C. B. CUSHWA.

METHOD OF ROLLING SHEET METAL.

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904,605.

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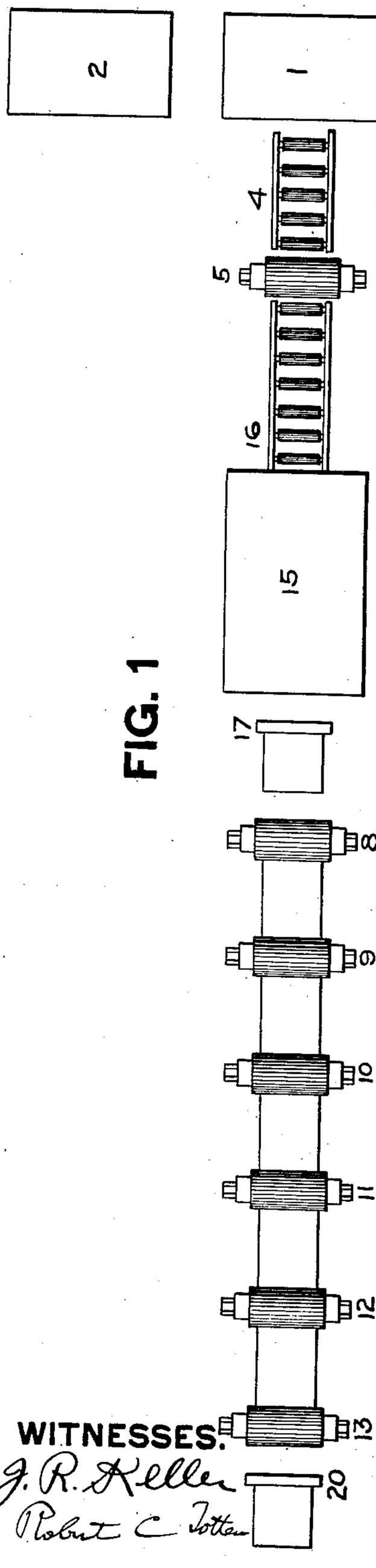

FIG. 1

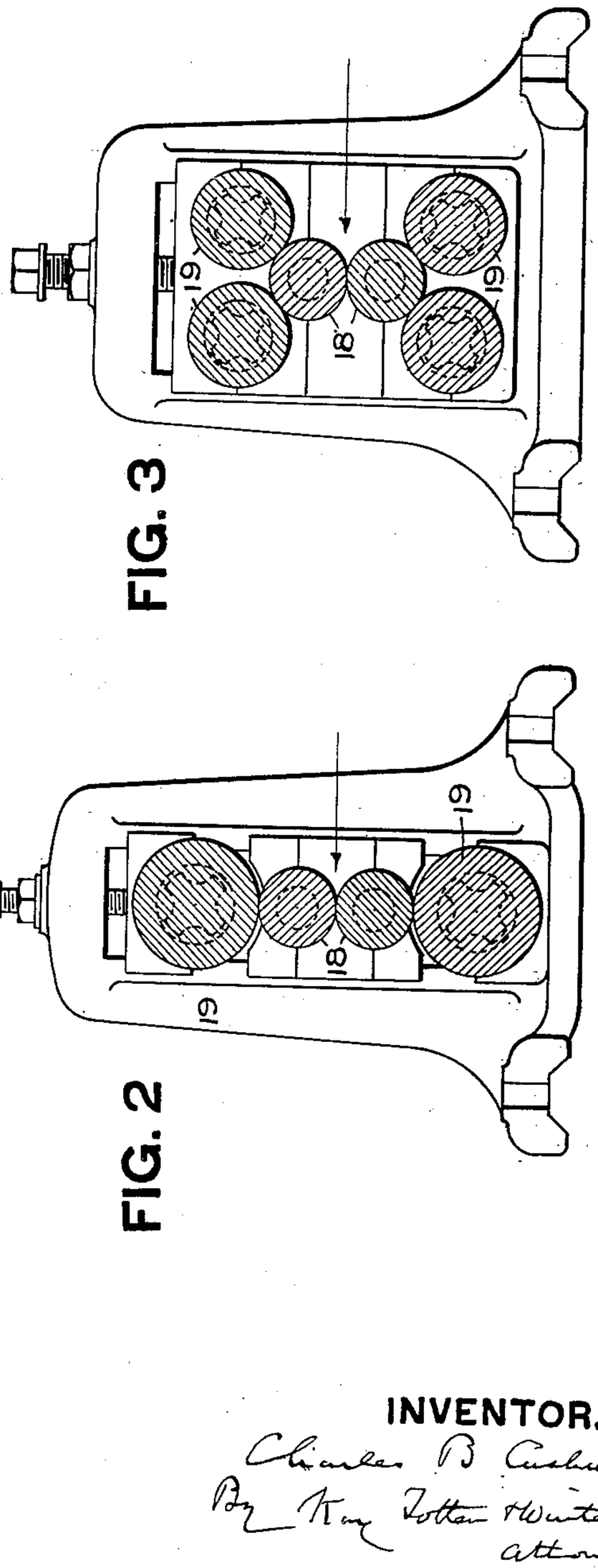

FIG. 3

FIG. 2

WITNESSES.

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METHOD OF ROLLING SHEET METAL.

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To all whom it may concern:

Be it known that I, CHARLES B. CUSHWA, a resident of Youngstown, in the county of Mahoning and State of Ohio, have invented a new and useful Improvement in Methods of Rolling Sheet Metal; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to a method of rolling metal in the form of thin sheets or strips, and its object is to provide a method whereby the many reheatings and the many manipulations and handlings of the metal employed in ordinary processes are dispensed with, thereby greatly reducing the cost of production; one wherein the amount of scrap produced is very largely reduced, and one wherein both faces of the sheet are subjected to the action of rolls, thus giving a bright and smooth surface on both sides.

The most commonly employed process of producing sheet and similar metal is to start with a sheet bar which is about $\frac{5}{8}$ to $\frac{3}{4}$ of an inch in thickness, and 5 to 8 inches wide, and of a length approximately equal to the width of sheets to be formed. These sheet bars are heated and reduced in breaking down rolls, which are ordinarily 2-high rolls through which the plate is fed a number of times. Two or more sheets thus formed are then piled one on the other and rolled down to about 18 to 20 gage. These sheets are then separated or opened up and again piled and reheated to a good rolling temperature and then further reduced. For the coarser gages this is generally sufficient, but for the finer gages the packs are doubled one or more times, again reheated and further reduced. This old hand process requires a large amount of labor and repeated reheatings, thus adding considerably to the cost of production. It also results in the production of a large amount of scrap, this being due to the fact that when piled the sheets do not stay in exact position but slip sidewise or endwise and thus result in producing edge portions which are of unequal thickness. If the edges are very thin they do not elongate in the further reduction but are caused to crack. All of these cracked and unequal edges must be sheared off. Furthermore, it is not possible to handle long packs by hand, and owing to the tendency of the sheets to separate and slip they are rolled mostly in lengths from 8 to 10 feet long. At each end of these sheets there is from 6 to 10 inches of scrap which must be sheared off. Furthermore, in rolling the sheets in packs only one side of the two outside sheets of the pack are subjected to the action of the rolls. These receive a bright and smooth finish. All of the other faces being in contact have a rough, duller finish, so that it is necessary to finish by cold rolling the sheets separately.

It has been proposed to roll sheets by running the packs or piles through continuous or tandem mills. This has the advantage over the old hand process of reducing the amount of labor and the number of reheatings. The sheets, however, are packed or piled and therefore the amount of scrap produced is equal to that of the old hand process, and the sheets also must be cold rolled in order to finish the same.

The object of my invention is a method of rolling sheets, strips and other thin metal, in which the above defects and objections are overcome.

It consists, generally stated, in starting with an ingot, billet or slab, roughing the same down to approximately $\frac{1}{2}$ inch or less in thickness, and then while still at the same heat passing the plates so produced singly through tandem mills consisting of a sufficient number of stands of small sized rolls to reduce the same to finished gage. As a consequence labor and reheatings are largely overcome, both faces of the sheet are of the same bright, smooth finish, thus dispensing with cold rolling to finish, and the finished sheet is of very long length, producing scrap only at its two ends, and the side edges being of the same thickness as the body and not cracked, so that only very little metal need be sheared off and the amount of scrap is reduced to a minimum.

In the accompanying drawing Figure 1 shows in diagram apparatus suitable for carrying out my process; and Figs. 2 and 3 are sectional views of suitable rolls for the tandem mill.

1, 2 and 3 represent suitable heating furnaces wherein the ingot, billet or slab is heated to a suitable rolling temperature. From these furnaces the heated ingot, billet or slab is transferred to the feed table 4 of the roughing down mill 5. The latter can be either a 2-high reversing mill or a 3-high mill. The heated ingot, billet or slab is

passed back and forth through the mill 5 in well understood manner until it is reduced to a plate of approximately the width of the sheet to be formed and from about one quarter to a half inch thick.

The ingot, billet or slab is much cheaper to produce than the sheet bars heretofore necessary. Furthermore, it can be roughed to the gage specified at a single heat, and its gage is still such that the plate holds sufficient heat to enable it to be reduced to finished gage in the tandem or continuous mills represented by the rolls 8, 9, 10, 11, 12 and 13. To guard against delays on these finishing rolls I prefer to run the plate as it emerges from the mill 5 into a furnace 15, suitable live rolls 16 being employed to convey the plate through said furnace. In this furnace the plate, if delayed, is maintained at a good rolling heat, even though it be delayed a considerable time before entering the finishing mill. A shear 17 is provided for clipping off the front ragged end of the plate before entering the finishing mill. The finishing mill is shown as composed of six stands of rolls arranged in tandem, but the number thereof may be greater or less than this number, and in any event will be sufficient to reduce the plate to the finished gage.

The tandem mills are of the form shown in Figs. 2 and 3 in which the reducing rolls 18 are of comparatively small diameter. In order to give these small sized rolls sufficient stiffness each is backed by one or two large rolls 19, Fig. 2 showing one such backing roll and Fig. 3 showing two. The small sized rolls 18 have only a small area of contact with the metal being reduced, hence they press more deeply into, and more rapidly reduce or stretch the metal, than do the large diameter rolls usually employed in sheet mills. The small area of contact between such rolls and the plate also has the effect of reducing the amount of heat absorbed from the plate so that the latter is maintained at a better rolling heat than if larger rolls were used. The plate, after being roughed down is still very close to the initial heat of the blank, that is, a good bright red heat, and the further reduction thereof in the tandem mill described is effected so rapidly and with such a small absorption of heat by the rolls, that the plate reaches practically the thinnest gages before the temperature falls below a dull red.

By my process I start with ingots, billets or slabs, which are cheap compared to the usual plate bar, and reduce them to finished gage and without piling or folding the partially reduced sheets, and substantially at the initial heat. The plate emerging from the finishing rolls is very long and its edges are only slightly irregular. As a consequence the amount of scrap is very small. After leaving the mill the plate is cut to finished size by shears 20.

The labor necessary to carry out my process is reduced to a minimum, and as reheatings are practically dispensed with there is also a great saving of fuel. Furthermore, each sheet is finished separately so that both faces are acted on by the rolls and consequently have a bright smooth finish, thus dispensing with cold rolling to finish. As a consequence the process is very economical.

In case the metal is to be formed as strips it can be either rolled in narrow widths or else passed through suitable slitting shears after emerging from the finishing rolls.

What I claim is:

1. The method of rolling sheet metal, which consists in heating a suitable blank, and without further heating reducing the same to 20 gage United States standard, or thinner, by subjecting the same to successive rolling actions applied to small areas equally on both sides of the plate, thereby effecting the reduction at a temperature not less than a good dull red.

2. The method of rolling metal sheets, strips and the like, which consists in heating an ingot, billet, or slab, reducing the same by rolling and without further heating to a plate approximately $\frac{1}{4}$ to $\frac{1}{2}$ inch thick, and then at the same heat reducing the same to finished gage by subjecting the same to successive rolling actions applied to small areas equally on both sides of the plate.

In testimony whereof, I, the said CHARLES B. CUSHWA have hereunto set my hand.

CHAS. B. CUSHWA.

Witnesses:
F. W. WINTER,
ROBERT C. TOTTEN.