No. 669,376. Patented Mar. 5, 1901.

T. V. ALLIS.

METHOD OF CONTINUOUS SHEET METAL ROLLING.

(Application filed June 13, 1899.)

(No Model.) 3 Sheets—Sheet 1.

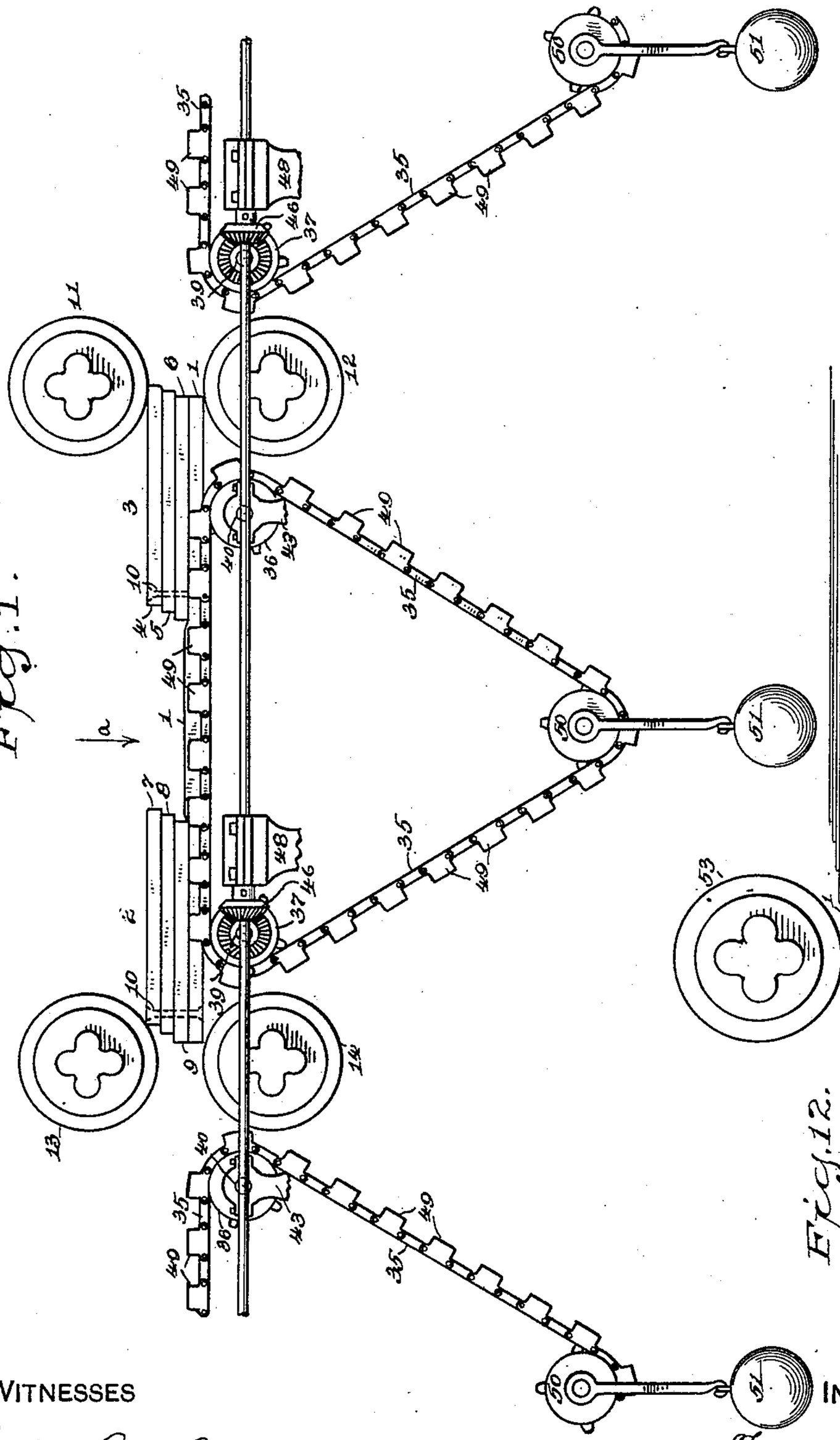

Fig. 1.

Fig. 12.

WITNESSES

H. A. Sawyer

L. R. Hyte

INVENTOR

Thomas V. Allis

By his Atty.

Geo. D. Phillips

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(No Model.) 3 Sheets—Sheet 2.

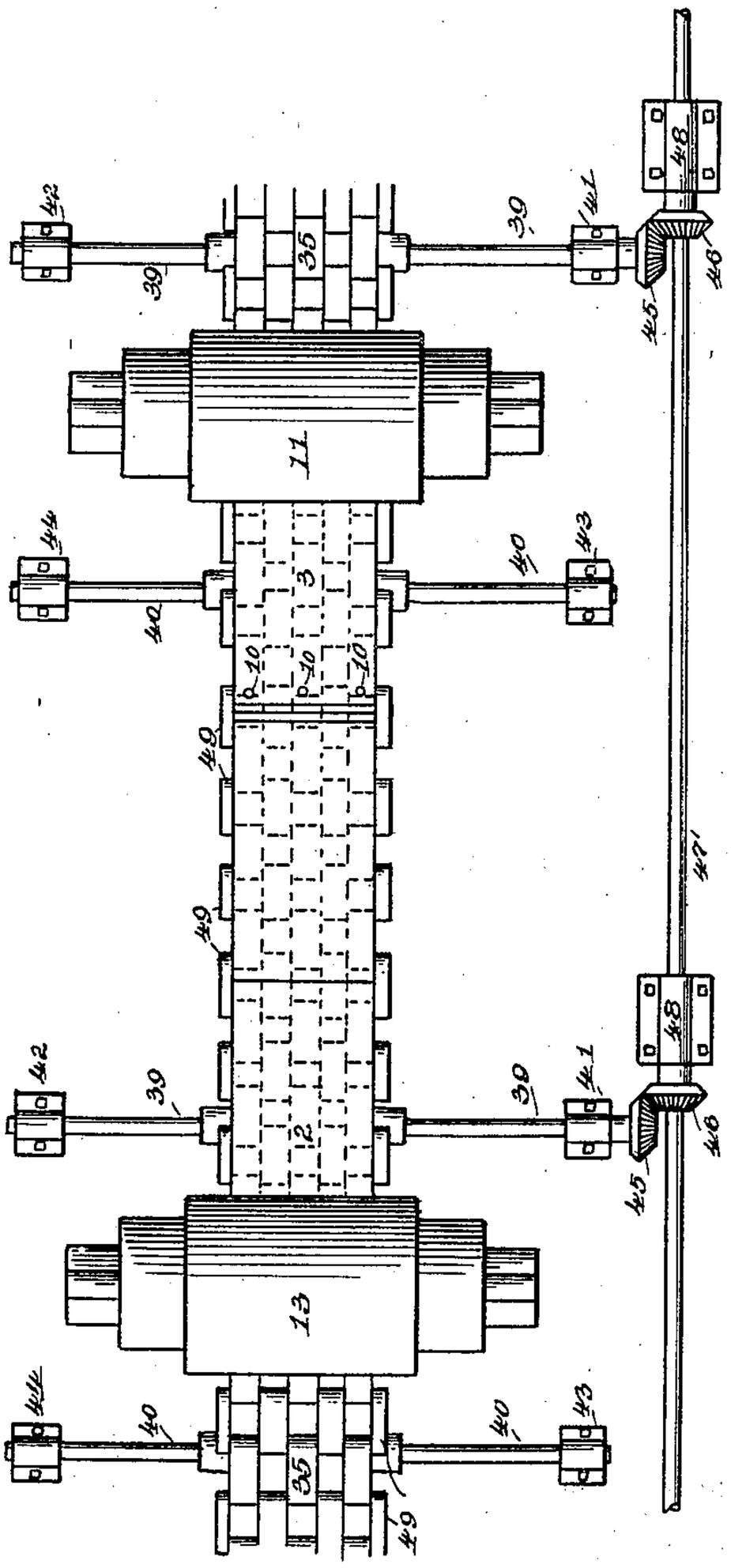

FIG. 2.

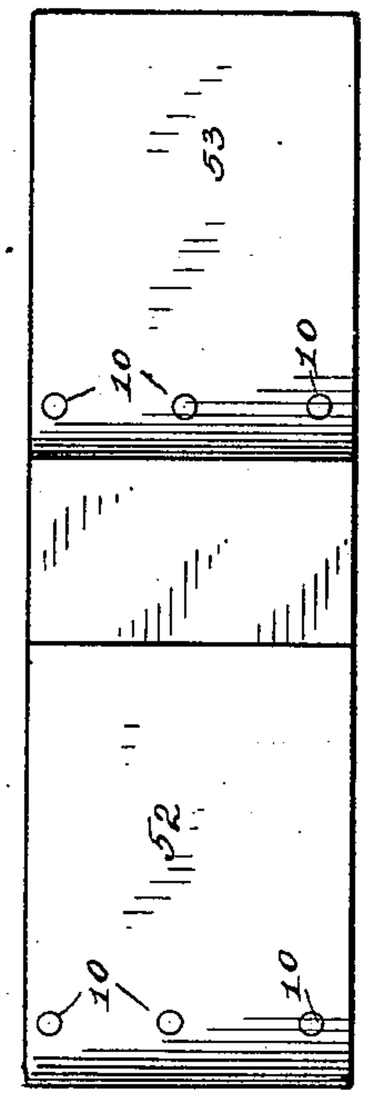

FIG. 11.

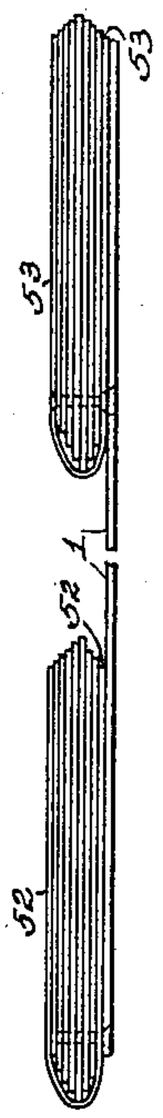

FIG. 10.

WITNESSES

H. A. Lamb

L. R. Hoyt

INVENTOR

Thomas V. Allis

By his Atty.

Geo. D. Phillips

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T. V. ALLIS.

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(No Model.) 3 Sheets—Sheet 3.

Fig. 3.

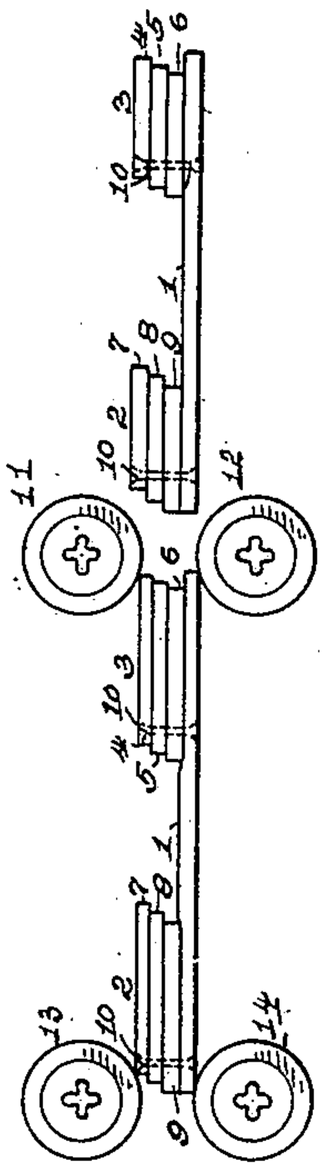

Fig. 4.

Fig. 5.

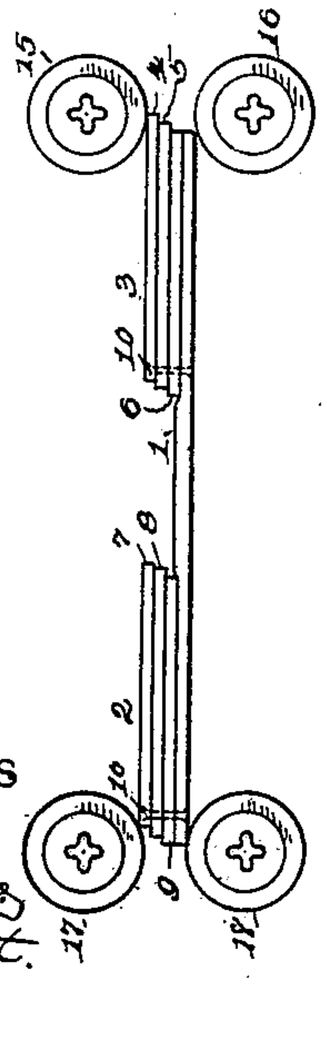

Fig. 6.

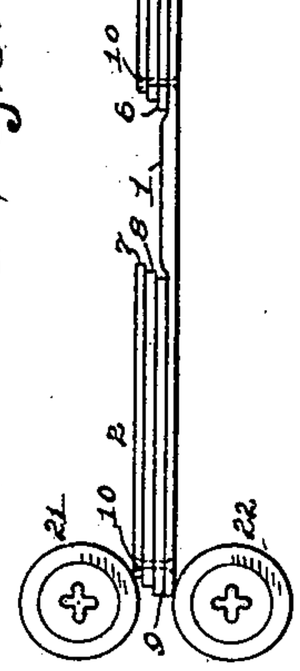

Fig. 7.

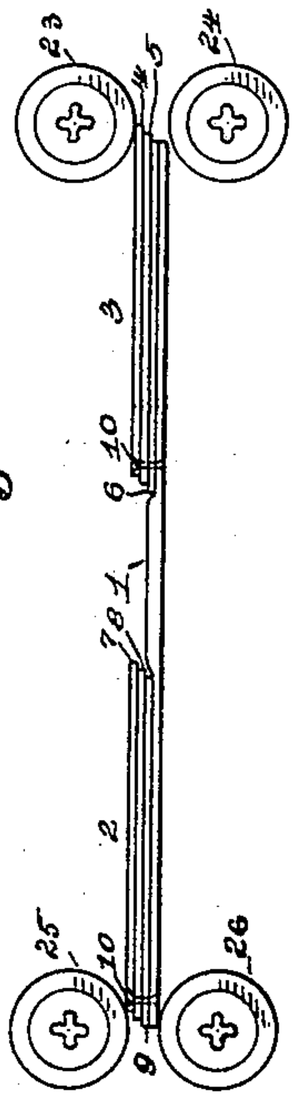

Fig. 8.

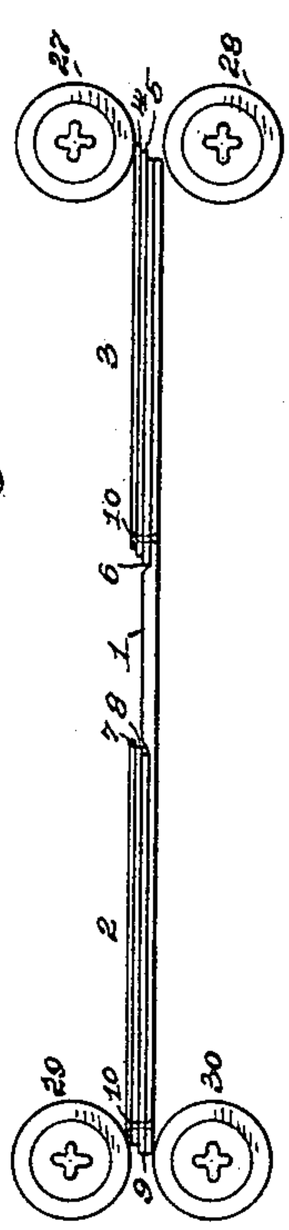

Fig. 9.

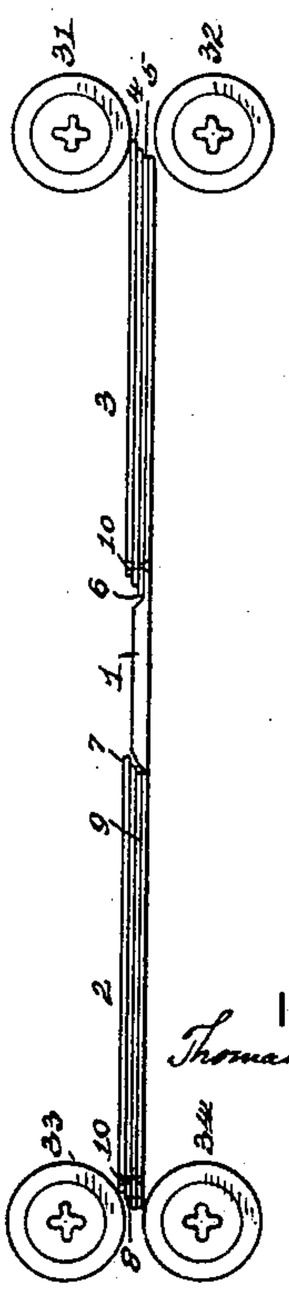

Fig. 13.

WITNESSES

H. A. Lamb.

L. R. Hoyt.

INVENTOR

Thomas V. Allis

By his Atty.

Geo. D. Phillips

UNITED STATES PATENT OFFICE.

THOMAS V. ALLIS, OF BRIDGEPORT, CONNECTICUT.

METHOD OF CONTINUOUS SHEET-METAL ROLLING.

SPECIFICATION forming part of Letters Patent No. 669,376, dated March 5, 1901.

Application filed June 13, 1899. Serial No. 720,341. (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 Continuous Sheet-Metal Rolling, of which the following is a specification.

My invention is an improved method of and apparatus for continuous sheet-metal rolling. Heretofore in reducing metal to a proper degree of thinness for tin-plate and kindred sheets the practice has been to reduce bars of about three-eighths of an inch in thickness as thin as is advantageous in a number of rollings by two operatives on a two-high mill, one operative on either side of the rolls. The first operative (the roller) enters the red-hot bars between the rolls and the other operative (the catcher) on the opposite side catches the bars with tongs and rapidly passes them back over the top roll to the first operative or roller. When the desired reduction has thus been accomplished, two of these rolled plates are paired or matched—*i. e.*, one placed on top of the other. This pair is then heated and together rolled down in the same manner, after which they are doubled by folding, thus making a pack of four leaves or layers, and again heated and rolled in the same way, then finally doubled again to eight leaves and rolled as before to a finish.

From the foregoing description of the present practice of hot-rolling metal sheets to thin gages, especially iron and steel, it will readily be seen that the results are only obtained at the expenditure of much severe and expensive manual labor and fuel for the several heatings. While there is nothing new or novel in the well-known art of continuous rolling, I seek to establish the fact that I have invented a new and useful improvement in the means and method whereby much of the labor and fuel required by the old and existing process of sheet-metal rolling are saved and better and more uniform results attained.

In my improved method the metal passing direct from one pair of rolls to other pairs of rolls in a series of reductions without the aid of operatives materially reduces the cost of labor, and as there is but one heating required in my process there is a large saving in fuel; besides, the quality of the product is much better as it gages more uniformly, for the reason that each consecutive pair of rolls in the train performs but a fractional portion of the work, and, therefore, retain much better and more uniform faces or surfaces than in the present method, where all of the reductions are made on one or two pairs of rolls, which rolls are brought nearer together by screws at each pass of the metal between them.

Instead of starting with a bar of metal about three-eighths of an inch thick and reducing by numerous heatings, doublings, and rollings I start with strips or plates about one-sixteenth of an inch thick, which are cheaply rolled in the ordinary process of strip or skelp rolling. From these plates or strips I form a pack aggregating about one-half inch in thickness. It is impracticable to reduce long packs to thin gages in a number of consecutive passes. The packs are therefore of necessity short and in some instances not as long as they are broad, and in such condition it would not be possible to guide them in a straight line through the rolls; hence my improvement in the arrangement and construction of my packs gives sufficient length for the proper guiding, which, in connection with my improved chain-apron guide, working between each pair of rolls, makes continuous pack-metal rolling possible.

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

Figure 1 represents a side elevation of a parent stem or guiding-strip carrying two packs of metal strips or plates riveted thereto, traveling-chain-apron guides, two of which are shown broken, driving mechanism for said aprons, broken view of the standards for supporting the shafts of said driving mechanism, and an end elevation of two sets of reduction-rolls, the frames and other mechanism for the same being omitted. Fig. 2 is an upper plan view looking in the direction of arrow *a* of Fig. 1. Fig. 3 is a side elevation of a parent stem or guiding-strip carrying at each end a pack of metal strips secured thereto before the first reduction. Figs. 4, 5, 6, 7, 8, and 9 show the various stages of

reduction that the parent stem or guiding-strip passes through with its load, also an end elevation of the several reduction-rolls and their relative position to the packs of metal strips. Fig. 10 is a broken side elevation of a parent stem or guiding-strip with the packs of metal strips attached thereto, showing the outer strip continued around so as to envelop the forward ends of the said strips. Fig. 11 is an upper plan view of the device shown at Fig. 10. Fig. 12 is a side elevation of a pack of thin metal strips attached to a parent stem or guiding-strip shown broken. The forward ends of such strips are stepped off, so to enable them to enter the bite of the rolls located adjacent thereto. Fig. 13 is a side elevation of a long parent stem or guiding-strip adapted to carry more than two packs of metal strips.

The construction and operation are as follows:

1 represents the parent stem or guiding-strip which is a strip of metal about the thickness of one of the initial strips or plates in the pack before reduction.

2 and 3 are packs composed of three metal strips or plates 4 5, 6 7, and 8 9, each pack secured together and to the parent stem or guiding-strip by means of the rivets 10, near the forward end of such strips or plates. This feature will not only keep the plates together and to the parent stem or guiding-strip, but also in alinement with such stem.

In Fig. 3 is shown, as before mentioned, the parent stem or guiding-strip 1, carrying the two packs 2 and 3, before any reduction is made thereon. These packs are located at the ends of said stem or guiding-strip and are of the same cross-dimension. The first reduction takes place between the rolls 11 and 12, thence through the rolls 13 and 14, and so on consecutively through the reduction-rolls 15 and 16, 17 and 18, 19 and 20, 21 and 22, 23 and 24, 25 and 26, 27 and 28, 29 and 30, 31 and 32, and 33 and 34. It will be understood that these several pairs of rolls are arranged in the same plane, so that as soon as the parent stem or guiding-strip, with its load, as shown at Fig. 3, has reached the position shown at Fig. 4 another stem, with its load, will have reached the position just vacated, and so on throughout the whole series of reduction-rolls, one parent stem, with its load, following close on the heels of the preceding one. It will be observed that only one pair of rolls are engaged with one pack on each parent stem or guiding-strip at the same time. When, therefore, the pack 2 is in the bite of the reduction-rolls 13 and 14, 17 and 18, &c., the pack 3 has cleared itself from the rear pair of rolls. In other words, the spacing or distance between each pair of rolls and the packs attached to the parent stem or guiding-strip are such that no two packs on one parent stem or guiding-strip are operated upon by the rolls at one and the same time, which obviates that nicety of adjustment of rolls necessary where the metal in reduction is in the bite of two or more pairs of rolls at the same time.

To support the several parent stems or guiding-strips, with their respective loads, while passing from one pair of reduction-rolls to another, as well as when one or the other of the several packs are under the propelling influence of the reduction-rolls or out of such influence, the traveling aprons 35, Figs. 1 and 2, are employed. As there are a multiplicity or several sets of these aprons, such parts of their construction as are alike will be designated by the same figures of reference. These aprons each consist of a wide endless sprocket-chain running around the sprocket-wheels 36 and 37, mounted upon the shafts 39 and 40, which shafts are journaled in the standard-boxes 41, 42, 43, and 44. On the ends of the shafts 39 are mounted the bevel-gears 45, adapted to register with the bevel-gears 46, mounted upon the horizontal driving-shaft 47, journaled in the standards or other like supports 48. This driving-shaft serves the whole series of individual traveling aprons and actuates them through the medium of its several bevel-gears registering with the bevel-gears carried by the short transverse shafts 39, as before mentioned, so that all of the several traveling aprons will move in unison.

The means for guiding the several parent stems or guiding-strips, with their loads, constitute a part of the apron construction. The outer row of links on each side of the sprocket-chain which constitutes the apron are provided with the extensions 49, rising vertically from such outer links and integral therewith. These extensions are high enough to form a guide for the loaded stems or guiding-strips, so that they are not only started true, but are kept so throughout the continuous rollings whether any of the packs are between the rolls or not.

50 represents idler sprocket-wheels to which the weights 51 are attached to keep the aprons taut.

It will be observed that the parent stem or guiding-strip 1, between the packs 2 and 3 attached to such stem, is quite thin as compared with such packs. This arrangement while it gives the necessary length for guiding would not be practicable excepting as operated in combination with my improved traveling-chain-apron guide moving between the rolls at a lineal speed greater than the circumferential speed of such rolls, which produces a tension by the tendency to draw the pack resting upon it faster than the rolls deliver. This pull keeps the parent stem or guiding-strip from bending or buckling or doubling upon itself between the packs, while the extensions 49 of the outer links of the chain, as before mentioned, will guide the parent stem or guiding-strip, with its attached packs, straight from and into each consecutive pair of rolls.

As will be observed, that portion of the parent stem or guiding-strip between the two packs is not affected by the reduction-rolls, while that portion overlaid by the two packs is rolled down or reduced with such overlying strips or plates and will therefore form part of the finished product. The central portion of such stem or guiding-strip being of the same thickness as the strips before reduction will be cut out in the trimming process to form a plate or strip for a pack on a new parent stem or guiding-strip. It will thus be seen that all of the parent stem or guiding-strip is utilized except what must necessarily be wasted in trimming.

In Figs. 10 and 11 is shown a method for giving additional security to the metal packs. It is possible where great reduction takes place that the beveled ends of the rivets may become obliterated, so that the plates will become separated. To prevent this the outer plates 52 and 53 of the packs are made long enough at least to envelop the forward end of the pack. This will not only keep each pack intact should the rivets give way, but it will protect the forward end of such pack against the tendency to open. In this arrangement it will be observed that the rivet passes through all of the plates and parent stem or guiding-strip, as shown in the other views.

Where a heavy reduction is necessary with only one pass through the reduction-rolls, it is absolutely necessary that the end of the pack be stepped off or shingled, as shown at Fig. 12. Otherwise it would be impossible for the pack to enter into the bite of the rolls 53 and 54, which rolls are only separated by a distance representing the thickness of the collective finished product of the several individual strips or plates, including the parent stem or guiding-strip. This feature is applicable to all packs whether such packs are attached to a parent stem or not.

In Fig. 13 is shown a long parent stem or guiding-strip carrying more than two packs of metal plates. With this arrangement it would be necessary to vary the speed of the reduction-rolls and traveling aprons in proportion to the elongation of such metal packs.

While I show guides for the parent stem or guiding-strip connected with and forming part of the traveling chain apron, it will be understood that stationary guides arranged on each side of the pack would answer the same purpose, and therefore I hold myself at liberty to employ either method.

When employing the method of protecting the end of a pack by folding over or carrying a strip around so as to envelop such end, I do not wish to be confined in its use to a parent stem or guiding-strip, as it could be used without such stem. Neither is it necessary to continue this folded-over strip to the full length of the pack on the upper side.

While I show the parent stem or guiding-strip carrying two or more packs of metal plates, it will of course readily be seen that such guiding-strip may have only one of such packs, it being understood that the sole object of this parent stem is simply to act as a guide in keeping the short plates attached thereto in proper alinement with the rolls. Without this feature it would be impracticable to carry short plates through a series of rolls.

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

1. The herein-described improvement in the method of reducing metal strips or plates in packs, which consists in temporarily attaching one or more packs on a guiding-strip and in alinement therewith, which strip is longer than any one of said packs, the whole adapted to pass through a series of reduction-rolls, for the purpose set forth.

2. The herein-described improvement in the method of reducing metal strips or plates in packs, which consists in temporarily attaching two or more packs at intervals on a guiding-strip longer than all of such packs combined and in alinement therewith, the length of such unoccupied portions of said guiding-strip being sufficiently long so that when the reduction of said packs and guiding-strip, immediately under such packs, is completed, such unoccupied portions of said guiding-strip will form layers for other packs to be similarly reduced, for the purpose set forth.

3. The herein-described improvement in the method of reducing metal strips or plates in packs, which consists in temporarily attaching one or more packs at intervals on a guiding-strip and in alinement therewith, the first layer of each pack being long enough to envelop and protect the end of the pack adapted to enter the bite of the rolls, for the purpose set forth.

4. The herein-described improvement in the method of reducing metal strips or plates in packs, which consists in temporarily attaching one or more packs at intervals on a guiding-strip, which strip is longer than any one of said packs and in alinement therewith, said guiding-strip containing said packs adapted to be passed through a series of sets of rolls so that, each set of rolls will contribute toward the reduction of said packs and also the guiding-strip underlying such packs, means whereby said guiding-strip and its load are supported and guided into and away from the several sets of rolls, for the purpose set forth.

Signed at Bridgeport, in the county of Fairfield and State of Connecticut, this 12th day of June, A. D. 1899.

THOMAS V. ALLIS.

Witnesses:
SIG. DORMITZER,
F. A. FAIRCHILD.