(No Model.)

F. LIGHTFOOT.

METHOD OF AND DIE FOR FORMING RAIL JOINTS.

No. 294,053. Patented Feb. 26, 1884.

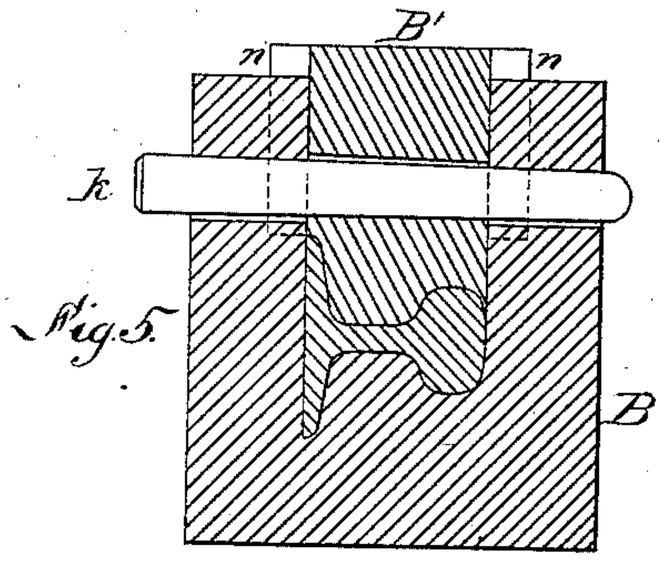

Fig. 5.

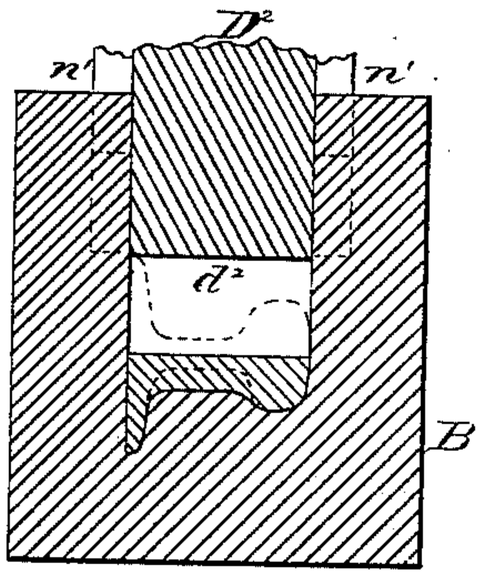

Fig. 6.

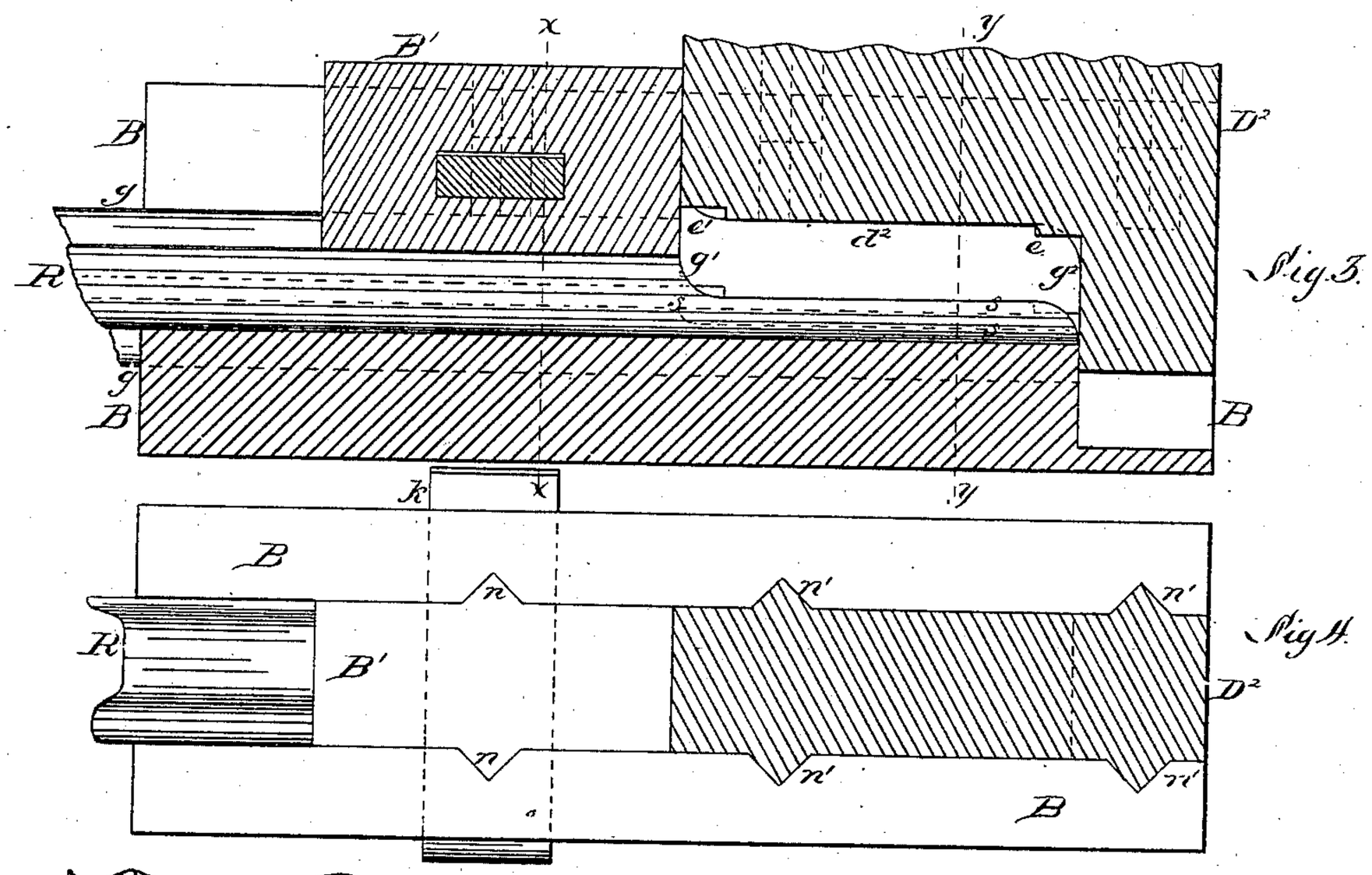

Fig. 3.

Fig. 4.

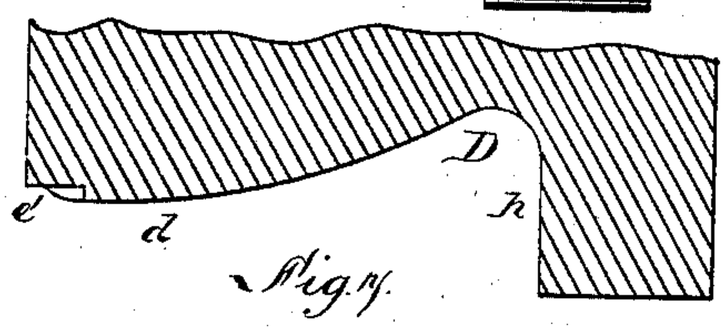

Fig. 7.

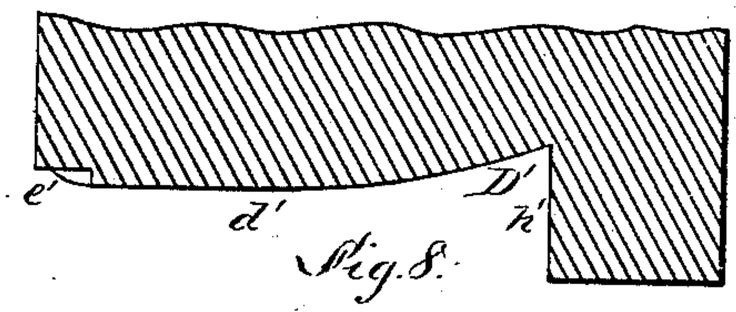

Fig. 8.

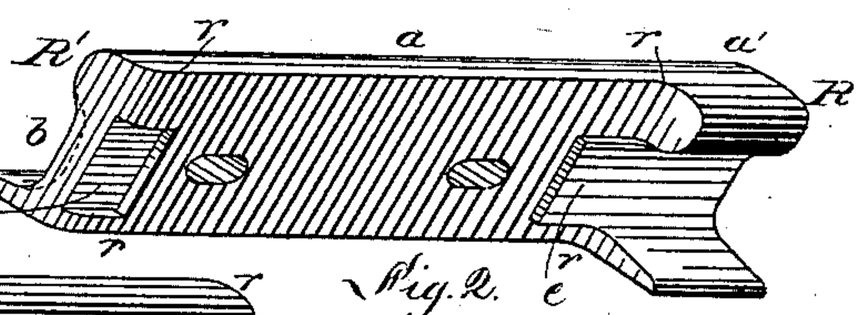

Fig. 2.

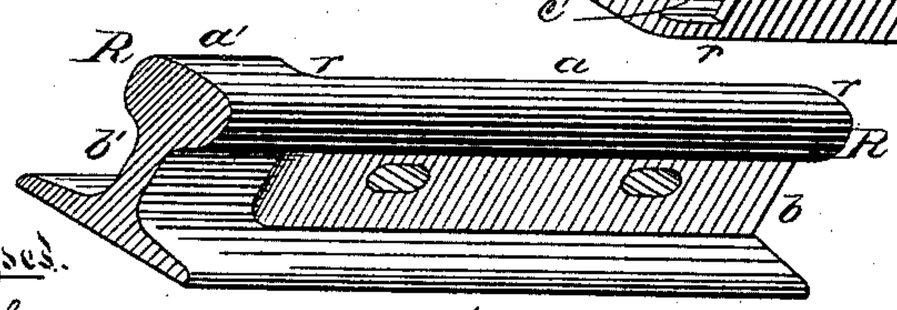

Fig. 1.

Witnesses.
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UNITED STATES PATENT OFFICE.

FRANCIS LIGHTFOOT, OF MEDIA, PENNSYLVANIA.

METHOD OF AND DIE FOR FORMING RAIL-JOINTS.

SPECIFICATION forming part of Letters Patent No. 294,053, dated February 26, 1884.

Application filed May 12, 1883. (No model.)

To all whom it may concern:

Be it known that I, FRANCIS LIGHTFOOT, a citizen of the United States, residing at Media, county of Delaware, State of Pennsylvania, have invented or discovered a new and useful Improvement in Methods of and Dies for Forming Rail-Joints; and I do hereby declare the following to be a full, clear, concise, and exact description thereof, reference being had to the accompanying drawings, making a part of this specification, in which—like letters indicating like parts—

Figures 1 and 2 are views in perspective of rail ends, showing the form or style of joint which the dies of the other figures are adapted to make. Fig. 3 is a vertical sectional view of the clamping-dies employed, showing a rail and the finishing-die in place, but the latter being at the end of its back-stroke. Fig. 4 is a top view of Fig. 3, except that the finishing-die is shown in section. Fig. 5 is a cross-section of Fig. 3 in the plane of the line *x x*. Fig. 6 is a cross-section in the plane of the line *y y*, Fig. 3, and Figs. 7 and 8 are longitudinal vertical sections of the first and second dies employed.

In Letters Patent of the United States No. 262,438, granted to me August 8, 1882, I described and made claim to an improved form or construction of rail-joint, which was characterized, chiefly, by the fact that the lapping rail ends were so upset as to be reduced in width, but retain their full weight. I have found that while thus upsetting the rail ends, or, as it may perhaps be better termed, laterally swaging or pressing them over to one side of the vertical longitudinal central plane of the rail, it is in some respects better to elongate them a little, or to draw somewhat the metal so swaged or pressed over; or, in other words, I have found that I can get a sufficiently strong joint with less labor and expense by so shaping the dies that while acting laterally on the side of the rail to press the metal of the full rail into a half-rail form they shall at the same time act partly to draw a portion of the metal of the rail end longitudinally along, and so elongate it somewhat; but even with this modification I still press the greater part of the metal of the rail end—say, in general terms, from sixty to eighty per cent.—directly over to or to one side of the vertical longitudinal middle plane of the rail end, and draw forward longitudinally and also displace laterally from about twenty to forty per cent. (more of less) of such metal, and this, which is the preferred embodiment of my method of making rail-joints, together with a suitable construction of dies for such purpose, I will now describe as constituting the present invention.

The method referred to consists in laterally forcing, by side pressure, all or nearly all of the metal of the rail end to or to one side of the longitudinal vertical middle plane of the rail, thereby bringing it to a half-rail form in such manner that the half-head shall have only half the width of tread of the full rail, and the web, while reduced in thickness on the side to which the pressure is applied, shall receive an added thickness on the other side, and at the same time the rail end shall be somewhat elongated. Rail-joints thus made are represented in Figs. 1 and 2, where the ends R represent the full size and shape of the ordinary T-rail. The metal of the rail ends is by the use of dies, presently to be described, forced over laterally with slight elongative side pressure to or beyond a plane, *r r*, which passes vertically along the middle of the rail in the direction of its length, so that each part or end R′ so worked shall have a half-tread, *a*, equal or approximately equal in breadth to one-half the full tread *a′*, and the web *b′* of the original rail, being reduced one-half in thickness by such pressure on one side, shall be increased in thickness on the other side, as represented at *b*. Preferably a tongue, *c*, and recess *c′* are made in each rail end, substantially as represented, so that the tongue *c* of one rail end may fit neatly into the recess *c′* of the other rail end, for purposes well understood. This work being done on one side at one end of the rail, and on the opposite side at the other end, and on corresponding sides in different rails, all rails so made will be duplicates of each other, and may be lapped or bolted or otherwise secured without regard to which way the ends come. The described proportioning of the treads gives a continuous tread of uniform size in the laid track, and the enlargement given to the outer side of each end web, as at *b*, makes up for the loss of strength which would necessarily result if the rail ends were merely halved. The residue of the metal thus laterally dis-

placed, and which will in any case be less than fifty per cent. thereof—say generally from twenty to forty per cent.—is by a "drawing" or elongating action worked out so as to lengthen somewhat the reduced rail end. I have found that an elongation of about from one-quarter to one-third of the total length of the reduced part gives good results—that is to say, by subjecting from six to seven inches of the length of the rail end to the action of the dies, as presently to be described, I secure the product desired with a reduced or lapping part of, say, from nine to eleven inches in length, more or less; but longer laps may be made by taking in a longer length of rail end; but the necessity of thickening the web, or, what amounts to the same thing, deepening the head on the outer and under side, will render it necessary to limit the drawing operation to an amount corresponding to less than fifty per cent. of the metal operated on.

The method of operation thus described may be practiced, among other ways, by the use of clamping and movable dies, substantially such as are represented in the drawings, but in which, as shown, the rail is laid on its side, and the compressing-die, while moving in a vertical direction, actually acts laterally as regards the rail end—that is, by a motion sidewise thereto—so as to compress the same in the manner above described.

B represents a U-shaped die-box, the bottom of which through its clamping portion—say from g to g', Fig. 3—is made of the shape of the side of the rail, and from g' forward to the end g^2 it is made of the same shape, except that beneath the web of the rail a recess is made suitable for the formation therein of the thickened rib b of Fig. 1. The shape of this recess is shown by dotted lines s s in Fig. 3 and by full lines in Fig. 6. The rail R (its end being first properly heated) is laid in the box on its side, with so much of its end projecting beyond the point g' as it may be desired to work or compress in the manner described. A clamping-die, B′, the lower end of which conforms to the shape of the side of the rail, is then secured tightly in place by a key, k, or in other suitable way, and lugs and grooves n may be added to insure the accurate seating of the clamping-die. The projecting rail end is then worked or operated on in succession, with or without reheating, by a series of movable and removable dies, D D′ D^2, in any desired number. Each die is provided with guiding-lugs n', which play in grooves in the side walls of the die-box. Taking first the die D, its working-face d is made full at the end next the clamp, but with only a moderate amount or degree of taper or inclination backward toward the end abutment, h, so that while its principal effect will be directly to compress and flatten the adjacent side of the rail and force the metal over into the recess or depression s, it will also to a moderate degree tend to draw a portion of the metal forward toward the abutment h. The force to do this work may be applied by the swaging blows of a power-hammer or by a hydraulic or other suitable press. This die, having done its work, is removed, and a second die, D′, is inserted and similarly operated. The working-face d' of this die approaches much more nearly a right line, so that its action is more completely a flattening and compressing one. Preferably it has a little drawing action along near its abutment h', so as with greater certainty to effect the drawing action desired. This die is then removed, and the third or finishing die, D^2, is inserted and operated as before. Its working-face d^2 conforms to the front face of the reduced part of the rail end, as shown in Fig. 2. The rail is then reversed, its opposite end worked the same way on the opposite side, and the operation is complete.

I have omitted specific description of the projections e and recesses e' in the die-faces, by means of which to make the recesses e' and the tongue e of Fig. 2; but these are an efficient auxiliary in getting a substantial joint; but other forms of irregular surfaces may be made on the lapping faces of the reduced rail ends, such that by interlocking with each other the strength and stability of the joint will be promoted; but such irregularities should in any event be comparatively shallow or small, so that, as regards the amount of metal employed in making them, they involve no substantial variation or departure from the requirement above referred to—that the metal of the rail end must be forced over laterally till the flattened side is in or substantially in the vertical longitudinal middle plane of the rail.

The work done by the first die, D, or the second die, D′, may be divided, so as to be done by two dies, each adapted to take up the work where the previous die left it, and carry it on in the same direction. Hence I do not limit myself to any particular number of dies, but believe three to be enough to insure good product with rapid working. The shape of the working-faces of the dies may also be varied more or less; but the skilled constructer will always keep in mind the essential requirements in the operation set forth—first, a compressing action, which secures the half-rail form, but thickened in the web, and, second, a drawing action, the two actions being relatively proportioned about as described.

The method of operation herein described is not limited to the use of the dies described, as the same results may be secured, though less advantageously, by a rolling instead of a swaging or pressing operation. Thus one or more rolls may take the place and do the work of the dies D D′ D^2, the rail being laid on a reciprocating table die, with the upper half of the rail exposed above the surface of the table, and the roll being so arranged that its work shall be done progressively from the point g' to the end of the rail; or the end may

be hammered down on an anvil-die or other like mechanism, or a combination of such mechanisms be employed.

I claim herein as my invention—

1. The method of making rail-joints which consists in laterally flattening each end of the rail, but on opposite sides, at opposite ends, down to the longitudinal vertical plane of the middle of the rail, thickening the web on the outer side thereof, and elongating the reduced end by means of dies, substantially as set forth.

2. A die-box, B B′, for clamping a rail and supporting its projecting end beyond or outside the clamping-point, in combination with a series of dies, D D′ D², more or less in number, for progressively elongating and flattening the rail end down to the vertical longitudinal middle plane of the rail, substantially as set forth.

3. In combination with the die-box B B′, the dies D D′ D², three or more in number, having working-faces *d d′ d²*, substantially as and for the purposes set forth.

4. The series of dies D D′ D², having each a recess, *e′*, for the formation of a tongue, *c*, substantially as set forth.

5. The die D², having recesses *e′* and projection *e*, substantially as and for the purposes set forth.

In testimony whereof I have hereunto set my hand.

FRANCIS LIGHTFOOT.

Witnesses:

J. R. FOULKE,

CALEB J. DUXBURY.