccentric, the block i is thrown against the upper fold or length of chain, it will lock the chain tightly against the lower end of the leg of the head D, whereby the latter will be caused to move along on the main frame A in the direction in which the upper fold or length of the chain is moving. As soon as it reaches the right spot, the eccentric i^1 is partially rotated, so as to break the lock, and then the head D will stop, though the chain may continue its motion. In order to move the head D back, I continue the rotation of the eccentric i^1, so as to bring the griping-block i against the lower fold or length of the chain, and thereby lock it to the inwardly-projecting lug or flange d^3, and then, the chain continuing its motion, the head D will be moved back any required distance, and may be released at the proper point, as before. In this way the head D, which carries the plunger P, which does the straightening, is brought to any desired point on the frame A where its action may be desired.

As the machine must often be used to straighten heavy shafting, which can be manipulated by hand only with difficulty, I employ revolving rollers $r\ r'$ for this purpose. One set of these rollers, r', may be mounted like ordinary friction-rollers in a box or frame, R′, fixed in position on the frame A, or adjustable, if so preferred. The other box, R, is made adjustable, so that it can be slid along the frame A, and the machine be thereby adapted for the straightening of short lengths of shafting. In order to give the rollers r a positive motion, so as thereby to rotate the shaft S, I make use of the shaft e, which, as already stated, enters into the hub of the band-wheel c^2. On this shaft e is a sliding clutch-collar, e^1, keyed to the shaft, and a forked shifting-lever, e^2, so arranged that by shifting the clutch e^1 into engagement with the counter-clutch on the adjacent end of the hub of the band-wheel c^2, the shaft may thereby be caused to rotate. This shaft e extends along any desired distance between the side beams which compose the frame A, as illustrated in Figs. 2 and 6, and arranged thereon, but so as to revolve with it and slide along on it, is a pulley-wheel, e^3, and this pulley-wheel is moved along in either direction by two lugs, e^4, which extend down from the box R, Figs. 2 and 3. On the axes of the rollers r are the pulley-wheels u and a band, r^2, passing around these, and around the wheel e^3, as well as over the tightening pulleys or idlers u', arranged as shown in Fig. 2, causes the revolving motion of the shaft e to be communicated to the rollers r, and by them the shaft S, which is to be straightened, is revolved to any desired position for being straightened, or continuously for being tested. Its rotation is stopped, whenever desired, by unshipping the clutch e^1.

In straightening the shaft S, it is placed in the machine on the rollers $r\ r^1$, and under the plunger P, and the place where the bend or irregularity occurs being ascertained, either by the eye or by rotating it in connection with any suitable testing device (and for this purpose a piece of chalk presented to its periphery will suffice,) the plunger P is brought directly over the upwardly-projecting crown of the irregularity, as near the apex as possible. In order now to support the shaft S at or near the points where the curve or crook begins, I employ the posts or rests n, one on each side of the head D, and usually at equal distances therefrom.

These rests n are recessed at their upper ends, so as to furnish seats in which the shafts S may rest firmly. They are arranged in the sliding blocks n^1, so as to be adjustable up and down. The blocks n^1 have each a rib, n^2, which plays longitudinally along the slot a^1 of the frame A. A bar, q, Fig. 5, extends transversely across from one leg of the head D to the other, directly under the center of the plunger P, and to this transverse bar q, at its middle point, is fastened a longitudinal bar, q^1, and to the ends of the latter I fasten the sliding rest-blocks n^1 by means of pins q^2, all as illustrated in Figs. 3 and 5. The bar q^1 has a series of holes, as shown at q^3, by means of which and the pins q^2 the rest-blocks n^1 may be adjusted nearer to or farther from each other, so as to be brought as near as may be under the points where the curve in the bar or shaft S begins, as above stated. To raise and lower the rests n, I employ sliding wedges o. A cross-bar, o^1, is affixed to the base of each wedge, and onto its projecting end I attach a hook in the crank-arms o^2. These crank-arms are at their other and adjacent end attached to the opposite arms of a crank or sides of a wheel, o^3, and this wheel receives its motion from a hand-wheel, o^4, on the same axle, but outside the machine. By turning this wheel the wedges o are thrust back or drawn forward at pleasure, so as to raise or lower the rests n. The height of these rests is such relatively to the height of the rollers $r\ r^1$ that when the rests are up the weight of the shaft and the resistance to the downward stroke of the plunger P will be

sustained by the rests; but when down the shaft S will rest on the rollers r r^1. To adapt the crank-arms o^2 for the different distances at which the rest-blocks n^1 may be set from each other, I make therein a series of notches, o^5, at distances apart equal to those of the holes q^3 in the bar q^1. The rest-blocks n^1 being set at the proper distances apart, one of the notches o^5 will readily engage each cross-bar o^1. Any suitable stop device may be employed to keep the rests n from coming entirely out of their sockets or turning around therein, such as a set-screw entering a slot in the side of each rest n, the slot being closed at its lower end. To give an up-and-down motion or stroke to the plunger P, I employ an eccentric, p, the outline of the shaft g^3 being shown by dotted lines, which eccentric plays in an ordinary yoke, p^1, and the latter is, by a knee-joint, p^2, connected with the upper end or head P^1 of the plunger P. The amount of eccentricity should be such as to give about the average length of stroke desired; but in order to increase this length of stroke, as well as to vary the points at which it shall begin and end, I introduce between the eccentric p and its yoke p^1 an eccentric sleeve, w, and extend such sleeve outside the ends of the yoke, so as to attach thereto one or more levers, w', by means of which levers I bring the full side of the eccentric sleeve to any desired point relative to the full side of the eccentric p. By bringing the full side of the eccentric sleeve up, as in Fig. 3, the plunger P will be raised a distance equal to the eccentricity of the sleeve, and the full side of p being also up, as in Fig. 3, the plunger will then be at the highest point for beginning a downward stroke; but if the full side of the eccentric sleeve, as in Fig. 4, be down, the full side of p being up, the plunger P will be at the lowest point for beginning a downward stroke; and to increase the length of stroke of the plunger P, I first throw the full side of the eccentric sleeve up, as in Fig. 3, let the plunger P make a full downstroke and come up; then throw the full side of the eccentric sleeve down, as in Fig. 4, and so lower the plunger, after which it may make a farther downstroke. In this way I provide for straightening a crook or curve greater than the average. Either of these two strokes of the plunger may be shortened, according to the amount of crook or curve in the shaft S, by adjusting the full side of the eccentric sleeve at the proper point between the highest and the lowest. The two levers w' are attached simply to enable the workman to regulate the stroke from either side of the head D.

As an additional means for regulating the length of the stroke of the plunger I make it in two parts, P P′, and connect them by a screw, s, the head of which is secured to the plunger-head P′, so as to rotate freely therein, but with the threaded end playing in a tapped socket in the plunger P, as shown. Around the shank of the screw I make a worm-wheel, s^1, in suitable position and arrangement to be acted on by an endless screw, s^2, the stem of which passes outside, and is operated by hand-wheels s^3, at either end, so that the workman can vary the adjustment on whichever side of the head D he may happen to be. And that this adjustment may not be made at random, I attach to the bearing of each end of the stem a dial-plate, v, suitably graduated, and to each end of the stem an index-finger, v'. The plunger P is prevented from turning as the screw s revolves by means of a set-screw, y, entering a slot in the side of the plunger. The lower end of the plunger is recessed so as to take a firm bearing on the shaft S in the operation of straightening. The shaft S to be straightened is placed on the rollers r r^1, with the rests n down. A curve or crook being found, and its length approximately ascertained, its crown is turned upward. The rests n are adjusted at the proper distances. The head D, carrying with it all the straightening devices described, is then adjusted in position with the plunger P directly over the apex of the crown of the bend. The rests n are thrown up so as to take the weight of the shaft. The plunger is adjusted to give the desired length of stroke or strokes, and after these are given the rests n are lowered, so as to let the shaft S come on the rollers r r^1, and a test is made to ascertain the correctness of the work already done, or the presence of crooks at other points. In this way the work is continued till the tests show that the shaft is perfectly true and straight.

While the eccentric sleeve may be employed as above stated, I more commonly use it as a means of throwing the plunger out of and into operation. In such use the lower end of the plunger will engage the shaft only when the full side of the eccentric sleeve is down, so that by throwing its full side up it will raise the lower end of the plunger so far above the shaft as not to strike it even at the end of its downstroke. Hence, the shaft can be rotated and tested without necessarily stopping the plunger; but if so preferred the plunger may be unshipped, when its action is not desired, by any of the means well known in the art. The upper and lower faces of the griping-block i, or of such movable device as may be substituted therefor, may be either plain, as shown, or be made with inequalities conformed to the irregularities in the chain employed, by which latter means an effectual lock will be more easily secured. Also, it will be observed, that the rest-blocks n^1 may be disconnected from the crank-arms o^2, and adjusted by hand to any desired point, as occasion may require.

I am aware that the upper and lower folds of an endless chain have been locked in the box of a lathe-head by pressure applied to the edges thereof; but the arrangement of a cam or eccentric between the lengths or folds, as described, is by far the better construction.

I claim as my invention—

1. In combination with the frame of a straight-

ening-machine a head, adjustable thereon, a plunger, and two rests, substantially as and for the purposes set forth.

2. In combination with a head, D, a rest, n, on each side, both simultaneously adjustable up and down by a single motion, substantially in the manner and for the purposes set forth.

3. The rest-blocks n^1, each adjustable on a frame, A, to and from the head D, and connected with the head, so as to be moved therewith, substantially as and for the purposes set forth.

4. The combination of vertically-adjustable rests n and rollers $r\,r^1$, arranged on the same frame relatively to each other and to the shaft to be straightened, substantially as and for the purposes described.

5. In combination with a sliding head, D, and endless chain a cam or eccentric, arranged between the lengths or folds of the chain to lock either way, and thereby reverse the motion of the head-block, substantially as set forth.

6. In a straightening-machine the bearing-rollers $r\,r$, adjustable lengthwise of the machine and along the shaft which drives them, substantially in the manner and for the purposes described.

7. The band-wheel c^3, in combination with a shaft to transmit motion to the rollers r, and a line of gearing to drive the chain, substantially as set forth.

In testimony whereof I have hereunto set my hand.

JAMES S. ATKINSON.

Witnesses:
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JAMES M. CHRISTY.