No. 699,129. Patented May 6, 1902.

T. V. ALLIS.

METHOD OF ROLLING METAL SHEETS.

(Application filed Feb. 1, 1901.)

(No Model.)

Fig. 1.

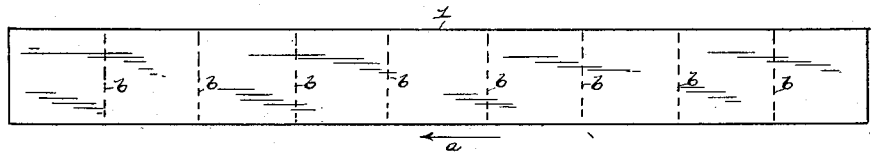


Fig. 2.

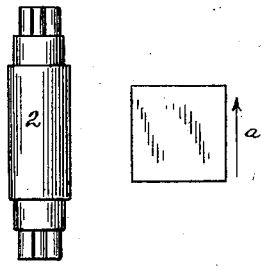


Fig. 3.

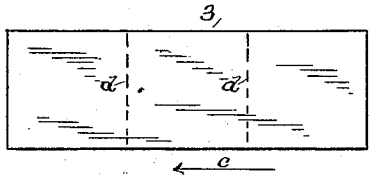


Fig. 5.

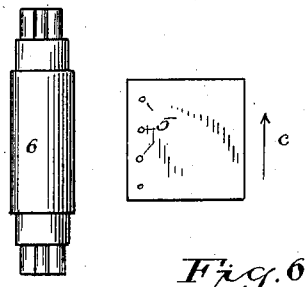


Fig. 4.

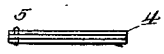
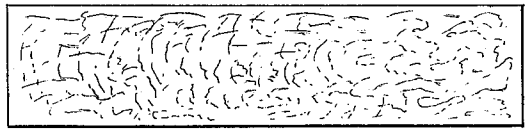


Fig. 6.



WITNESSES.

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UNITED STATES PATENT OFFICE.

THOMAS V. ALLIS, OF BRIDGEPORT, CONNECTICUT.

METHOD OF ROLLING METAL SHEETS.

SPECIFICATION forming part of Letters Patent No. 699,129, dated May 6, 1902.

Application filed February 1, 1901. Serial No. 45,628. (No model.)

To all whom it may concern:

Be it known that I, THOMAS V. ALLIS, a citizen of the United States, and a resident of Bridgeport, in the county of Fairfield and State of Connecticut, have invented a certain new and useful Improved Method of Producing a Laminated Structure in Metal Sheets, of which the following is a specification.

My invention is an improved method for rolling metal sheets.

Heretofore the process of making thin metal sheets, principally iron and steel, has been to hot-roll ingots and blooms into bars of about three-eighths of an inch in thickness and eight to ten inches wide. This rolling from the ingot or bloom to the bar will naturally transform the crystalline structure to a fibrous condition. Sections are then cut from these bars and rolled crosswise. These sections are rolled but once across the grain to the thickness required for tin-plate and kindred uses. The reduction of bars three-eighths of an inch thick to sheets one-hundredth of an inch thick (about the thickness of tin-plate) establishes a too well defined grain in one direction to make the metal as tough as desired for cupping, drawing, and many other uses.

By my improved method the metal is rolled at each step in the process at right angles to the previous rolling. Each successive step in rolling does not entirely change the direction of the grain produced by the previous step, so that by changing the direction of rolling in each step the fiber or grain of the metal will become so mixed or confused, as it were, that there will practically be no pronounced grain, but rather a laminated structure or condition of marked toughness so essential to cupping and drawing.

To enable others to fully understand my invention, reference is had to the accompanying drawings, in which—

Figure 1 represents a metal bar rolled to a certain thickness to be cut into sections for cross-rolling. Fig. 2 is a view showing one of the sections that has been severed from the bar shown at Fig. 1 in position for rerolling across the grain and represents the first step. Fig. 3 is a plan view of this section after passing through the rolls and adapted to be cut into sections or plates for recross-rolling. Fig. 4 is a pack of plates severed from the metal strip shown at Fig. 3 riveted together and ready to be rolled. Fig. 5 shows the pack in position before the rolls to be recross-rolled. Fig. 6 is a view of the finished pack after it has passed through the last step in the process.

The operation is as follows: 1, Fig. 1, represents a metal bar rolled to a thickness of about three-eights of an inch, with the grain running in the direction of arrow *a*, from which sections, as represented by dotted lines *b*, are to be cut for the first step in rerolling. These sections are then given a quarter-turn and passed through the rolls 2 across the grain of the previous rolling, (indicated by arrow *a*.) This second rolling produces an elongation of the metal, as represented by the strip 3, (shown at Fig. 3,) and it has so changed the position of the fiber that the grain has partially assumed the direction represented by arrow *c*. This strip is then subdivided (see dotted lines *d*) into sections of equal width and these sections made up into the packs 4, as shown at Fig. 4, and are secured together by the rivets 5. These packs are then given a quarter-turn, as shown at Fig. 5, and passed through the rolls 6 across the grain, (represented by arrow *c*.) This last rolling in packs will so disarrange the fiber that there will be no well-defined grain or fiber, (see Fig. 6,) but a tangled crazed condition, exceedingly tough and ductile.

The number of steps shown are sufficient for tin-plate or other like sheets; but where an extra tough metal is required the number of steps in the rolling process will be correspondingly increased—*i. e.*, the pack shown at Fig. 6 will be again cut up and packs formed therefrom, fastened together, and again cross-rolled. In this case it would be advisable to lessen the amount of reduction in the first pack-rolling, so as to distribute the total amount of reduction required through as many recross-rollings in packs as is necessary to bring said plates to the thickness required.

While the plates or packs could be passed and repassed through the same pair of reduction-rolls, it would expedite rolling to provide a series of such rolls for each step, the process being that of hot-rolling, although I do not wish to be confined to the number of reduction-rolls. What is to be understood as a step in my method of reduction is whenever

the strips, plates, or packs are given a quarter-turn and entered into the rolls at right angles to the previous rolling, whether one set of reduction-rolls are used or a different set each time the metal is recross-rolled, the change in the direction of rolling is considered a step.

My packs being formed by piling several plates one upon another and not by the old method of doubling, it becomes necessary to fasten said plates forming the packs in some secure manner to retain them in correct position one with another while entering and passing through the rolls. The least displacement of any one of the plates or leaves in a pack whereby there is an overlapping edge causes such edge to crack, and in so cracking the fracture extends to other leaves or plates, causing considerable loss in scrap. I have found that riveting the plates together which form the packs at their entering end to the rolls, which is along one of their selvage edges, to be an effective and expeditious manner of fastening; but I do not confine myself strictly to riveting, as any improved means of fastening may be used. This locates the rivets or fastenings at one edge and in line with the previous rolling and at right angles to the sheared ends. The location of the rivets or fastenings in this position serves two important purposes: First, it holds the packs so that they can be rolled at right angles to the previous rolling, and, second, the even-sheared ends can be abutted and firmly held against a gage to locate them in the very necessary true relation with each other, giving free room for the punches to operate close to the untrimmed rough edge without interfering in any way with the gages which are holding said plates in a rigid position during the process of punching. Waste is thus saved by locating the fastening near one rough selvage edge of the pack, which after being rolled is sheared off as scrap.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The method of producing a laminated or confused structure in metal sheets, which consists in reducing thin plates to sheets by hot-rolling the plates in packs at right angles to the path or line of the previous rolling of said plates, as set forth.

2. The method of producing a laminated or confused structure in metal sheets, which consists in reducing plates to sheets by hot-rolling the plates in packs through a series of cross-rollings, whereby the plates comprising the packs are rolled at right angles to a previous rolling in packs, as set forth.

3. The method of reducing hot metal plates to sheets, to produce a laminated or confused structure of the metal in the sheets, which consists in forming the plates into a pack, with the grain of the several plates lying in the same general direction, fastening the plates together along one of their side or selvage edges, and rolling the pack across the grain of the plates, as set forth.

Signed at Bridgeport, in the county of Fairfield and State of Connecticut, this 30th day of January, A. D. 1901.

THOMAS V. ALLIS.

Witnesses:
JOHN B. CLAPP,
GEO. E. HEBBARD.