

April 23, 1929.

E. S. SEAVEY

1,710,592

METHOD OF FORMING SPLICE BARS

Filed March 10, 1926

3 Sheets-Sheet 1

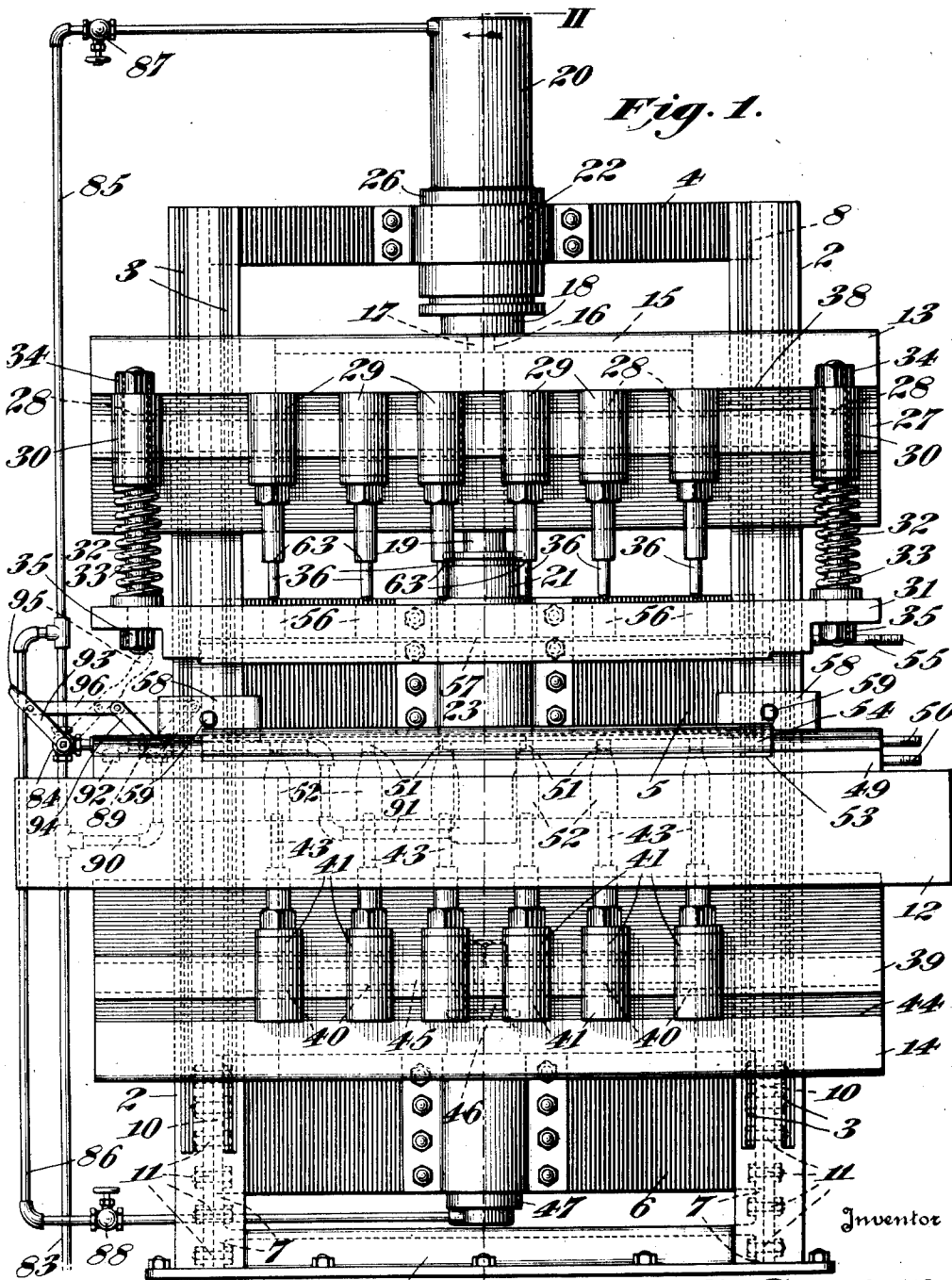


Fig. 1.

Inventor

Elmer S. Seavey.
By R. S. A. Dougherty

Attorney

April 23, 1929.

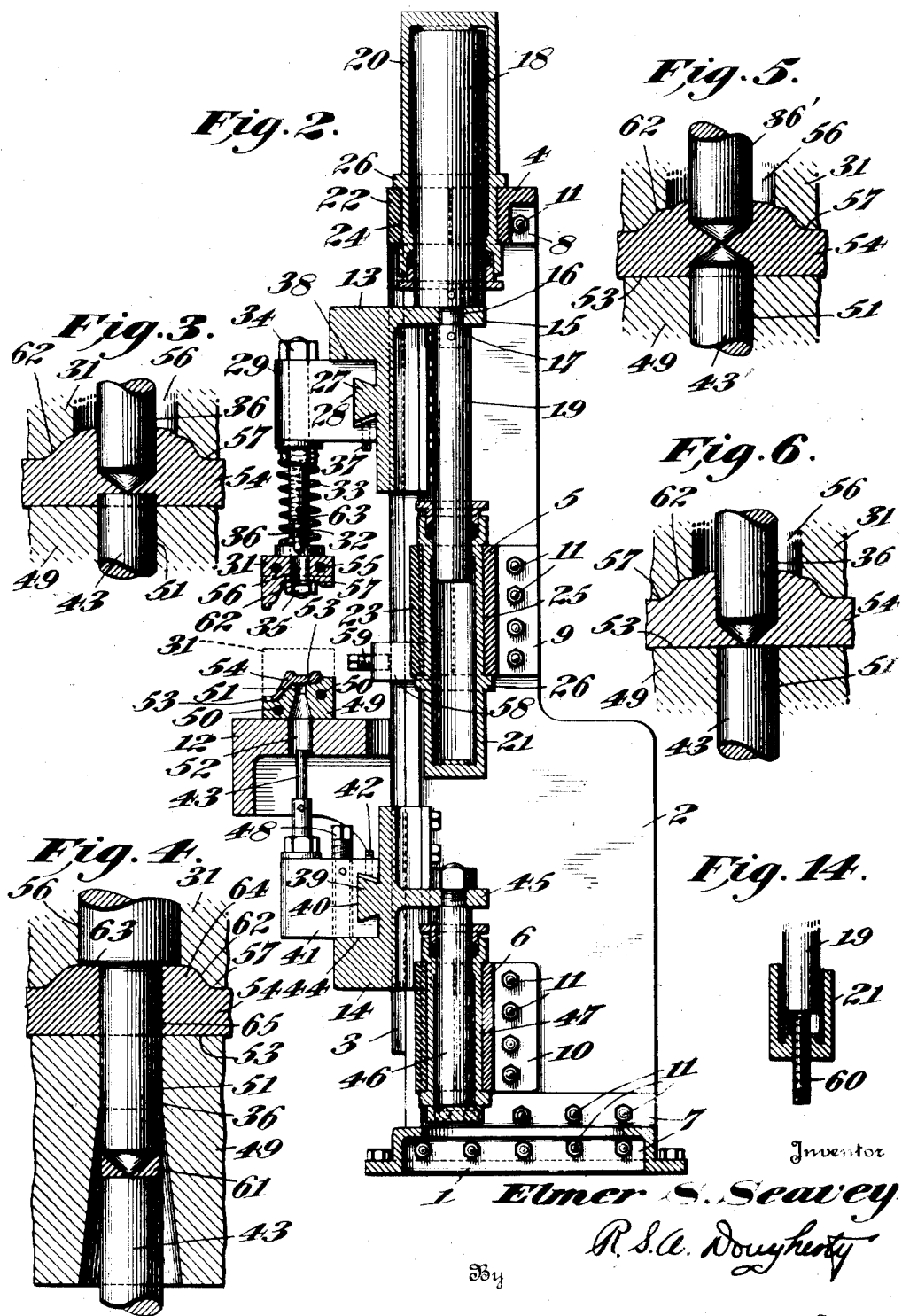
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Fig. 7.

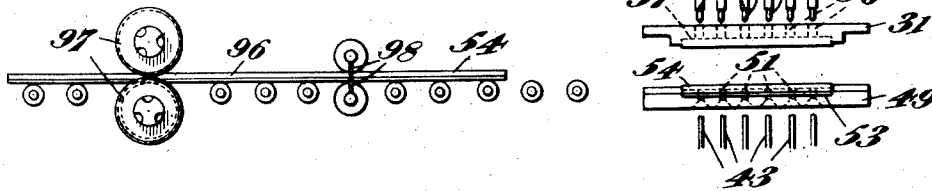


Fig. 8.

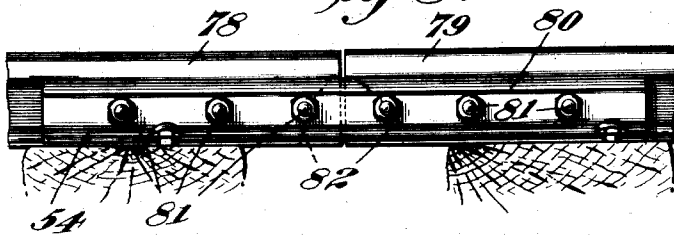


Fig. 10.

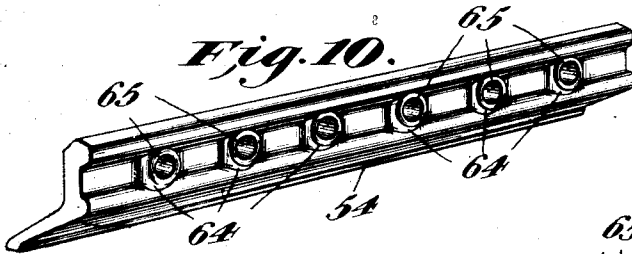


Fig. 11.

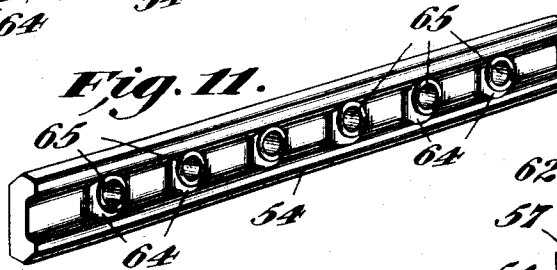


Fig. 9.

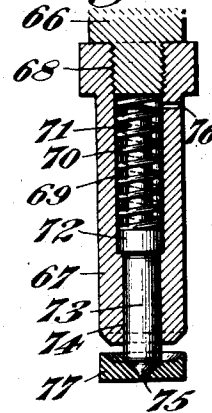


Fig. 13.

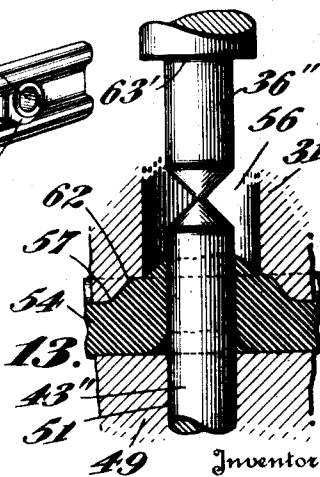
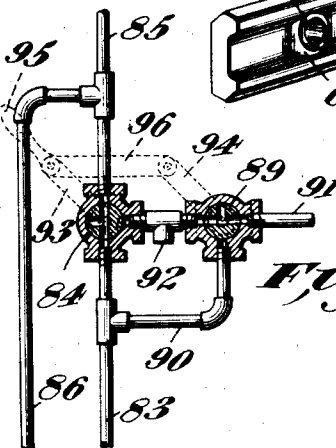


Fig. 12.



Elmer S. Seavey.
R. S. A. Dougherty

Patented Apr. 23, 1929.

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UNITED STATES PATENT OFFICE.

ELMER S. SEAVEY, OF BETHLEHEM, PENNSYLVANIA, ASSIGNOR TO BETHLEHEM STEEL COMPANY.

METHOD OF FORMING SPLICE BARS.

Application filed March 10, 1926. Serial No. 93,614.

My invention relates to a method for perforating metal bars and in forming bosses around the perforations, and is more especially adapted for use in the manufacture of splice-bars used for connecting together the abutting ends of railway track-rails or the like.

One of the objects of my invention is to form perforations in splice-bars or the like without reducing the stiffness of the bar.

Another object of my invention resides in the manner I have of punching the bar whereby a considerable stronger bar is produced without adding materially to the weight of the bar or cost of manufacturing the same.

A further object of my invention relates to the method of perforating and reinforcing splice-bars by extruding the metal in forming the holes punched around the punches at the side of the bar to form reinforcing bosses at one operation.

Another object of my invention relates to perforating and reinforcing a metal bar in such a manner as to extrude the metal in forming the holes around the punches at the side of the bar and then compressing the extruded metal to form a reinforcing boss around the holes punched.

Heretofore in the manufacture of splice-bars of low carbon steel a stock bar of a considerable length is rolled, which, after it issues from the finishing roll-pass, is conveyed to a hot-bed to cool. After the stock-bar has become cold it is cut into the desired splice-bar lengths, and then perforated. It is the usual practice to punch the holes in these splice-bars while the bar is cold, and it often happens in so doing that the sides of the holes are left rough, or fractures occur around the punched holes due to imperfect punching. However if high carbon steel is used in making splice-bars it is now the usual practice to reheat the splice-bar lengths just before punching. In any case, when a perforation is formed in the usual splice-bar one third to one fourth of the cross sectional area of the bar is cut or punched out of the bar, reducing relatively the strength of the bar at this point. To obviate this difficulty and to develop as near as possible the strength of the full cross-sectional area of the bar, I punch holes in the bar while the bar is hot or in a semi-plastic condition, and preferably as indi-

cated diagrammatically in Fig. 7 just after the stock-bar has left the finishing roll-pass, it is cut into the desired lengths and then conveyed to a perforating machine, which punches holes in the bar, but instead of punching out the metal in the bar to form a hole, I punch holes in the bar in such a way that the metal is displaced or forged laterally around the hole in the bar thereby forming a reinforcing boss on the side, or sides of the bar.

In some cases it may be found preferable not to operate the rolling mill in conjunction with a punching machine, for the reason that in case one of the machines breaks or is made inoperative for any cause the other machine would have to remain idle thereby effecting two shifts of men, and I do not wish to limit myself to punching the bar directly after rolling but may reheat and punch the splice-bar lengths at any time after the bar has been rolled.

Other objects of my invention will appear hereinafter.

Having thus given a general description of my invention, I will now, in order to make the same more clear, refer to the accompanying three sheets of drawings in which like characters of reference indicate like parts.

Fig. 1 is a front elevation of my improved machine adapted to perforate metal bars,

Fig. 2 is a vertical section of the machine shown in Fig. 1, taken on the line II—II of Fig. 1.

Fig. 3 is a detail view drawn on a larger scale illustrating the first position in perforating a bar with one kind of a pair of oppositely disposed punches, one punch having a flat end face being advanced into the bar to be punched to the end of its working stroke, while the other punch has a pointed end face which has advanced until it has met the flat face of the opposite punch.

Fig. 4 is a detail view similar to that shown in Fig. 3 but showing the position of the punches at the end of the perforating operation,

Fig. 5 is a detail view illustrating the first position the punches will assume in punching a bar, when the punches both have pointed end faces.

Fig. 6 is a detail view similar to Fig. 3, but showing the punch with the flat end face advanced to the end of the working stroke,

only to the side of the bar to be punched,

Fig. 7 illustrates diagrammatically how a bar may be rolled, cut into lengths and then perforated, without reheating the bar.

Fig. 8 shows the manner of splicing the abutting ends of a pair of railroad-rails together and the points at which a splice-bar usually fails under heavy load.

Fig. 9 illustrates a form of punch I may use having an ejector for preventing the slug from sticking to the ends of the punches at the end of the punching operation.

Fig. 10 is a perspective view of the inside of an angle splice-bar of well known type with bosses formed around the perforations in accordance with my invention.

Fig. 11 is a perspective view of the inside of another type of splice-bar with bosses formed around the perforations similar to those illustrated in Fig. 10.

Fig. 12 is a detail view of the valve controlling mechanism and pipe connections for reciprocating the punch carriages.

Fig. 13 illustrates the first position of another manner of punching a bar and forming a boss around the perforation; and

Fig. 14 illustrates an adjustable stop formed in the end of one of the cylinders for reciprocating the punch carriages.

Referring now to the characters of reference on the drawing and more especially to Figs. 1, 2, 3, 4, 6, 10, and 11 the numeral 1 indicates the base plate of the punching machine and 2 the side frames having slide-ways formed thereon as at 3, 4 the top frame, and 5 and 6 intermediate cross tie members, all of which are flanged as at 7, 8, 9 and 10, respectively, and attached to the side frames 2 by means of bolts 11. The side frames 2 are further connected by means of a work-receiving table 12 for supporting the work to be punched.

Oppositely disposed carriages 13 and 14 are adapted to reciprocate on the slide-ways 3. The carriage 13 having rearwardly extending flanges 15, perforated at 16, for receiving pin 17 which connect the pistons 18 and 19 of the main punching pressure cylinder 20, mounted on the top frame 4, and the pull back cylinders 21, mounted on the cross tie member 5 by means of flanged clamping segment plates 22 and 23 which engage grooves 24 and 25 in the sides of the cylinders between the shoulders 26 and the enlarged inner ends thereof.

The carriage 13 is formed with a dove-tailed projection 27 which extends into dove-tailed grooves 28 formed in the punch-holders 29 and into the bracket supports 30 for the resiliently mounted die 31, said die being attached to the supports by means of bolts 32, at each end of the die. A helical spring 33 with washers at each end is mounted on the bolts 32 between the resil-

iently mounted die 31 and the bracket supports 30, one end of said bolts extending through the bracket supports 30, with a nut thereon as at 34, while the opposite ends extend through the outer ends of the resiliently mounted clamping-die with a retaining nut as at 35. The punch-holders 29 which carry punches 36, and the bracket supports 30 are adjustably mounted on the dove-tailed projection of the reciprocating carriage 13 and are retained in adjusted position by means of set-bolts 37, and to more fully support and back up the punch-holders and bracket supports I provide an outwardly extending abutment 38.

The oppositely disposed carriage 14 is similar in construction to carriage 13, having a dove-tailed projection 39 engaging dove-tailed grooves 40 in the punch-holders 41 which are retained in adjusted position by means of set-bolts 42 and carry punches 43, said carriage having an outwardly extending abutment 44, and a rearwardly extending flange 45, to which is attached the piston 46 of a fluid-pressure cylinder 47 which is mounted on the cross frame 6. The carriage 14 is limited in its upward movement by means of adjustable stop-bolts 48 which are carried by two or more of the punch-holders 41 and engage the under side of the work-receiving table 12. 49 indicates a stationary die mounted on the work-receiving table 12 which may have water cooling pipes 50 and perforations therethrough as at 51, which register with slots or holes 52 in the work-receiving table through which the punches extend. The top surface of the stationary die is recessed as at 53, and made to conform in contour to one side of the bar 54 to be punched.

The movable die 31 is mounted opposite the stationary die 49, having water cooling means 55 and perforations 56 for the passage of the punches, and having its outer face 57 made to conform to the contour of the other side of the bar 54.

The carriage 13 is limited in its downward movement by means of stops 58, which are mounted on the slide-ways 3 and which may be adjusted and held in any desired position by means of set-bolts 59, or as indicated in Fig. 14 a set-bolt 60 may be used in the lower end of the pull back cylinder 21 against which the end of the piston contacts to limit the forward movement of the carriage.

I may however in some cases dispense with the adjustable stops 58 and 60, and limit the downward stroke of the carriage 13 by means of the lower end of the piston 19 coming in contact with the end wall of the cylinder 21.

Referring to Figs. 1, 2, 3, 4, 6 and 7, it will be noted that one of the punches indicated by the numeral 43 has a flat end face while the opposed punch 36 has a pointed

end face. In this way a smaller slug 61 of scrap is punched out, although both of the punches may be made pointed as shown in Figs. 5 and 13, if desired.

5 In Fig. 3, I have illustrated on a larger scale the bar to be punched, confined between the dies 31 and 49. The die 31 having a recess formed therein as at 62. In this figure, punch 43 has pierced the bar a short distance and is shown at the end of its working stroke while punch 36 has pierced the bar from the opposite side and advanced until the pointed end has come in contact with the flat face of the end of punch 43, and, in so doing has extruded the metal around the punch, filled the recess 62, and extended into the perforation 56 in the movable die 31. Owing to the greater diameter and power of the piston 18, for advancing the carriage 13, over that of the piston 46 for advancing the carriage 12, the punch 36 will continue to advance forcing back the punch 43 until the carriage 13 comes in contact with the stops 58, and the end of the enlarged portion 63 of the punch 36 comes in contact with the extrusion flow of metal adjacent thereto, thereby compressing it and forming a boss 64 around the perforation 65 as shown in Fig. 4 of the drawings.

30 In Fig. 6, I have shown a view somewhat similar to Fig. 3, but in which the punch 43 when it is at the end of the working stroke does not pierce the bar to be punched and only advances until it contacts with the side of the bar 54.

35 In Fig. 5, I have illustrated a pair of oppositely disposed punches 36' and 43', each having pointed end faces, in which both punches meet substantially in the center of the web of the bar, when punch 43' is at the end of its working stroke, otherwise the construction and operation is the same as described in Figs. 3 and 4.

40 In Fig. 13, I have illustrated another modified form of punching the bar in which punch 43'' is shown at the end of its working stroke as having passed entirely through the bar to be punched, while the point of the punch 36'' has just come in contact with the point of punch 43'' and is ready to advance until the shoulder 63' comes in contact with the extruded metal to compress it, thereby forming a boss as clearly shown in Figs. 10 and 11 of the finished bar. This method of punching shown in Fig. 13 has the advantage of having all the metal retained in the bar and no scrap or slug is punched out.

When a slug or scrap piece is punched out it often happens that the slug will stick to the end of the punch and has to be removed. In Fig. 9, I have shown a punch having means for ejecting the slug in which the punch is formed in two parts 66 and 67

67 is tubular and formed with a socket 69 for receiving a helical spring 70 which surrounds the reduced end 71 and contacts with a collar 72 of an ejecting pin 73, which extends through the central opening 74 of the head portion 67 of the punch and with the forward screw-threaded end of the punch portion 66. When the punch head portion 67 is piercing the bar the ejecting pin 73 which has a pointed outer end 75 is easily forced backward until the reduced upper end contacts with the screw-threaded end of 66 and in order that it may act more freely an air opening is formed in the side wall of the punch head portion 67 as at 76. At the end of the punching operation, the ejecting pin is projected forward by means of the spring into the position shown in Fig. 9 when the slug 77 will fall off the end of the punch.

85 In Fig. 8, I have shown the abutting ends of a pair of railroad rails 78 and 79 spliced together by means of the usual splice bar 80 and bolts 81, and 82 indicates the points where splice bars are weakest and usually break.

Referring now to the fluid pressure controlling mechanism as illustrated in Figs. 1, 2 and 12, 83 indicates the main fluid supply pipe which is controlled by a three-way valve 84 which controls the admission or exhaust of fluid pressure to the cylinders 20 and 47 through branch pipes 85 and 86, respectively. Valves 87 and 88 are provided in branch pipes 85 and 86 for opening, closing and regulating the amount of supply of fluid-pressure to the cylinders 20 and 47 so that the carriages 13 and 14 may be advanced with the desired speed so that the punches will operate together at the required time. Another three-way valve 89 controls the supply or exhaust of fluid-pressure to the pull-back cylinder 21 having a pipe connection 90 between the main supply pipe 83 and the valve, and another pipe connection 91 between the valve and the pull-back cylinder. These two three-way valves 84 and 89 are also connected together by means of an exhaust pipe 92. Arms 93 and 94 are attached to the stems of the three-way valves 84 and 89. The arm 93 having a handle 95 formed at its outer end and these arms are connected together by means of a link 96 so that both of the three-way valves will work together in unison in such a manner that when the three-way valves are in the position indicated in full lines in Figs. 1 and 12, fluid-pressure will be admitted to both cylinders 20 and 47 thereby advancing the carriages 13 and 14 to the end of the working stroke or to the completion of the punching operation, and the fluid-pressure from the pull-back cylinder 21 will be exhausted. When the arm 93 having the handle 95 is rotated a quarter of a revolution as indicated

in dotted lines in Fig. 1, the fluid-pressure from cylinders 20 and 47 will be exhausted while fluid-pressure will be admitted to the pull-back cylinder 21 as will be readily understood by referring to the drawings.

The method of punching and operation of my machine are as follows: Assuming that the splice bar length has been reheated or that the stock-bar 96 has just issued from the finishing pass of rolls 97 and the bar cut by means of a shear 98 into the desired lengths 54 and then conveyed to the stationary die 49 while still in a hot or semi-plastic condition as indicated diagrammatically in Fig. 7, and the machine and valve controlling mechanism being in the positions shown in Figs. 1, 2 and 12, which is the position they will assume at the beginning of the working stroke, fluid pressure will be admitted to cylinders 20 and 47 thereby advancing simultaneously both of the reciprocating carriages 13 and 14 toward each other. The valves 87 and 88 in the pipe connections 85 and 86 should be adjusted so that the resiliently mounted movable die 31 will contact with the face of the stationary die 49, thereby confining the bar 54 therebetween before the punching operation commences. The carriages 13 and 14 carrying punches 36 and 43 continue to advance toward each other until the punch 43 reaches the end of its working stroke which is determined by means of the adjustable stop 48, which comes in contact with the under side of the work-receiving table 12, the end of the working stroke of these punches being indicated in Figs. 3, 5, 6, and 13 of the drawings. The punches 36 carried by carriage 13 however continue to advance after it contacts with the end of punches 43, and owing to the greater size and power of cylinder 20, over that of 47, forces back the punches 43 and extrudes the metal in the bar punched, into, and filling the recesses 62 in the movable-die 31, until the shoulder 63, on the punches 36, comes in contact with the extruded metal and compresses it to the desired degree, which is determined by the carriage 13 coming in contact with the adjustable stops 58 or the lower end of the piston 19 coming in contact with the end wall of the cylinder 21. The end of the punching operation being indicated in Fig. 4.

In Figs. 10 and 11, I have illustrated splice-bars having bosses around all of the perforations. I may in some cases, however, only form bosses around the two central perforations or I may instead of forming round holes as illustrated in the drawings, punch other shaped holes with bosses around them, as oval, triangular, square, hexagonal or any other form desired, and although I have shown the bosses formed

on the inside of a splice bar they could be formed on the outside of the bar, or on both sides equally as well. Although I have shown and described my invention in considerable detail, I do not wish to be limited to the exact and specific details shown and described, but may use such substitutions, modifications, or equivalents thereof as are embraced within the scope of my invention or as pointed out in the claims.

Having thus described my invention what I claim and desire to secure by Letters Patent is:

1. The method of forming splice-bars, which consists in rolling a bar section, in cutting the section into desired splice-bar lengths, and in punching the splice-bar to form bolt-holes by extruding the metal in punching around the holes to form reinforcing bosses.

2. The method of forming splice-bars, which consists in rolling a bar section, in cutting the bar section into the desired splice-bar lengths, taking the splice-bar lengths while in a heated or semi-plastic condition and in punching bolt holes in the splice-bar by extruding metal in forming the bolt-holes around the holes to form bosses.

3. The method of forming splice-bars, which consists in rolling a bar section, in cutting the bar section into the desired splice-bar lengths, punching bolt holes in the splice-bar by extruding metal in forming the bolt-holes around the holes to form bosses on the side of the bar and then compressing the bosses.

4. The method of forming splice-bars, which consists in rolling a bar section, in cutting the bar section into the desired splice-bar lengths, taking the splice-bar length while in a heated or semi-plastic condition, punching bolt-holes in the splice-bar by extruding metal in forming the bolt-holes around the holes to form bosses on the bar, and then compressing the bosses.

5. The method of making a splice-bar, which consists in rolling a bar to form a web member with a rib at opposite edges along one side of the bar, cutting the bar into the desired splice-bar lengths, and then forming bolt holes in the web member of the splice-bar in such a manner as to extrude the metal around the bolt-holes to form bosses on the side of the splice-bar.

6. The method of making a splice-bar, which consists in rolling a bar to angular cross section having a web member with a rib at opposite edges along one side of the bar, cutting the bar into the desired splice-bar lengths, punching bolt-holes in the web member of the splice-bar by extruding the metal in forming the bolt-holes to form bosses on one side of the bar between the

ribs and then compressing the metal around the bolt-holes.

7. The method of forming splice-bars, which consists in rolling a bar section, cutting a rolled bar section just after it has left its finishing roll pass and while still in a hot and semi-plastic condition into the desired splice-bar lengths, and then punching bolt-holes in the splice-bar thereby forming bosses around the bolt-holes by the extrusion of the metal in punching the holes.

8. The method of forming splice-bars, which consists in rolling a bar section, cutting the rolled bar section just after it has left its finishing roll pass and while still in a hot and semi-plastic condition into the desired splice-bar lengths, punching bolt-holes in the splice-bar thereby forming bosses around the bolt-holes on one side of the bar by the extrusion of the metal in punching the bolt-holes and then compressing the bosses.

9. The method of forming splice-bars, which consists in rolling a bar section, cutting the bar section into desired splice-bar lengths, and then punching the splice-bar to form bolt-holes by extruding the metal displaced in punching to form bosses around the bolt-holes on the inside of the splice-bar.

10. The method of forming splice-bars, which consists in taking a rolled bar section having a web member with ribs extending from opposite edges along one side of the bar, cutting the bar into the desired splice-bar lengths, and then punching the web-member of the splice-bar to form bolt-holes by extruding the metal displaced in punching to form bosses around the bolt-holes.

11. The method of forming splice-bars, which consists in taking a rolled flanged bar of metal while in a heated or semi-plastic condition, cutting the bar into desired lengths, and then punching the splice-bar to form bolt-holes by extruding the metal displaced in punching to form reinforcing bosses around the bolt-holes.

12. The method of forming splice-bars, which consists in taking a rolled bar of metal while in a heated or semi-plastic condition, cutting the bar into desired splice-bar lengths, confining the heated splice-bar length between dies, punching the splice-bar to form bolt-holes surrounded by reinforcing

bosses formed by extruding the metal displaced in punching.

13. The method of forming splice-bars with reinforcing bosses around the bolt-holes, which consists in taking a rolled flanged bar of metal while in a heated or semi-plastic condition, cutting the bar into desired splice-bar lengths, confining the heated splice-bar length between dies, punching the splice-bar to form bolt-holes, by extruding the metal displaced in punching to form bosses around the holes, and then compressing the bosses.

14. The method of forming splice-bars, which consists in cutting a rolled flanged bar section just after it has left its finishing roll pass and while still in a hot and semi-plastic condition into the desired splice-bar lengths, confining the bar between dies adapted to conform to the contour of the bar, punching the splice-bar to form bolt-holes by extruding the metal displaced in punching to form bosses around the holes on one side of the bar.

15. The method of forming splice-bars, which consists in cutting a rolled flanged bar just after it has left its finishing roll pass and while still in a hot and semi-plastic condition into the desired splice-bar lengths, confining the bar between dies adapted to conform to the contour of the bar, punching the splice-bar to form bolt-holes by extruding the metal displaced in punching to form bosses around the holes on one side of the bar, and then compressing the bosses.

16. The method of forming perforations in splice-bars, which consists in taking a splice-bar blank while in a heated and semi-plastic condition, and then perforating the bar and forming bosses around the perforations on one side of the bar by the metal displaced in forming the perforations.

17. The method of forming perforations in splice-bars, which consists in taking a splice-bar blank while in a heated and semi-plastic condition, and then perforating the bar thereby forming bosses around the perforations on one side of the bar by the metal displaced in forming the perforations, and then compressing the bosses around the perforations.

In testimony whereof I hereunto affix my signature this 25th day of February, 1926.

ELMER S. SEAVEY.