(No Model.) 4 Sheets—Sheet 1.

A. J. GUSTIN.

RAIL STRAIGHTENING MACHINE.

No. 343,270. Patented June 8, 1886.

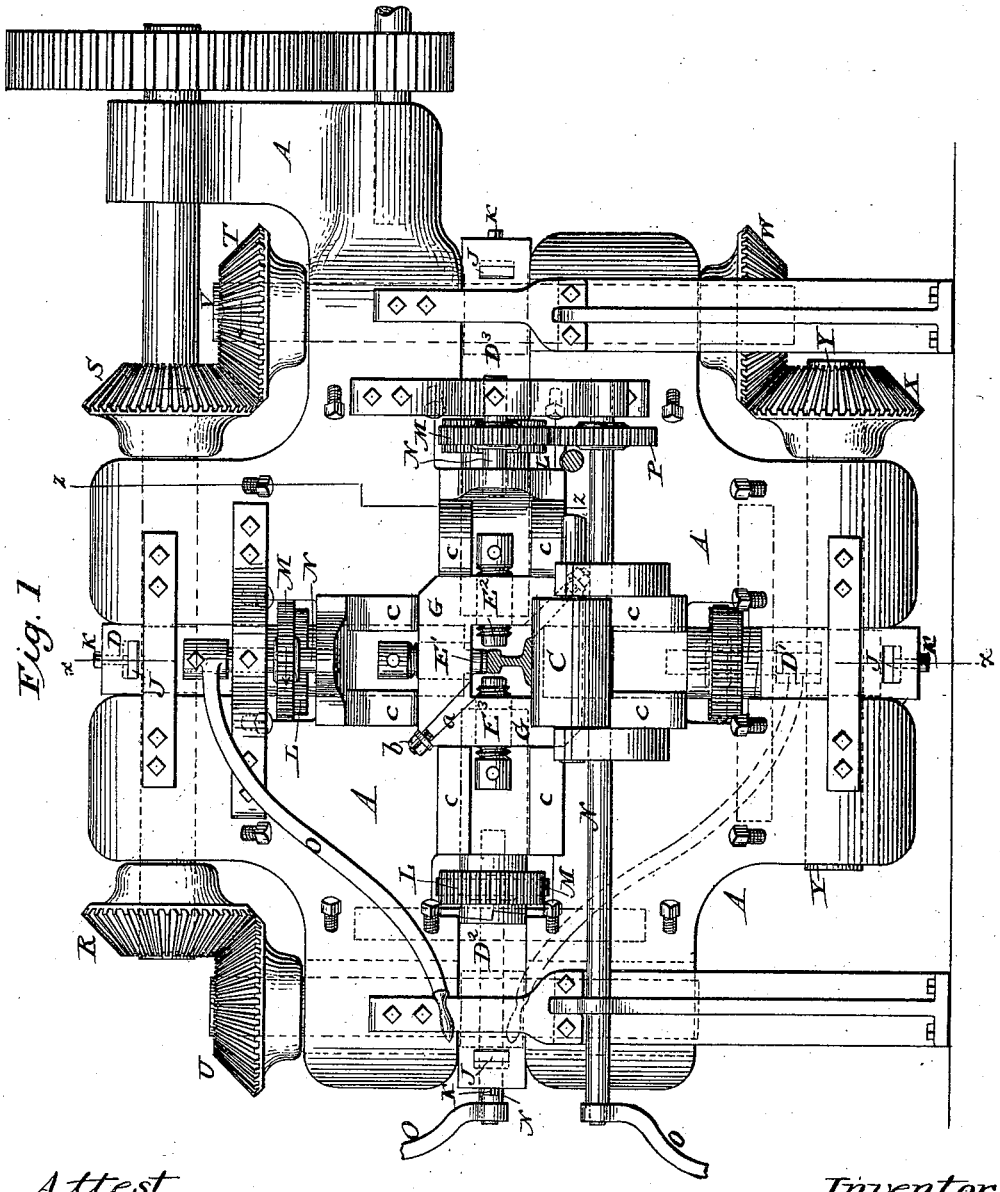

Fig. 1

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Sidney P. Hollingsworth

Newton Wyckoff.

Inventor.

A. J. Gustin

By his Attorney

Philip T. Dodge.

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RAIL STRAIGHTENING MACHINE.

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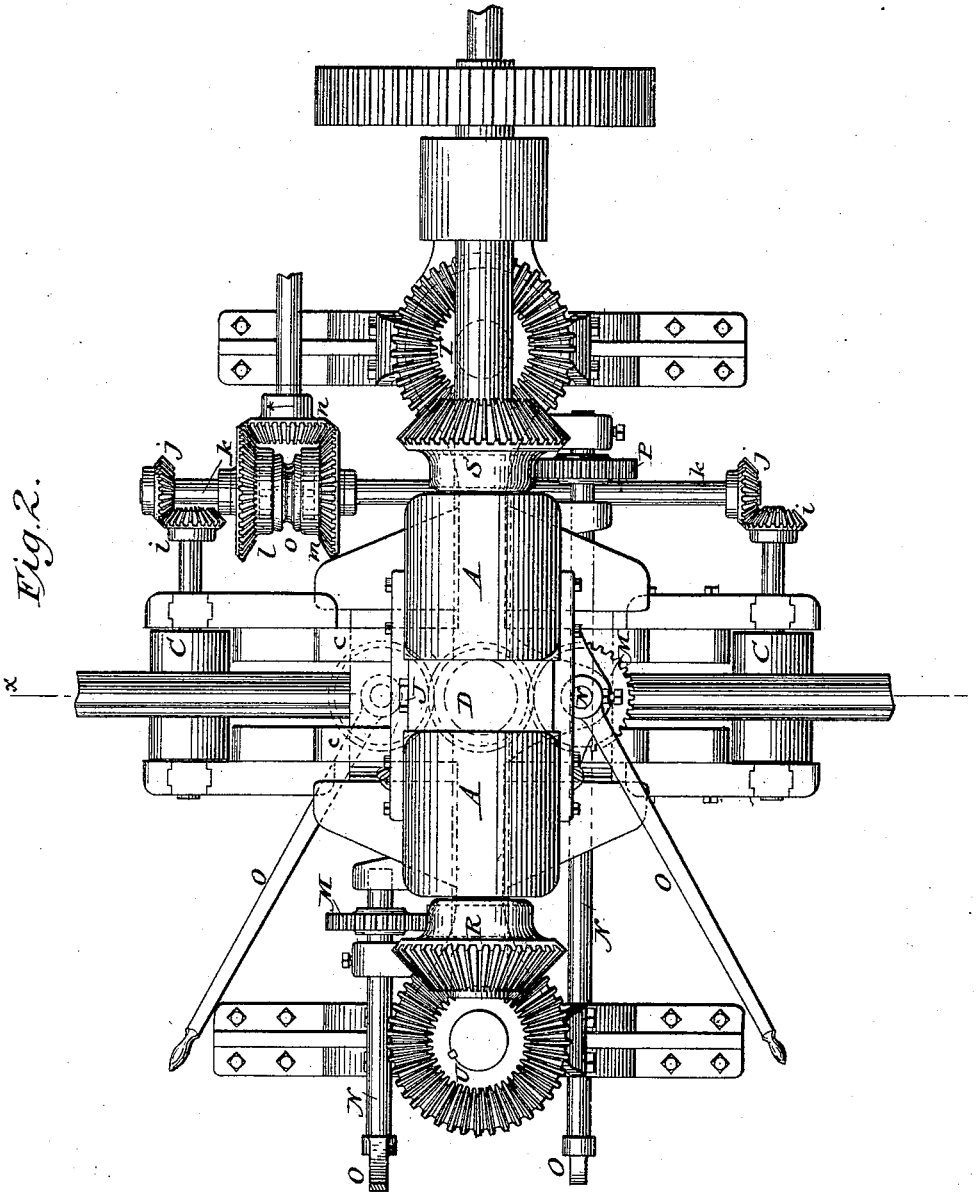
Fig. 2.



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Sidney P. Hollingsworth

Newton Wyckoff

Inventor

A. J. Gustin

By his Attorney

Philip T. Dodge

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RAIL STRAIGHTENING MACHINE.

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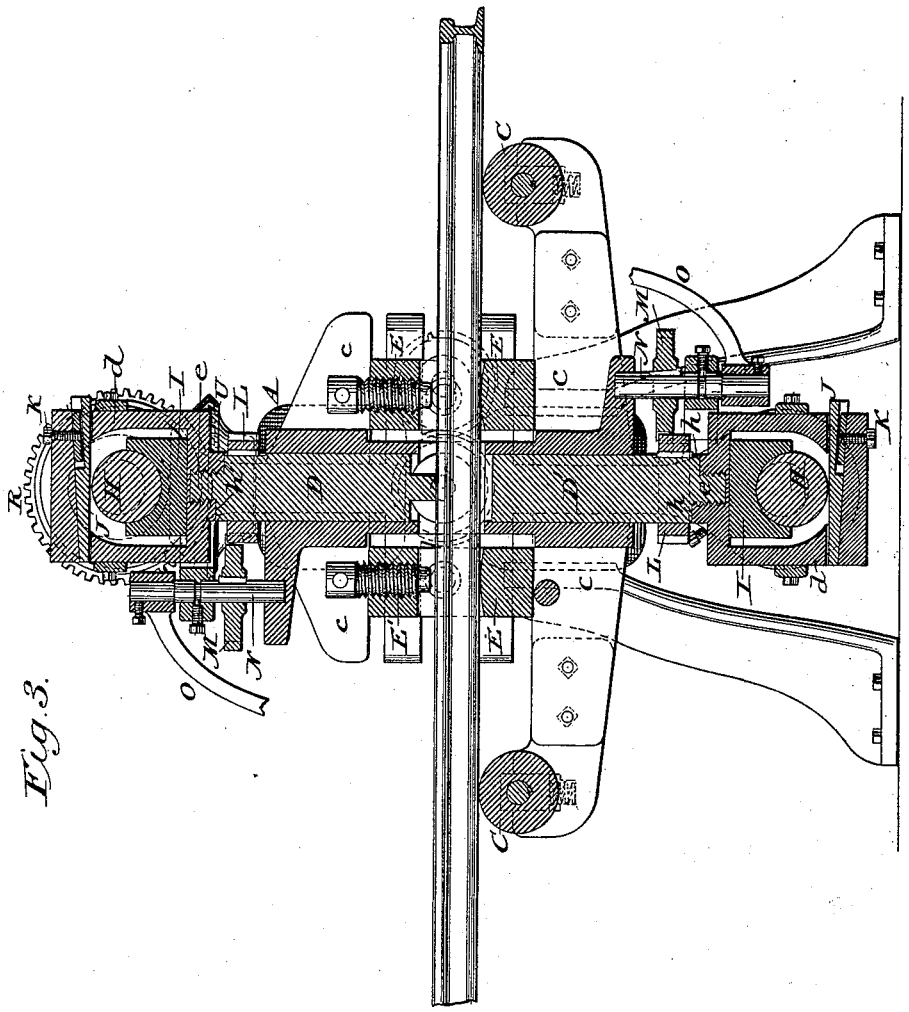

Fig. 3.

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Sidney P. Hollingsworth

Newton Wyckoff.

Inventor.

A. J. Gustin

By his attorney.

Philip T. Dodge.

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A. J. GUSTIN.

RAIL STRAIGHTENING MACHINE.

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Fig. 8.

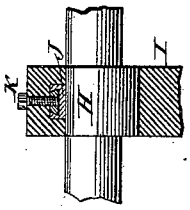


Fig. 9.

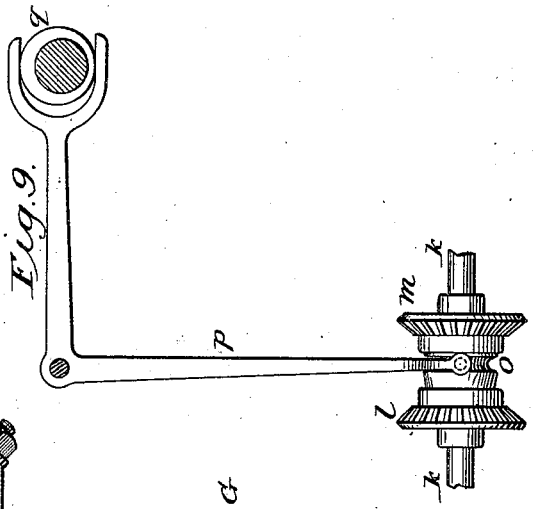


Fig. 4.

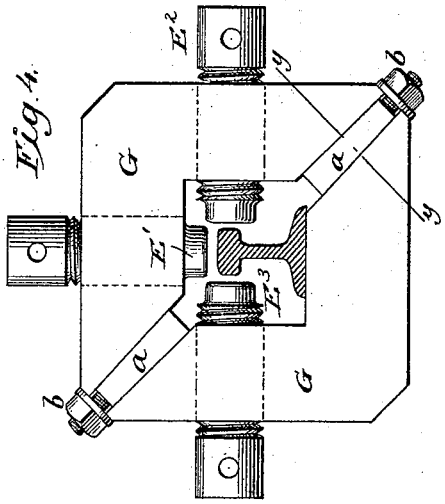


Fig. 5 on y-y

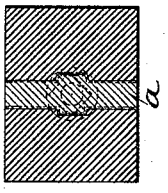


Fig. 7.

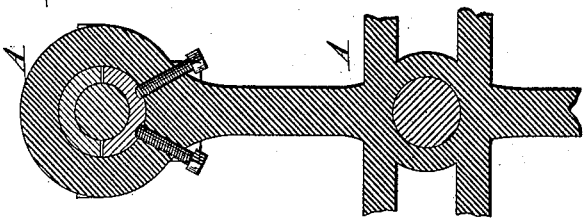
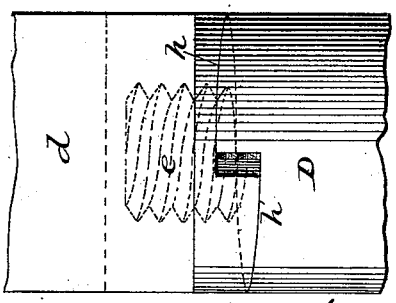


Fig. 6



Attest.

Sidney P. Hollingsworth

Newton Wyckoff

Inventor.

A. J. Gustin

By his attorney

Philip T. Dodge.

UNITED STATES PATENT OFFICE.

ANDREW J. GUSTIN, OF BOSTON, MASSACHUSETTS.

RAIL-STRAIGHTENING MACHINE.

SPECIFICATION forming part of Letters Patent No. 343,270, dated June 8, 1886.

Application filed October 14, 1882. Renewed January 25, 1884. Again renewed November 18, 1884. Again renewed July 29, 1885. Serial No. 172,998. (No model.)

To all whom it may concern:

Be it known that I, ANDREW J. GUSTIN, of Boston, in the county of Suffolk and State of Massachusetts, have invented certain Improvements in Rail-Straightening Machines, of which the following is a specification.

My invention relates to a machine of improved construction designed for straightening metal bars, more particularly designed, however, for the purpose of straightening railway-rails.

The object of my invention is to provide a machine whereby crooked and irregular bars of metal may be rapidly and accurately straightened with a small expenditure of manual power, it being the intention to dispense with a large portion of the hand-labor which was necessary in the use of previously-existing machines.

Practical experience has demonstrated that the operation of straightening railway-rails can be effected practically only by the use of a piston or equivalent pressure device acting upon the rail between two points of support therefor.

Various machines have been hitherto constructed wherein anvils or supporting devices of various kinds designed to sustain the rail were combined with an intermediate pressure device to act thereon. In the operation of these machines it was necessary that the bar should be repeatedly turned or rotated while passing endwise through the machine, in order to bring one point or another in position to be acted upon by the pressure device. This manipulation of the iron involved a great expenditure of manual labor and rendered the operation both slow and expensive. Moreover, the straightening of the rail, instead of being effected automatically and positively by the machine, was dependent wholly upon the skill of the attendant, who was required to detect irregularities or bends in the metal by the eye alone, and present the rail accordingly to the pressure device.

It is the particular aim of my invention to produce a machine wherein the straightening of the rail shall be effected automatically and positively, thus avoiding the uncertainty attending the use of previously-existing machines; and also, in this connection, to avoid the necessity of turning or revolving the rail, and thereby reduce both the labor required and the time consumed.

With these ends in view the invention consists, essentially, in the combination, in an organized machine or apparatus, of supports or anvils to sustain the rails, and two or more pistons or pressure devices arranged to act upon the rail in different directions or upon different sides; in combining with the rail guiding or supporting mechanism pressure devices adapted to act upon all four sides of said rail in such manner that without turning the rail pressure may be applied thereto on either of the four sides, as may be required; in the combination of a series of pistons or reciprocating pressure devices adapted to act upon different sides of the rail, combined with means for keeping said pistons constantly in motion and advancing them toward the rail successively and alternately, so that the rail passing through the machine will be automatically straightened; in driving mechanism combined with the multiple pistons in such manner as to operate the same successively; in anvils or rail-supporting devices of special arrangement, whereby the proper action of the pressure devices from different directions is permitted; in means for adjusting the advance or movement of the pistons or pressure devices; in the combination of a series of pistons or pressure devices adapted to act upon a rail from different sides, with adjusting devices whereby the advance of the respective pistons or pressure devices may be regulated independently of each other; and in various other features and combinations which will be more fully explained.

As will be apparent to any skilled mechanic after examination of the following specification, my improvements may be embodied in various forms and modified in various respects without changing essentially the mode of action or departing from the limits of the invention. I have, however, in the accompanying drawings represented a machine wherein the improvements are embodied in the preferred form.

Referring to the accompanying drawings, Figure 1 represents a front elevation of my improved machine. Fig. 2 is a top plan view

of the same. Fig. 3 is a transverse vertical section on the line *x x*, Figs. 1 and 2. Fig. 4 is a detail view illustrating the manner of supporting and adjusting the anvils or supports by which the rail is sustained while being subjected to the action of the pressure devices. Fig. 5 is a cross-section on the line *y y* of the preceding figure. Fig. 6 is a view illustrating the manner in which provision is made for adjusting the stroke or advance of the pistons or pressure devices. Fig. 7 is a vertical section on the line *z z*, Fig. 1, illustrating the construction of the main frame. Fig. 8 is a cross-section through the eccentric by which one of the pistons or pressure devices is actuated, the several devices being duplicates of each other. Fig. 9 is a view of the lever for operating the clutch.

In proceeding to build my machine I first construct a rigid main frame, A, of the form represented in the drawings, or of any other suitable form adapted to sustain the various operating mechanisms hereinafter referred to. Through the center of this frame I leave an opening through which the rail to be straightened may be passed in a horizontal direction. For the purpose of supporting this rail in its passage through the machine I mount upon suitable arms upon opposite sides of the main frame two horizontal rollers, C C, as plainly represented in Figs. 1, 2, and 3. These rollers are designed to sustain the weight of the rail, and aid, if desired, in advancing the same through the machine. As shown in Fig. 3, each of these rollers is sustained in vertically-movable boxes or bearings supported by spiral springs, whereby the rolls are caused to sustain the rail normally above the face of the anvils by which it receives support while being acted upon by the pressure devices. It is not, however, necessary to sustain the rolls by yielding supports, as good results may be obtained when the rolls are seated in rigid supports, it being found in practice that the rails possess sufficient elasticity to admit of their being sprung downward between the rolls a sufficient distance to bear upon the anvils without receiving a permanent set.

Opposite the four sides of the central opening through which the rail passes I locate the four reciprocating pistons or pressure devices D D′ D^2 D^3, which are substantially duplicates of each other, although differing in certain minor particulars hereinafter described. It will be observed that the plunger D is arranged to descend vertically above the rail, and the piston D′ a end vertically beneath the same, while the remaining pistons D^2 and D^3 are arranged to slide inward horizontally on opposite sides of the rail, as most clearly represented in Fig. 1. It will be observed that by means of the pistons thus arranged pressure may be applied to the rail on either of its four sides, while the rail remains in position with its face resting upon the supporting-rolls.

The mechanism for advancing the pistons successively toward the rail will be hereinafter described.

In order to secure the proper effect of the pistons when acting upon the rail, it is necessary that the rail shall receive support on the side opposite the piston at two points separated from each other to a greater or less extent. I therefore provide the machine with four pairs of anvils or supports, E E′ E^2 E^3, located four on one side of the pistons and the remaining four on the opposite side.

The anvils E E, by which the rail receives support on the under side, are secured permanently in position, as plainly represented in Fig. 3; but for the purpose of adapting the machine for treating rails of different sizes and forms, and to admit of compensation for wear, &c., the remaining anvils opposite the top and two faces of the rail are threaded externally, in order to admit of their being adjusted by turning them to and from the rail. By thus providing for the adjustment of the anvils they may be moved inward toward each other to any extent desired. This adjustment, combined with an adjustment in the stroke of the pistons hereinafter described, adapts the machine for treating bars and rails of all sizes and forms.

The adjustable anvils E may be sustained in any suitable manner. Inasmuch, however, as it is preferred in most cases to make provision for changing the distance between the anvils on one side of the machine and those on the other, in order that the rail may receive support at points separated to a greater or less extent from each other, I prefer to support the anvils in such manner that the pair acting upon each side of the rail may be adjusted to and from each other. A simple construction for securing this adjustment consists in mounting the anvils at each side of the machine in a supporting plate or frame which is movable, so that by adjusting each plate the entire series of anvils thereon may be shifted equally. The preferred method of constructing and securing this adjustable plate or frame is clearly represented in Figs. 1, 2, 3, and 4.

Referring to Fig. 4, G represents a rectangular frame or plate provided with central opening for the passage of the rail, and having the three anvils E′ E^2 E^3 screwed into it from opposite sides, the inner ends of the anvils being presented in proper position to sustain the rail when it is carried loosely against them, as hereinafter explained. The frame or plate is divided, as shown, diagonally through opposite corners, and the two parts separated by means of intermediate wedges, *a*, the outer ends of which are threaded and provided with nuts *b*, so that by turning the nuts the wedges will be drawn outward and caused to move the two parts of the plate away from each other. The expanding-plate thus constructed is seated vertically in an upright position, with its faces transverse to the line in which the rails are passed through the machine between

the four arms *c* in the main frame, and after being adjusted in the required position is secured by simply turning the nuts, whereby the plate is expanded and caused to take a firm and rigid hold between the sustaining-arms. By simply loosening the nuts the plate may be released, whereupon it may be moved to and from the pistons or pressure devices, as desired, and again secured in the desired position by turning the nuts.

It is to be understood that as regards this adjustment of the anvils to and from the intermediate pressure device my invention is not restricted to the details represented in the drawings, as any equivalent construction permitting the adjustment of the anvils may be substituted for that herein shown.

For the pupose of operating the reciprocating pistons or pressure devices D D' D^2 D^3, I provide each one at the outer end with an open head or yoke, *d*, in which there revolves an eccentric, H, and a sliding block or plate, I, in which the eccentric bears in the manner represented, so that at each revolution of the eccentric the piston is moved forward toward the rail. The retraction of the piston is effected by providing the head or yoke with a transverse key, J, bearing upon the outer side of the eccentric, as shown. This key, which is inclined on the outer side and secured by a set-screw, K, may be adjusted endwise, and thus serves as a means for compensating for wear and maintaining the parts in a condition to run smoothly and without play.

While it is preferred to make use of the eccentric and the sliding block as a means of operating the pistons, it is to be distinctly understood that a crank and pitman, or any equivalent means known in the art, may be employed for imparting a reciprocating motion thereto.

In order to adapt the machine for treating rails of different sizes and to compensate for wear, it is advisable to construct the parts in such manner that the pistons may be lengthened or adjusted to advance to a greater or less extent. A simple means of securing this adjustment is clearly represented in Figs. 3 and 6. The body portion of each piston, instead of being secured to its head or yoke, is provided at the outer end with an externally-threaded neck, *e*, which is screwed into the yoke, as shown and which serves as a means of adjusting the body endwise with respect to the yoke.

In order to prevent the destruction of or injury to the threaded neck, I provide means for relieving the same from the excessive strain to which the pistons are subjected. This provision consists in forming on the end of the piston, around or outside of the threaded neck, a spiral or inclined bearing-surface, *h*, which is seated upon a corresponding surface on the head or yoke. The pitch or inclination of this spiral bearing-surface is adapted to correspond with the pitch of the screw-thread, so that as the piston is adjusted by means of the screw-thread a firm and solid bearing is maintained between the inclined faces, which are thus caused to receive the entire strain or force applied in driving the pistons against the rail.

In operating the machine it is desirable that provision shall be made for effecting the endwise adjustment of the pistons independently of each other without stopping the motion of the machine. For this purpose I provide a series of hand-levers, which are extended on one side of the machine in position to be readily reached by an attendant, and connect these levers through intermediate devices with the pistons. These connections are plainly represented in Figs. 1, 2, and 3. Each piston has secured upon its outer end a pinion, L, which engages with a second pinion, M, applied to a shaft, N, which has a hand-lever, O, secured upon its outer end, so that by moving the lever a rotary motion is imparted through the intermediate pinions to the body of the piston, causing the latter to be screwed forward or backward in relation to its operating-yoke.

In order that the shaft N, which adjusts the pistons on the right-hand side of the machine in Fig. 2, may be lowered sufficiently to be out of the path of the entering rail, it is necessary to employ between its pinion and the pinion on said piston a third or intermediate pinion, P, as represented in Fig. 1.

In order that the end motion of the piston shall not disengage the adjusting-pinions, the pinions L are made of greater width from the face than the pinions M. This construction admits of the pinions L being moved to and fro with the pistons without being disengaged from the pinions M. It is manifest that, if preferred, the reverse arrangement may be adopted and the pinions M made of greater width than the pinions L.

Passing now to the means by which the series of pistons or pressure devices are operated continuously and advanced successively toward the rail, reference is made to Figs. 1 and 2. A driving-shaft is extended horizontally through bearings on top of the frame, and provided at the middle with an eccentric for operating the upper piston. Near opposite ends the shaft is provided with two miter-gears, R and S. The gear S engages with and drives the corresponding gear, T, applied to one end of a shaft, which carries the eccentric for operating the right-hand piston, while the gear R operates a corresponding gear, U, which drives a shaft carrying the eccentric for operating the left-hand piston. The shaft V, by which the right-hand piston is operated, is continued downward and provided with a miter-gear, W, which engages with and drives a like gear, X, applied to a horizontal shaft, Y, located in the base of the machine, and carrying the eccentric by which the lower piston is operated. It will be observed that in this manner motion is communicated to all four of the pistons, which are moved forward and backward at equal speeds. The eccentrics operating the respective pistons are ad-

justed with respect to each other in such manner that the four pistons are advanced successively one after another, so that as a rail is passed through the machine the pistons will be advanced toward its four sides or faces in succession, a bend or irregularity on any one of its four sides being thus corrected automatically. It will of course be understood that although the pistons may advance on all sides of the rail each one is practically inoperative, unless there chances to be a bend or projection in the rail on that side.

In order to admit of crooked or irregular rails being readily introduced into the machine, it is advisable to adjust the anvils which face each other at a distance apart greater than that which would be required for the admission of a straight rail, or, in other words, at a distance apart greater than the height or width of the rail, respectively, as clearly represented in Figs. 1 and 4. This adjustment admits of crooked rails being readily introduced into the machine without binding against or being checked by the anvils. It will be understood that when the anvils are thus separated the advancing piston will be compelled to carry the rail against the opposing anvils before the bending or straightening action will commence. The rails will thus be moved laterally by the horizontal pistons. In the case of the lower piston, the rail will be raised vertically against the upper anvil; but in the case of the upper piston it will not be required to move the rail, for the reason that the latter will rest by gravity upon the supporting-rolls beneath.

The passage of the rail through the machine may be effected by hand, but it is preferred to cause its advance by means of power applied automatically to the sustaining-rollers C.

As shown in Fig. 2, bevel or miter gears *i* are applied to the journals of the supporting-rolls and driven by corresponding gears, *j*, on opposite ends of a shaft, *k*. This shaft is provided with two bevel-gears or friction-wheels, *l* and *m*, loose thereon, which are driven by an intermediate wheel, *n*, mounted upon a driving-shaft. An intermediate sliding clutch, *o*, connected to the shaft by a spline or feather, is adapted to engage alternately with the two wheels for the purpose of communicating motion thereto. By shifting this clutch motion may be transmitted through the intermediate parts to the supporting-rollers C, causing the latter to turn forward or backward, as required, or by placing the clutch in an intermediate position the rail sustaining and feeding rolls may be permitted to remain at rest. In this manner a rail may be caused to advance continuously through the machine, or may be caused to move backward, in the event of its being necessary to pass any given point or portion of the same a second time between the straightening devices.

For the purpose of rendering the machine, as far as possible, automatic in its action, I propose to combine with the driving-clutch *o* automatic devices operating from any suitable moving part of the machine, by which the clutch shall be thrown into and out of engagement with the wheel by which the rail supporting and feeding rolls are turned in a forward direction at such times as to cause the rail to be carried intermittingly through the machine, it being usual in operations with the machine to advance the rail at each step a distance equal to that between the two anvils or points of support, although this distance may be increased or diminished, if desired. A simple arrangement for effecting this automatic movement of the driving-clutch is represented in Fig. 9, wherein it will be perceived that a lever, *p*, for operating the clutch, is connected at its upper end with an eccentric, *q*, mounted upon the main driving-shaft of the machine. The rotation of the shaft causes the eccentric to move the lever and shift the clutch at such intervals that the driving-rolls will be caused to advance the rail during the interval when all the pistons are withdrawn, and then permit the rail to remain at rest during the period in which the successive pistons advance. When this automatic mechanism is employed for throwing the roll-feeding devices into and out of action, the eccentric is to be so arranged that it will throw into action that pinion only which causes the advance of the rail, and not the one which effects the retrograde motion. Consequently, when reliance is to be placed wholly on the automatic devices, the wheel *m*, for effecting the retrograde motion, may be omitted.

While it is preferred to impart motion to both the rail-sustaining rolls, it is manifest that the driving devices may be connected with but one of said rolls.

It will be observed that in my machine the pressure devices act in right lines and at right angles to the axis of the rail. This movement is of the highest importance, in that the devices while acting in one direction have no tendency to twist or spring the rail in another. In attempting to straighten rails by means of pressure devices which turn upon centers, it is found that the movement of the device in a curved path transverse to the axis of the rail has a tendency to bend or spring the latter in a direction at right angles to that in which the pressure is to be applied. Experience has demonstrated that any pressure device which acts otherwise than in right lines will give unsatisfactory results.

Having thus described my invention, what I claim is—

1. In a machine for straightening rails, the combination, with four pairs of anvils or rail-supports, of four separately-movable pistons or pressure devices arranged for joint action, with the respective anvils on different sides of the rails, whereby the machine is adapted to effect the straightening of rails from all sides without revolving or turning said rail therein.

2. In a machine for straightening rails, the combination, with pressure devices to act upon the rail from different sides, of driving mechanism for operating said pressure devices successively, and the means, substantially as described, whereby the attendant may vary the motion of the pressure devices independently without arresting the motion of the machine.

3. In a rail-straightening machine, rail sustaining or guiding devices combined with bending mechanisms arranged to exert pressure upon the rail from its four sides successively, whereby an automatic straightening of the rail is effected without turning the same over.

4. In a rail-straightening machine, the combination, with anvils to sustain the rail on one face, of a movable presser to act upon the opposite face, and automatic feed-rolls, whereby the rail is advanced intermittingly, as described.

5. The combination, with the straightening devices, of the rail-feeding rolls, driving mechanism therefor, and automatic devices whereby said driving mechanism is periodically thrown into and out of action, whereby each rail is caused to advance intermittingly past the straightening devices.

6. The combination, with the rail-straightening mechanism, substantially as described, of two rolls, one or both adapted to feed the rail, the driving gear or clutch, the eccentric for operating said clutch, connected with and driven by the shaft that operates the rail-straightening mechanism, substantially as described, whereby the feed-roll is thrown into and out of action alternately, thereby causing the rail to be advanced intermittingly through the machine.

7. In a rail-straightening machine, a series of presser devices arranged to act upon different sides of the rail, combined with opposing anvils or rail-supports separated from one another to an extent greater than required for the admission of a straight rail between them, whereby the admission and treatment of crooked rails are permitted.

8. In a rail-straightening machine, the combination, with four movable presser devices acting on different sides of the rail, of two series of anvils, each series grouped around the rail, the anvils separated to such an extent as to leave a free space between them and the rail as the latter passes through the machine.

9. In a rail-straightening machine, the combination, with movable presser devices, of corresponding anvils or supports grouped in such manner as to permit the passage between them of the rail, the anvils opposite one face of the rail separated from those on the other, as described and shown, to permit lateral play of the rail, whereby the presser devices severally are caused to move the rail to and fro from the anvils on one side against those on the other.

10. In a rail-straightening machine, the several combinations of longitudinally-adjustable piston, adjusting-pinions, and operating-lever, grouped, substantially as described, to control the pressure on the respective sides of the rail instantly and independently.

11. In combination with the body of the piston or presser device, the actuating-slide connected therewith by a screw, and the inclined bearing-surfaces, as described, whereby the screw is caused to maintain the connection between the parts and permit the retraction of the body by means of the head while the inclined surfaces receive the forward pressure and relieve the screw from excessive strain and wear.

12. In a rail-straightening machine, the combination, with a main frame, of the anvils or rail-supports and the sectional frames for sustaining said parts, constructed and arranged, substantially as described, for lateral adjustment within the main frame, whereby the distance between the companion anvils may be varied.

13. The combination, with the main frame and anvils, of the anvil-sustaining frame divided and provided with adjusting-wedges, substantially as shown, whereby the ready adjustment of the anvils is permitted.

14. In a rail-straightening machine, independently-reciprocating pressers or straightening-pistons arranged to act on different faces of the stationary rail, combined with means, substantially as described, for actuating said pistons independently, and the train of driving-gear connecting the operating mechanisms of the respective pistons with each other, said gear arranged, substantially as described, to cause the alternate or successive action of the respective pistons.

15. In a rail-straightening machine, the series of anvils opposed to each other to sustain the rail on opposite sides alternately, and separated a distance sufficient to permit a slight movement of the rail to and fro between them, combined with alternately-operating pressure devices arranged to act upon opposite sides of the rail, whereby the rail is subjected to the straightening action on its two sides alternately and without being turned or revolved.

16. In a rail-straightening machine, the combination, with rail-supporting anvils arranged to bear on different sides of the rail, of two or more sliding pressure devices opposed to the respective anvils, eccentrics acting to move the pressure devices, and gear connecting said eccentrics, the parts being so arranged as to cause the successive action of the different pistons.

ANDREW J. GUSTIN.

Witnesses:
PHILIP T. DODGE,
WILLIAM H. SHIPLEY.