

No. 670,591.

Patented Mar. 26, 1901.

G. S. MERRILL.

ART OF INCREASING THE CROSS SECTIONAL AREA OF METAL RAILS OR
ANALOGOUS ARTICLES.

(No Model.)

(Application filed Nov. 4, 1898.)

5 Sheets—Sheet 4.

Fig. 9.

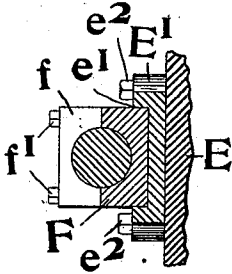


Fig. 8.

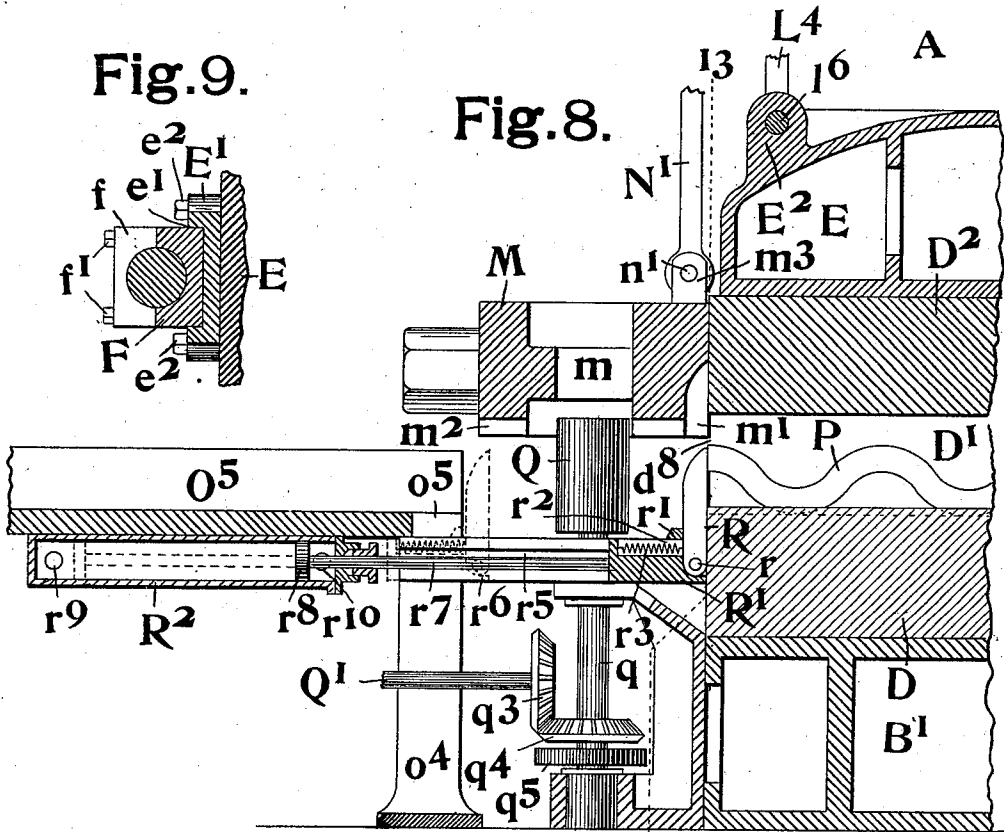
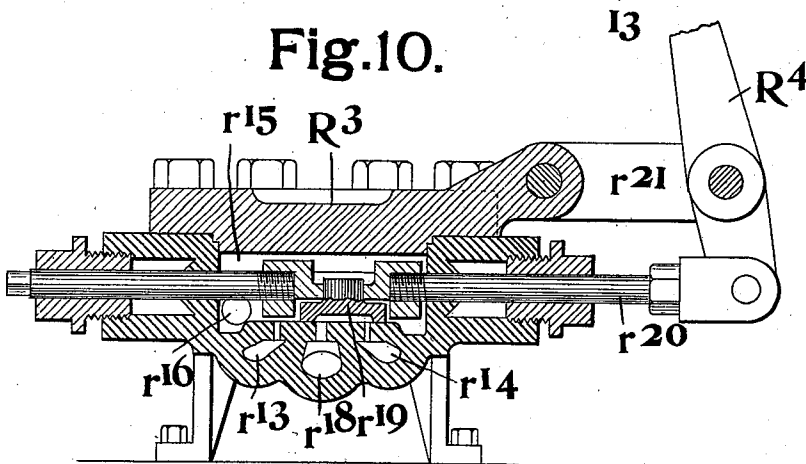


Fig. 10.



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5 Sheets—Sheet 5.

Fig.12.

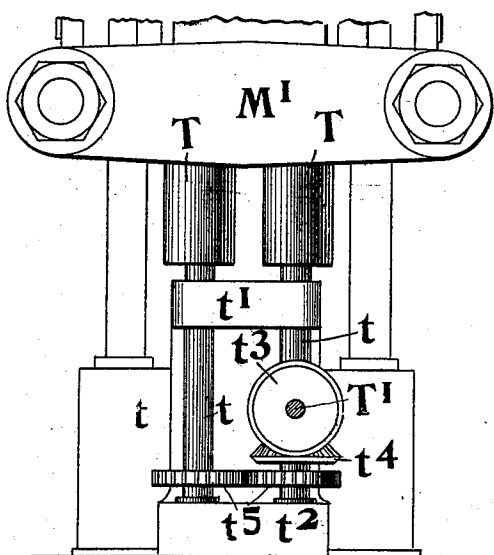


Fig.13.

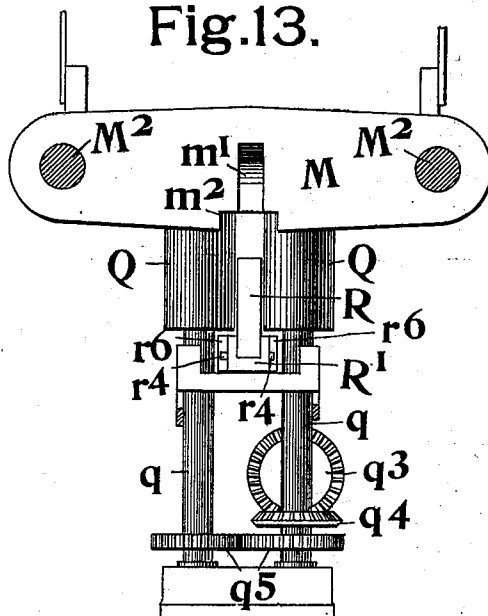


Fig.11.

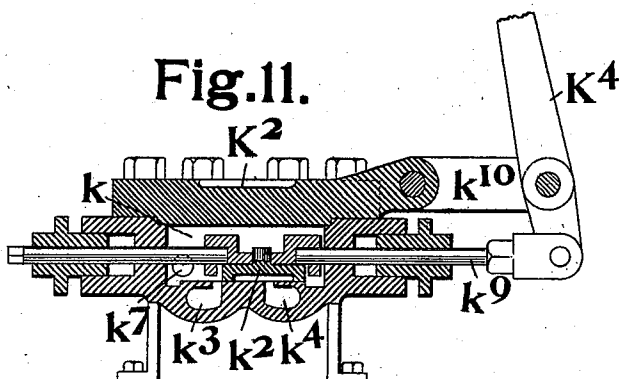


Fig.14.

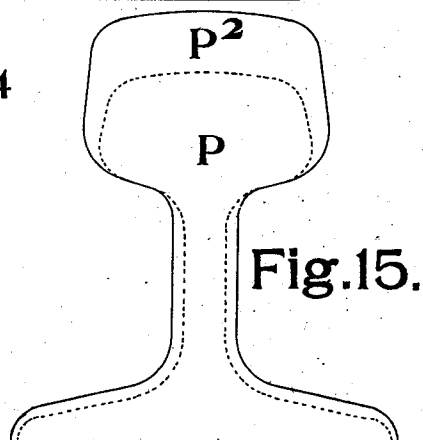


Fig.15.

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UNITED STATES PATENT OFFICE.

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ART OF INCREASING THE CROSS-SECTIONAL AREA OF METAL RAILS OR ANALOGOUS ARTICLES.

SPECIFICATION forming part of Letters Patent No. 670,591, dated March 26, 1901.

Application filed November 4, 1898. Serial No. 695,524. (No model.)

To all whom it may concern.

Be it known that I, GEORGE SPENCER MERRILL, a citizen of the United States, residing at Beloit, in the county of Rock and State of Wisconsin, have made certain new and useful improvements in the Art of Increasing the Cross-Sectional Area of Metal Rails or Analogous Articles, of which the following is a specification.

My present process is an improvement in a branch of the process of restoring worn rolled or drawn metallic articles described in the specification accompanying my application for Letters Patent of the United States serially numbered 668,512, and my apparatus is designed for use in carrying out my improved process.

In my improved process I increase the average cross-sectional area of rails treated in the following manner: I form in each rail a series of crimps, preferably after first heating the rail to a heat not lower than a red heat and not high enough to injure the metal therein. The crimps formed are preferably lateral crimps and are preferably all in the same plane and of about the same depth. I do not limit myself to any special form or depth of crimp, however, or the use of any special number of crimps, but prefer a form and depth not calculated to strain or form cracks in the metal of the rail; and the crimping should shorten the rail sufficiently to give it a weight per foot of the distance in a straight line between its ends after crimping at least as great as the restored rail is intended to possess. After the crimping is completed I next, preferably while the rail is hot and preferably while it is not below a red heat, subject it to a pressure exerted substantially in the plane of its crimps and adapted to substantially straighten it, and at the same time I limit the longitudinal movement of the ends of the rail as well as its lateral movement and preferably also guide and limit the flow of the metal in the rail at angles to the plane of the crimps. In this way the greater part of the transverse pressure applied is converted into longitudinal pressure, and where the crimps are substantially uniform in size and are all in the same plane all parts of the rail may, as a rule, be subjected by this process to longi-

tudinal pressure simultaneously, or substantially so, and all difficulties relating to the necessary flow of the metal in the rail are overcome, and the rail is substantially straightened and its cross-sectional area increased at the same time.

The outward movement of the ends of the crimped rail while being subjected to transverse pressure is limited in any suitable manner. The means which are shown in the accompanying drawings for limiting the longitudinal movement of the crimped rail under pressure permit of a slight increase in the length of the rail during the transformation of transverse pressure into longitudinal pressure.

The shape and size in cross-section of the compressed rail are governed by the means guiding and limiting the transverse flow of the metal of which it is composed. The device used for that purpose is ordinarily a suitable die.

After having its cross-sectional area increased the rail may be subjected to a rolling or compression process of any kind for the purpose of reducing its cross-sectional area to any degree that is desired; but this subsequent reduction of cross-sectional area forms no necessary part of my present invention.

In the accompanying drawings I have shown an apparatus which is especially useful in carrying out my new process.

Referring to said drawings, Figure 1 is in part a side elevation and in part a vertical longitudinal section on line 1 1, Figs. 3, 4, 5, and 7, with the supports for the crimping-rolls shown omitted. Fig. 2 is an enlarged vertical longitudinal section of details on line 1 1, Fig. 3. Fig. 3 is a rear end elevation of the press and discharger illustrated in Fig. 1 with supply-pipes, valve mechanism, and blocks F' and F'' omitted. Fig. 4 is an enlarged vertical cross-section of the press on line 4 4, Fig. 1, looking forward. Fig. 5 is a detailed plan view with the rear portion of the apparatus broken away and crimping mechanism omitted. Fig. 6 is an enlarged detailed vertical longitudinal section on line 6 6, Fig. 5. Fig. 7 is a detailed vertical transverse section on line 7 7, Fig. 1. Fig. 8 is an enlarged detailed vertical section on line 1 1, Fig. 5, illustrating means

for feeding the press. Fig. 9 is a detailed horizontal cross-section of a guide on line 9 9, Fig. 1. Fig. 10 is an enlarged section of a valve on line 10 10, Fig. 5. Fig. 11 is a similar view on line 11 11, Fig. 5. Fig. 12 is a detailed rear elevation with parts broken away. Fig. 13 is a vertical transverse section on line 13 13, Fig. 8. Fig. 14 represents a side elevation of a worn rail, the side elevation of the same rail after crimping, and the approximate form of the rail after passing through my press. Fig. 15 is an enlarged cross-section of a compressed rail with the form of the rail before treatment shown in dotted lines. Fig. 16 is a detailed vertical longitudinal section on line 16 16, Fig. 5.

Similar letters refer to similar parts throughout the several views.

The form of my apparatus shown in the drawings consists of rail-crimping mechanism, a rail-press, press feeding mechanism, shown arranged to cooperate with the crimping mechanism in doing the work of feeding, discharging mechanism, and withdrawing mechanism designed to cooperate with the discharger.

I prefer to use a vertical press, and in constructing the preferred form A thereof, Figs. 1, 2, 3, 4, 5, and 8, I preferably use a top frame B and a bottom frame B', which are substantially alike, and preferably connect them together and hold them in position by means of bolts C, provided with spacing-flanges *c* and nuts *c*². The bottom frame B' supports the lower member D, Figs. 1, 3, and 4, of a die. The member D is preferably secured to the press-frame B' by means of bolts *d*. Its face is preferably shaped so as to give the under side of rails passing through the press the desired form and size and preferably contains a groove *d*¹, adapted to form one side of the base of a rail, and a groove *d*², adapted to form one side of its head. From one side of the member D a part *d*³ projects upward, which is adapted to close one side of the die-cavity D' when the die is closed. Above the member D of the die a vertically-reciprocating member D² is arranged, whose face is like that of the member D and contains grooves *d*¹ and *d*², arranged opposite the corresponding grooves in the lower member, and on the side opposite the one on which the part *d*³ of the member D projects it is provided with a downwardly-projecting part *d*⁴, adapted to close its side of the die-cavity D'. The member D² of the die is preferably provided with flanges *d*⁵, containing recesses *d*⁶, Fig. 1, and is shown secured to a platen E by means of bolts *d*⁷, inserted laterally into the recesses *d*⁶ in the member D² and recesses *e* above them in the sides of the platen.

To the sides of the platen E, Figs. 1, 3, 4, and 9, guide-blocks E', each having a slot *e*¹ formed in its face, are shown secured by bolts *e*², and said platen preferably reciprocates between guide-plates F, filling said slots *e*¹ of the guide-blocks E', and shown fastened to

the bolts C by means of straps *f* and bolts *f*¹. The upper member D² of the die is guided by guide-blocks F', arranged below the plates F on their side of the press, and at points opposite the blocks F' similar blocks F² are shown, arranged between the bolts C and the lower member D of the die for the purpose of bracing the latter. The blocks F' and F² are each secured to bolts C by means of an outside guide-plate G and connecting-bolts *g*. The platen E is preferably operated by means of hydraulic power, and in the preferred form of my press I secure to the top of the platen, by means of bolts *e*³ or otherwise, two rams H, one of which reciprocates in a cylinder I and the other in a cylinder I', Figs. 1, 3, and 5. The cylinders I and I' are shown secured by means of bolts *i* to the under side of the top frame B, and water is admitted to and escapes from said cylinders through ports J, coupled together by a pipe K, from which a pipe K' leads to the valve-port *k*³ of a valve-chest K², Figs. 1, 5, and 11. The form of valvular devices illustrated forms no part of my invention. The valve-chest K² shown contains in the valve-chamber *k* a slide-valve *k*², governing the port *k*³, and an exhaust-port *k*⁴. A pipe *k*⁶ is shown leading from the latter, and the former is shown connected with the supply-main K³ by means of a pipe *k*⁷. The valve *k*² is shown operated by means of a lever K⁴, pivotally connected with the valve-rod *k*⁵ and connected with the valve-chest by means of a link *k*¹⁰.

The platen E and the parts thereto attached are preferably raised by means of a pair of rams L, Figs. 1, 2, 3, and 5, preferably arranged above opposite ends of the platen E and each reciprocating in a vertical cylinder L', (shown secured to the top frame B by means of bolts *l*. Water is admitted to and escapes from said cylinders through ports *l*¹, and said ports *l*¹ are preferably at all times connected with the main supply-pipe K³ by means of pipes *l*², *l*³, and K⁷. The rams L are each shown provided with a T-head L³, containing a transverse bolt-hole *l*⁴. To the head L³ a pair of hangers L⁴ are shown attached by a bolt *l*⁵, passing through their upper ends and through said bolt-hole *l*⁴. The lower ends of the hangers L⁴ are shown secured by means of bolts *l*⁶ to shoulders E², projecting from opposite ends of the platen E.

The ends of the die-cavity D' are preferably closed by end gates M and M', Figs. 1, 2, 3, 4, 5, and 8, preferably fastened together by means of a pair of bolts M², passing on opposite sides of the press. The inner faces of said gates rest against and may be guided by and held in position longitudinally by the members D and D² of the press-die and are preferably prevented from moving laterally by guide blocks M³, secured to the bolts M², and which move in contact with the guide-plates G, Figs. 1 and 4, hereinafter referred to. Each of the gates M and M' preferably contains a central opening *m*, passing through it from top to

bottom, Figs. 1, 5, and 8, and the gate M, closing the mouth d^8 of the die-cavity D', preferably has a cavity m' formed in its inner face, Figs. 8 and 11, and a slot m^2 in the under side thereof, Figs. 13 and 14. The gates M and M' are raised by means of a pair of vertically-movable cylinders N, Figs. 1, 2, 3, and 5, to which they are connected by hangers N'. I prefer to use a pair of these hangers for each gate and preferably secure the upper ends of each pair to opposite sides of the proper cylinder by means of a bolt n and attach their lower ends to lugs m^3 , projecting from the gate, by means of bolts n' . The cylinders N each reciprocate upon a stationary ram N², secured to the top frame B by bolts n^2 , and which contains a passage n^3 , connecting the interior of the cylinder N, reciprocating thereon, with a port n^4 . The ports n^4 are preferably connected with a valve-chest N³, provided with passages, valves, and connections, substantially like the device for governing the passage of water to and from the cylinders I and I' illustrated in Fig. 11.

In the apparatus shown in the drawings the crimping mechanism O, Figs. 1 and 7, is preferably arranged in front of the press and in position to assist in feeding it. It preferably contains a pair of fluted crimping-rolls O', each having projections o , which enter the interdental spaces o' of the other, and each preferably contains an encircling groove o^2 , which preferably follows the contour of the roll and preserves substantially the same depth throughout. When the rollers are in position, said grooves come opposite and coact with each other. Each groove is perfectly adapted to receive one side of a rail, and the opening o^3 , formed between the rolls by the two opposite grooves, is preferably adapted to receive the end of a rail P when presented with one side uppermost. The rolls O' are preferably journaled one above the other in standards O² and may be provided with intermeshing gears O³, though they are not essential. A pulley O⁴ for communicating motion to the rolls is shown attached to one of them. When the crimping-rolls O' are in motion in the direction indicated by arrows in Fig. 1, a rail presented to them on the outer side thereof, with one end in position to enter the opening o^3 between them, is drawn in, crimped, and forced along in the direction of the die-cavity of the press. After leaving the crimping-rolls the crimped rail P in the form of apparatus shown enters a guiding-trough O⁵, Figs. 1, 5, and 8, shown supported upon a standard o^4 , and which preferably contains a slot o^5 , extending inward for a short distance from the inner end. The crimping-rolls preferably continue to propel the rail forward until its front end passes beyond said trough and preferably until it reaches a pair of vertical feed-rolls Q, which are preferably used and arranged in position to receive the crimped rail and pass it on to the press. Said rolls are preferably placed so that they can enter

the vertical opening m in the gate M when said gate is lowered and in that way avoid interference while standing nearer the mouth of the die-cavity than would otherwise be practicable. They are preferably supported upon shafts q and are preferably driven at a speed enabling them to coöperate with the crimping-rolls. Motion may be communicated to one of said shafts q from a shaft Q' through gears q^3 and q^4 and from that shaft to the shaft q of the other roll through gears q^5 , Figs. 1, 8, and 10, or by any other suitable means. After the crimped rail leaves the crimping-rolls and ceases to receive motion therefrom the feed-rolls Q continue to force it forward into the die-cavity D' until its outer end reaches a point where said rolls lose their grip, and it then becomes desirable to supply some additional means for forcing the rail completely into the die-cavity. In the mechanism which I prefer to use for that purpose a reciprocating pusher-foot R is pivoted or hinged to a cross-head R', preferably by means of a substantially horizontal pivot r , and is preferably adapted to turn forward into a substantially horizontal position and to come to rest when turned back into a vertical position against a shoulder r' . Said shoulder preferably contains a cavity r^2 , and at a point near the inner end of this cavity I preferably secure a tension-spring r^3 to the cross-head and by securing the outer end of said spring to the back of the presser-foot R cause it to tend at all times to draw said foot up against said shoulder r' . Slides r^4 preferably project from the ends of the cross-head R' and slide in parallel grooves r^5 , formed in guides r^6 . Motion is communicated to the cross-head and the pusher-foot attached thereto through a piston-rod r^7 , attached to a piston r^8 , which reciprocates in a cylinder R², having ports r^9 and r^{10} , and which is shown attached along the under side of the trough O⁵. The ports r^9 and r^{10} are respectively connected by pipes r^{11} and r^{12} with ports r^{13} and r^{14} of a valve-chest R³, Figs. 5 and 10, whose inlet-port r^{16} is shown connected with the supply-main K³ by a pipe k^8 , and a pipe r^{17} leads from the exhaust-port r^{18} . The valve-chamber r^{15} shown contains a common slide-valve r^{19} , which in one position connects the pipe r^{11} with the exhaust and permits water to pass to the pipe r^{12} from the valve-chamber and in the opposite position connects the pipe r^{12} with the exhaust and allows water to pass from the valve-chamber to the pipe r^{11} . The valve r^{19} is shown operated by means of a lever R⁴, pivotally connected with the valve-rod r^{20} and connected with the valve-chest by means of a link r^{21} . The described valve-chest R³ and its valve and ports are all of common form.

When water is admitted to the cylinder R² through the port r^{10} , the piston r^8 is forced back and draws the cross-head R' and presser-foot R back with it until the latter stands back of the rolls, as shown in dotted lines in Fig. 8. The rail to be subjected to the action

of the press is then started on its way through the crimping-rolls, and when it reaches the presser-foot presses it down in front of it and passes over it. As soon as the rail has passed the presser-foot water is admitted to the cylinder through the port r^9 and allowed to exhaust through the port r^{10} and the presser-foot R is forced forward and follows the rail until it strikes it and then pushes it forward into the die-cavity until the rail is in position to be operated upon by the press. The presser-foot R preferably stops at the mouth of said cavity in the position in which it is illustrated in Figs. 1, 8, and 13 and preferably remains there, partially closing the mouth of said cavity, until the press has done its work. As soon as the rail is in position the end gates M and M' of the press are lowered, so as to close the ends of the die-cavity D'. When the gates M and M' are lowered, the presser-foot R passes into the cavity m' in the face of the gate M and preferably fits it closely. As soon as the end gates are closed the platen E is lowered, and the rail, whose crimped form is approximately in dotted lines in Fig. 1 and in full lines in Figs. 8 and 14, is substantially straightened and at the same time compressed longitudinally and increased in cross-sectional area, while preferably at the same time kept in the shape of a rail in cross-section by the die. Its preferred form when compressed is indicated in Figs. 1, 3, 14, and 15. When the remodeling of the rail is thus accomplished, the end gates and the platen E are both caused to rise by a suitable movement of the proper valve-levers, and the presser-foot R is then caused to resume its original position. I prefer to so proportion the parts as to cause the end gates to rise more rapidly than the platen E, so as to loosen the ends of the compressed rail, and, though it is not essential, I consider it a good plan to set the end gates in motion before the platen. In its upstroke the platen E preferably rises high enough to leave a longitudinal opening d^5 in the side of the die-cavity for the passage of means for forcing the compressed rail P² far enough forward to enable it to be gripped by suitable means for drawing it out of the press. In the form of discharger mechanism S, Figs. 3, 5, 6, and 16, which I prefer to use a cylinder S', provided with trunnions s and s' , turns in a horizontal plane in bearings s^2 , shown supported by a standard s^2 . It contains a reciprocating piston s^3 , to which a piston-rod s^4 is attached. The piston-rod s^4 projects through the inner end of said cylinder, and the outer end of said rod is preferably provided with a finger s^5 , adapted to enter the opening d^5 in the side of the die-cavity when the platen E is at the end of its upstroke and said finger is in its outermost position, as shown in Fig. 3. The finger s^5 is caused to extend forward far enough to enter said die-cavity by admitting water through a port s^6 , back of the piston s^3 , and is drawn out of said cavity by admitting water through

the port s^7 in front of said piston and allowing the water back of the piston to exhaust through the port s^6 .

To the ends of each of the trunnions s and s' tubes s^8 and s^9 , whose outer ends are respectively closed and which each contain perforations s^{10} , are respectively preferably attached. The tube s^8 is connected with the port s^6 by means of a pipe s^{11} , and the tube s^9 is connected with the port s^7 by means of a pipe s^{12} . The tube s^8 rotates in a pipe-coupling s^{13} , which connects its perforations s^{10} with a pipe s^{14} , and the tube s^9 rotates in a similar coupling s^{13} , which connects its perforations s^{10} with a pipe s^{15} . The pipes s^{14} and s^{15} lead, respectively, to ports r^{13} and r^{14} of a valve-chest S³, which, together with its interior mechanism, is preferably exactly like the valve-chest R³, Fig. 10, and corresponding parts are lettered alike in each. The chest S³ is shown connected with the supply-main by pipes s^{16} and k^3 . In operating the discharger the piston s^4 is forced out to the end of the stroke, so that its finger s^5 is directly behind the rear end of the rail, as shown in Figs. 3 and 5, and then while thus extended they are moved forward in the arc of a circle and made to force the compressed rail far enough out of the die-cavity to enable the rotating withdrawing-rolls T to catch it. After that water is admitted into the cylinder through the port s^7 and the piston-rod retracted and its finger s^5 drawn out of the opening through the side of said die. At the same time the cylinder S' and said piston-rod and finger are caused to swing back until the cylinder is once more in the position in which it is illustrated. This swinging motion is preferably communicated to the cylinder S' by means which I will now describe. A cylinder S⁴, attached to and supported by the standard S³, contains a reciprocating piston-head s^{17} , whose piston-rod s^{18} is provided at its outer end with a T-head s^{19} , which is shown connected with trunnions s^{20} , projecting from the cylinder S' by means of links s^{21} . The cylinder S⁴ is provided with ports s^{22} and s^{23} , from which pipes s^{24} and s^{25} lead to a valve-chest S⁵, which and the valve mechanism therein may be in all respects like those of the valve-chests R³ and S³. The pipe s^{24} preferably connects with a port r^{13} and the pipe s^{25} with a port r^{14} . The withdrawing-rolls T, Figs. 1 and 12, are preferably in all respects like the rolls Q, hereinbefore described, and preferably rotate at about the same speed and in the same direction. They are preferably arranged immediately beneath the opening m in the gate M', as shown, and enter said opening when the gate is lowered. They are preferably supported upon shafts t , journaled in bearings t' and t'' . One of the shafts t in the arrangement illustrated receives motion from a shaft T' through gears t^3 and t^4 , and from that shaft motion is communicated to the shaft t of the other roll through gears t^5 or any other suitable means. When the longitudinally-compressed

5 rail P² is pushed far enough out of the die-cavity D' to be gripped by the rolls T, they catch it and continue its withdrawal until it is pulled completely out of the die-cavity. After it leaves said rolls it may be removed from their neighborhood by any suitable means.

Though the apparatus described is the one I prefer to use in carrying out my process, any other suitable apparatus may be used.

10 I do not herein claim an apparatus for carrying out my new process, the same constituting the subject-matter of an application (which is a division hereof) for Letters Patent filed August 3, 1900, Serial No. 25,753.

15 I claim—

1. The process of increasing the cross-sectional area of metal rails and analogous articles consisting in forming in each article treated a series of crimps, and after crimping it, 20 subjecting it to transverse pressure substantially in the plane of its crimps, while limiting its movement at an angle to the direction in which pressure is applied, and the longitudinal movement of its ends, and so transforming a part of the transverse pressure applied, into longitudinal pressure.

2. The process of increasing the cross-sectional area of metal rails and analogous articles consisting in heating each article treated 30 to a heat not lower than a red heat and not high enough to injure the metal therein; forming

ing in each, a series of crimps in substantially the same plane; and subjecting each crimped rail or other article while at a temperature not lower than a red heat, to transverse pressure, substantially in the plane of its crimps, while limiting its movement at an angle to the plane of its crimps, and the longitudinal movement of its ends and so transforming a part of the transverse pressure applied, into longitudinal pressure. 35 40

3. The process of increasing the cross-sectional area of metal rails and analogous articles, consisting in forming in each article treated, a series of lateral crimps in substantially the same plane, and subjecting each crimped article to transverse pressure substantially in the plane of its crimps, while limiting its movement, at an angle to the plane of its crimps, and the longitudinal movement 50 of its ends, and governing the transverse flow of the metal therein, and so transforming a part of the transverse pressure applied into longitudinal pressure and increasing its cross-sectional area and giving it a substantially uniform size and shape in cross-section, throughout simultaneously, substantially as described. 55

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