Our invention relates to finishing tie plates or similar articles after the long bars from which they are to be cut are delivered from a rolling mill or other apparatus, and our invention comprises various steps and apparatus for punching spike or fastening holes therein, shearing plates into short and predetermined lengths and for cambering them as required.

The plates of certain forms are provided with ribs against which one edge of the rail flange abuts in order to maintain the track gauge, and these plates are laid on wooden ties and provided with holes through which driven or screw spikes are inserted to hold the rails thereon and to the ties by means of their flanges. In certain cases these tie plates are required to be cambered; that is, made slightly convex on their upper surfaces, the curvature being in the general direction of the alignment of the rail, whereby the rails bear principally on the central portion of the tie plate in order to prevent the rocking action of the tie plate on the rail and the consequent cutting and destruction of the ties which would otherwise be occasioned thereby. Such an arrangement of the rail on cambered tie plates provides a good support for the rail while allowing it to deflect slightly due to the passage of the trains without disturbing the tie plates cutting the ties, or causing undue stresses between the tie plate and the tie.

By means of our invention we supply tie plates or similar articles in the form of long bars to our apparatus, and which then, by its substantially automatic operation, punches holes in the plates, shears individual plates to predetermined lengths, carries the sheared plates forward from the punching and shearing apparatus on a set of carrying rollers or otherwise and advances the individual plates by a step-by-step movement to a separate cambering apparatus, where the plates are supported on their lower sides by a concave die, which supports the edges of the plate, and a plunger with a convex end is forcibly projected against the plate to cause it to assume the necessary curvature or camber, after which the plates are delivered from the apparatus ready for inspection, bundling if necessary, and shipment.

Having thus given a general description of our invention, we will now, in order to make the matter more clear, refer to the annexed sheet of drawings, which forms part of this specification, and in which like characters refer to like parts:

Figure 1 is a diagrammatic view in front elevation of our improved apparatus for cutting, punching and cambering and conveying tie plates, illustrating the application of our invention; Figure 2 is an end elevation of the cutting and punching machine; Figure 3 is a perspective view of one form of cambered tie plate; Figure 4 is an end elevation of the cambering machine; Figure 5 is a vertical transverse section on a larger scale through the cambering machine, the section being taken on the line V—V of Figure 1; Figure 6 is a vertical section through a portion of the mechanism for conveying the tie plates taken on the line VI—VI of Figure 1, and Figure 7 is a detail view of the end portions of the conveyor bars.

Referring now to the characters of reference on the drawings:—1 indicates the punching and shearing machine as a whole, 2 are the rolls for supporting a long tie plate bar 3 as it is fed into the machine, 4 are the spike hole punches, 5 are the dies thereof, and 6 is the holder or keeper for the same. An upper top shear blade 7 is provided, which, in connection with the bottom shear blade 8, serves to shear the bars to the desired lengths, this being arranged by setting the stop or gauge 9 at the required distance from the cutting edges of the shear blades so that the extreme end of the long bar 3 abuts against the stop 9 prior to the downward movement of the upper shear blade 7. A roller conveyor 10 is provided, which has a plurality of rollers closely set together and driven by a suitable gearing, which is actuated by the pulley 38 and the belt 39, which belt may be driven by any suitable source of power at a desired speed, but preferably in harmony with the speed of the other apparatus. As the bar 3 is fed into the punching and shearing machine 1, its end contacts with the gauge or stop 9, the punches descend and punch spike holes; about the same time the previously punched portion at the right hand end of the bar is sheared off by the movement of the shear blade 7, the distance between the punches and the shear blade being so arranged that the spike holes are in the right locations and
the sheared cut is made at a predetermined distance from the spike holes and the tie plate is cut to the desired width. As illustrated, a punched portion of a bar is between the shear blade 7 and the punches 4 so that directly under the punches, as illustrated in Figure 1, and to the right thereof, there are three tie plates under process of finishing. After the tie plate is sheared off by the shear blade 7 it drops on the roller conveyor and the sheared tie plate 11 is transported to the right on a further conveyor apparatus. This conveyor apparatus comprises the conveying dogs or paws 12 mounted on pivot pins 13 and provided with stop pins 14 to limit their movement by contact of the lower ends or tails 15 of the conveyor paws 12, all of these being mounted in the conveyor bars 19, as illustrated.

The cambering machine is generally indicated as 28, provided with a top cambering punch 16, which is curved slightly in a convex manner as shown to the approximate curvature of the tie plate, while 17 is the bottom cambering die, which is concavely curved to substantially correspond with the curvature of the other side of the tie plate. As the tie plates are traversed to the cambering mechanism step by step, as will hereinafter be described, and are placed directly between the bottom cambering die 17, the head of the ram 21 descends and the tie plates are cambered and assume a slightly curved form as illustrated by tie plates 18 shown in Figures 1 and 3.

The conveyor bars 19 and attachments are supported on the structural member 20 and a link 22 is pivotedly connected to said conveying bars, and journaled thereto is the roller 23 mounted thereon. Pivoted to the other end of the link 22 is the crank arm 24, which is mounted on shaft 25, the end of which is mounted another crank arm 27, and pivoted to the end of this crank arm is the pitman 28, which pitman is provided with a sleeve nut with right and left hand threads as illustrated so the length may be adjusted. This pitman is also pivoted, as illustrated, to the ram 21 of the cambering machine and consequently moves up and down with it. As the head 21 moves up and down the pitman also moves up and down and partially rotates the various cranks with which it is connected, and thereby causes the conveyor bars 19 and their attachments to reciprocate forward and backward in a step-by-step movement, and the length of this movement may be so adjusted as to move the sheared tie plates to the cambering apparatus and deliver them one by one thereto in harmony with the up and down movement of the ram 21, so that when the ram 21 is up a flat tie plate is delivered to the cambering die, whereupon the cambering head 21 moves downwardly and cambers the plate, and the step-by-step conveyor then removes the cambered plate and delivers another plate to the cambering apparatus, and the operation so continues. A further framework is provided for supporting and guiding the conveyor bars, this being composed of the frame 29 mounted on the base plate 30, while 31 is the spacing block between the conveyor bars in order to hold them apart the proper distance. A top cover plate 32 is provided on the top of the frame 29 as illustrated, which serves to hold and guide the conveyor bars, and this also serves as a support for the sheared plates as they are moved along this step-by-step conveyor by contact of the dogs or paws 12. These paws or dogs 12 are pivoted so that when they move backward; that is, from right to left, as viewed in Figure 1, they turn and pass under the tie plate after moving them, and after these paws have passed the edges of the tie plates they return to their operating position by gravity, ready to move the tie plates left to right on reversal of the movement of the conveyor bars. The spacing block 31 slides on top of the support 20 and is secured to the conveyor bars 19 by means of the bolt 33, and the ends of the conveyor bars 19 are secured together by means of the bolt 34, and to this bolt is attached a wire rope or cable 35, which passes over the sheave 36 and is provided with a counterweight 37 to take up the slack and insure the return movement of the conveyor dogs.

In the operation of our apparatus the punches and the shear blades may be so adjusted that the punches just touch the bar or are beginning the punching as the shear blades are beginning the cut, so that the pressure of the punches will serve to hold the bar and prevent deflection thereof while a plate is sheared from its end portion, thus facilitating a clean and square shear cut, or the punches and the top shear blade may operate substantially simultaneously, or again the punches may be so adjusted that they will be punching the spike holes just before the shear cut is begun.

The punches may also be of slightly different lengths, in which case they would, in a measure, act progressively, and the severe stresses due to entirely simultaneous action of all the punches and the shear blades or of the punches would be obviated.

We prefer, however, to arrange as first stated, namely, so that the punches or some of them are punching the holes while the top shear blade begins its cut.

It should also be understood that in finishing tie plates in the manner described by us we camber the plates separately and individually while their sides are free and not when one of them is part of the long bar. This individual cambering between the die
and the cambering plunger provides a correct method of cambering and furnishes a substantially uniform curvature of a pre-determined amount, which is not the case where the cambering is attempted to be done on a tie plate with one end free and the other end forming a part of the long bar, as in such cases one side is free while the other is held as a part of the long bar, causing uneven and sometimes a contraflexed curvature, all of this being obviated by our method of cambering the tie plates individually. Our cambering die may be either formed of one curved piece of the approximate width of the tie plate, or it may be hollow in the center or formed of two pieces, which contact with the portion of the tie plate near its edges, leaving the central portion free to be bent between the two pieces.

To sum up the operation of the apparatus, it is as follows:—A long tie plate bar of any kind as 3 is fed forward to the machine on the rollers 2, and its front end contacts with the stop or gauge 9; the plunger or ram holding the punches 4, and the upper shear blade 7 then descends by the operation of the punching and shearing machine. The cut and punched tie plate then falls on the roller conveyor 10 and is carried thereby, and the bar 3 is fed forward for a further cutting and punching operation. While this is going on the cut tie plates 11 are being transported on the conveyor 10 and thence deposited on the step-by-step conveyor having the conveyor bars 19, and the conveyor dogs or paws 12 move them forward step by step and deposit them one at a time on the cambering die 17 underneath the cambering punch 16 while this punch is up, and during the return movement of the dogs 12 the cambering punch 16 descends and cambers the tie plate, which is again moved forward by the action of the step-by-step conveyor and is delivered from the end of the conveyor for inspection, bundling and loading.

The cambering die 17 is provided with a slot as illustrated in Figure 5 in which the conveyor bars operate while the dogs 12, when in operative upright position, project upwardly therefrom to contact with the edges of the tie plates and move them step by step as described.

Although we have shown our cambering machine as applied to a special form of tie plate and the cambering punch and die and the shear blades are made to substantially conform thereto, we wish it understood that any form of tie plate, either with or without a rib, or plain, or with any form of teeth, indentations or projections can be treated similarly in our manner, and the tools can be made of corresponding conformations.

Although we have shown and described our invention in considerable detail, we do not wish to be limited to the exact and specific details thereof as shown and described, but may use such modifications in, substitutions for, or equivalents thereof as are embraced within the scope of our invention, or as pointed out in the claims.

Having thus described our invention, what we claim and desire to secure by Letters Patent is:

1. In a tie plate finishing apparatus, a punching and shearing machine provided with a reciprocable plunger having a convex end and a corresponding fixed concave die adapted to camber the plate, a separate cambering machine, and automatic means for conveying individual sheared plates to and from the cambering tools.

2. In a tie plate finishing apparatus, a punching and shearing machine provided with a reciprocable plunger having a convex end and a corresponding fixed concave die adapted to camber the plate, a separate cambering machine, automatic means for conveying punched and sheared plates from the punching machine to the cambering tools, including a step-by-step conveyor actuated by and in harmony with the movement of the cambering punch.

3. In a tie plate finishing apparatus, a shearing and punching machine, provided with an adjustable gauge or stop, adapted to punch a tie plate bar and shear individual plates therefrom, a separate cambering machine provided with a cambering plunger and die, and automatic means for delivering and conveying the individual plates thereto and therefrom.

4. In a tie plate finishing apparatus, a combined punch and shear adapted to punch holes in tie plate bars and shear individual plates therefrom, means for predetermined the width of said plates, a cambering machine provided with a plunger and die, and a conveyor between the two machines adapted to automatically deliver individual plates from the punching and shearing machine to the cambering machine.

5. In a tie plate finishing apparatus, a punching machine for punching a long bar, a shear for cutting individual plates therefrom after the punching is accomplished, a cambering machine, a roller conveyor adapted to carry the individual sheared plates and deliver them to a step-by-step conveyor having a reciprocating motion so as to deliver them to the cambering tools.

6. In a tie plate finishing apparatus, a punching machine for punching a long bar, a shear for cutting individual plates therefrom after the punching is accomplished, a cambering machine, a roller conveyor adapted to carry the individual plates and deliver them to a step-by-step conveyor having a reciprocating motion so adjusted as...
to deliver them to and from the cambering tools.

7. In a tie plate finishing apparatus, the combination with a shearing and punching machine of a separate cambering machine provided with a cambering punch and die, a conveyor between said machines adapted to automatically convey individual plates and deliver them separately to and from the cambering tools.

8. In a tie plate finishing apparatus, a combination punching and shearing machine adapted to approximately simultaneously punch holes in a long bar and shear tie plates of predetermined widths from the end thereof, a cambering machine provided with a cambering punch and die, a conveyor between said tools adapted to deliver individual plates from the punching and shearing machine to the cambering machine, the latter portion of the same comprising a step-by-step conveyor having conveyor bars and dogs pivotally secured thereto and from the cambering tools, adapted to deliver the plates one at a time to the cambering machine, and remove the same therefrom.

9. In a tie plate finishing apparatus, the combination with a punching and shearing machine and a cambering machine provided with a plunger and die, of an interposed conveyor, that portion of which, in connection with the cambering machine, is adapted to operate step by step in harmony with the movement of the cambering punch and to deliver plates separately thereto and therefrom.

10. In a tie plate finishing apparatus, a punching and shearing machine, an adjustable stop or gauge therefor, a roller conveyor operated in harmony with said punching and shearing machine and adapted to deliver plates therefrom, a cambering machine provided with a step-by-step conveyor operated by and in harmony with said cambering machine, and adapted to receive individual plates from said roller conveyor and deliver them to and from the cambering tools.

11. In an apparatus of the character described, the combination with a punching and shearing machine and means for delivering punched and sheared plates therefrom, a cambering machine provided with a step-by-step conveyor having conveyor bars and dogs pivotally secured thereto, link connections between the reciprocating head of the cambering machine and said conveyor bars, adapted to reciprocate said conveyor in harmony with the motion of the cambering machine, and thereby deliver individual plates to and from the cambering tools.

12. The method of finishing tie plates from long bars, consisting in punching holes therein, advancing the bar and shearing a plate therefrom of predetermined width, and continuing said operation, then automatically delivering the sheared and punched plates to a separate cambering machine provided with a reciprocable plunger having a convex end and a corresponding fixed die, cambering them thereby, and automatically delivering the same therefrom.

13. The method of finishing tie plates from long bars, which consists in punching holes therein, then moving the bar so that a predetermined length thereof extends beyond a shearing knife, then punching other holes through the bar and substantially at the same time shearing a predetermined length therefrom, then automatically conveying the punched and sheared plates to a cambering machine and moving them step by step under a cambering punch and automatically delivering them therefrom.

14. The method of making tie plates, which consists in rolling long bars of suitable cross-section, then punching holes near the end of said bar, then moving the bar longitudinally so that a predetermined length extends beyond a shearing knife, then shearing the end therefrom while at the same time punching other holes in the bar, then advancing the sheared and punched bars automatically from the punching and shearing machine to a separate cambering machine and to the cambering tools thereof, by a step-by-step movement, actuated by the movement of the cambering machine, and automatically delivering the cambered plates therefrom.

In witness whereof we hereunto affix our signatures.

JOHNSON V. SYMONS.
THOMAS H. JOSE.
GEORGE E. THACKRAY.