(No Model.) 2 Sheets—Sheet 1.

C. A. MARSHALL.

PROCESS OF OPENING AND SHAPING TUBE BLANKS.

No. 389,586. Patented Sept. 18, 1888.

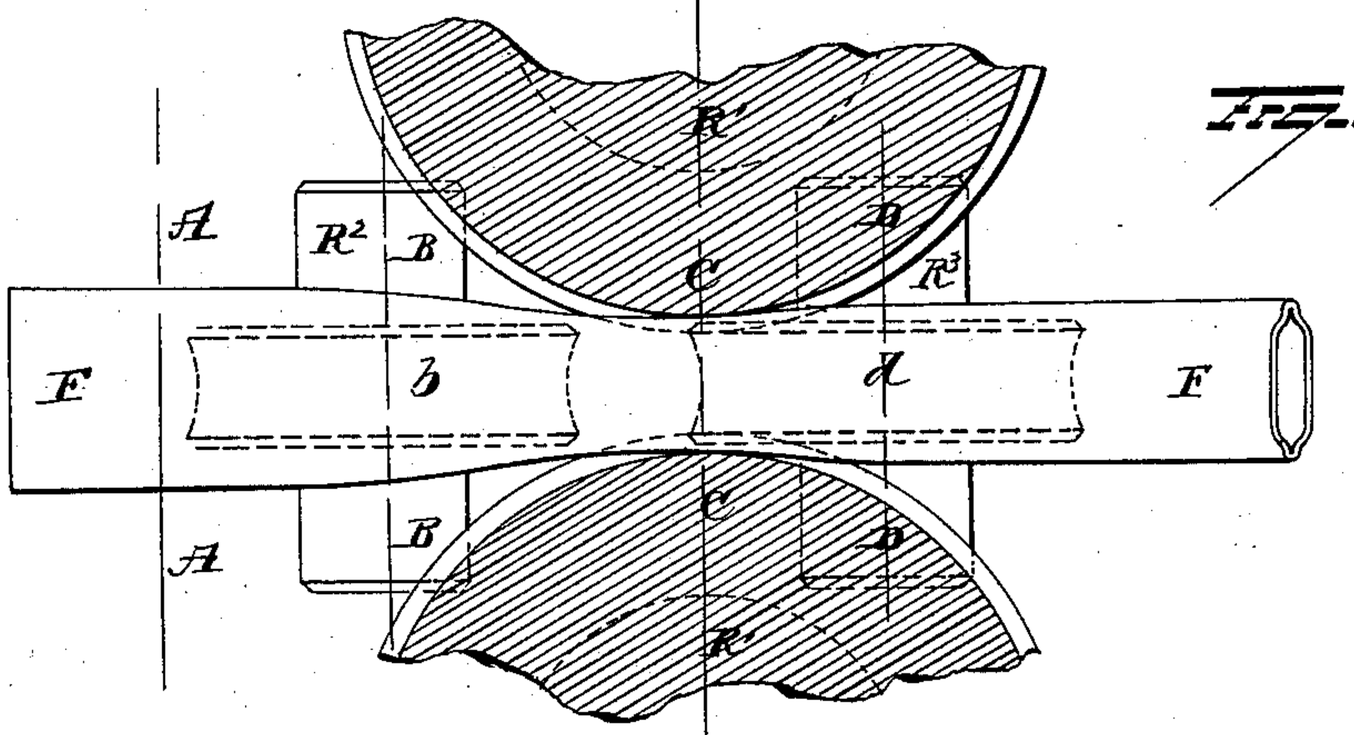


Fig. 1.

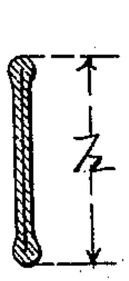


Fig. 2.

Fig. 3.

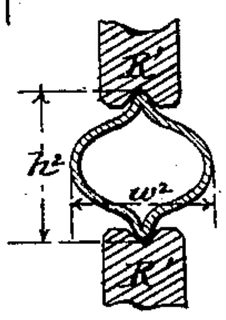


Fig. 4.

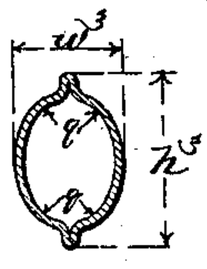
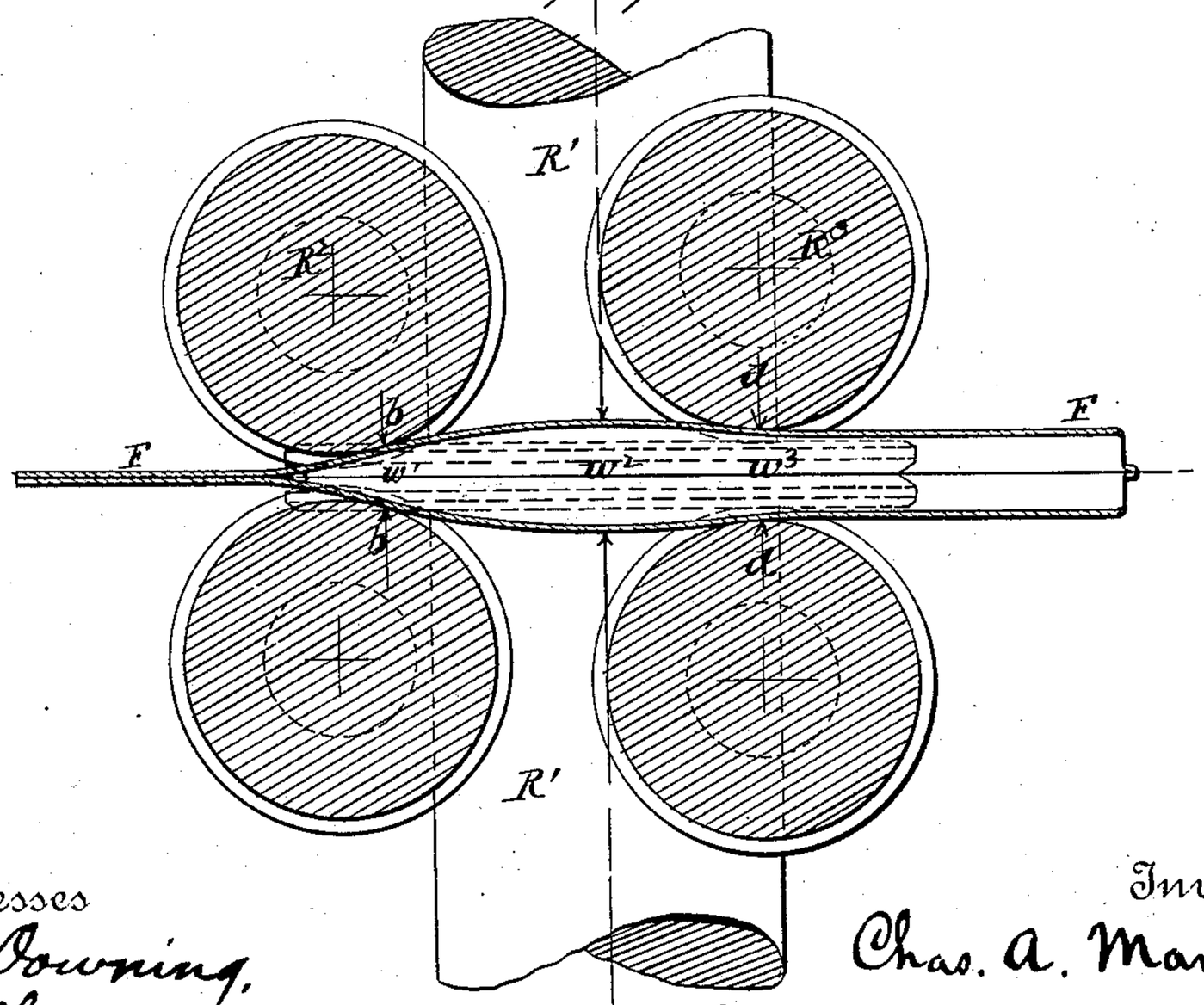


Fig. 5.

Fig. 7.



Witnesses
G. F. Downing.
V. E. Hodges.

Inventor
Chas. A. Marshall

By his Attorney
H. A. Seymour

(No Model.) 2 Sheets—Sheet 2.

C. A. MARSHALL.

PROCESS OF OPENING AND SHAPING TUBE BLANKS.

No. 389,586. Patented Sept. 18, 1888.

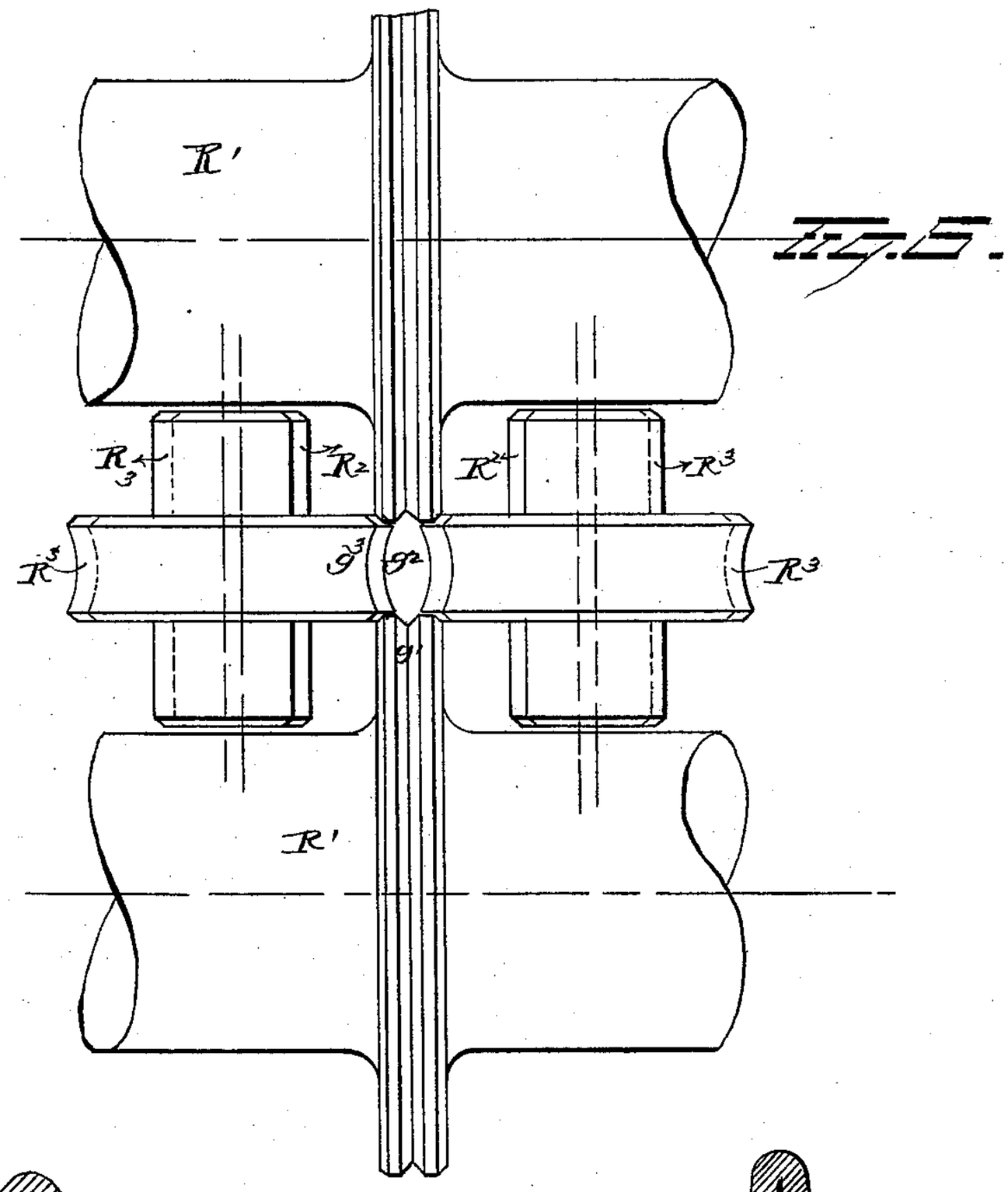


FIG. 5.

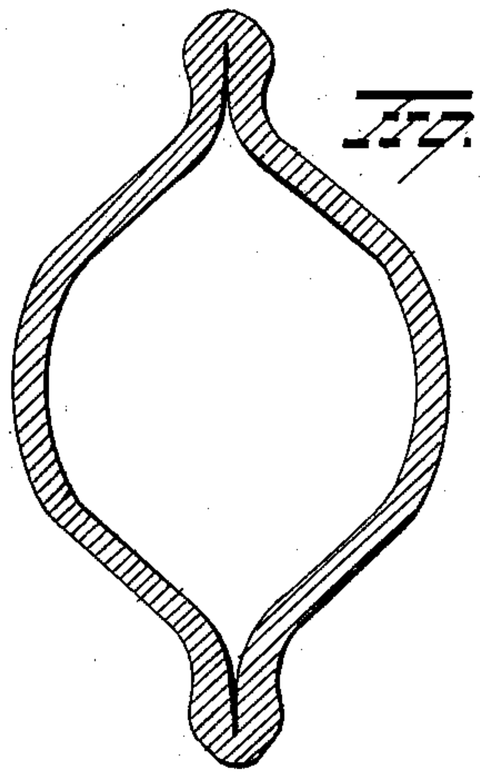


FIG. 8.

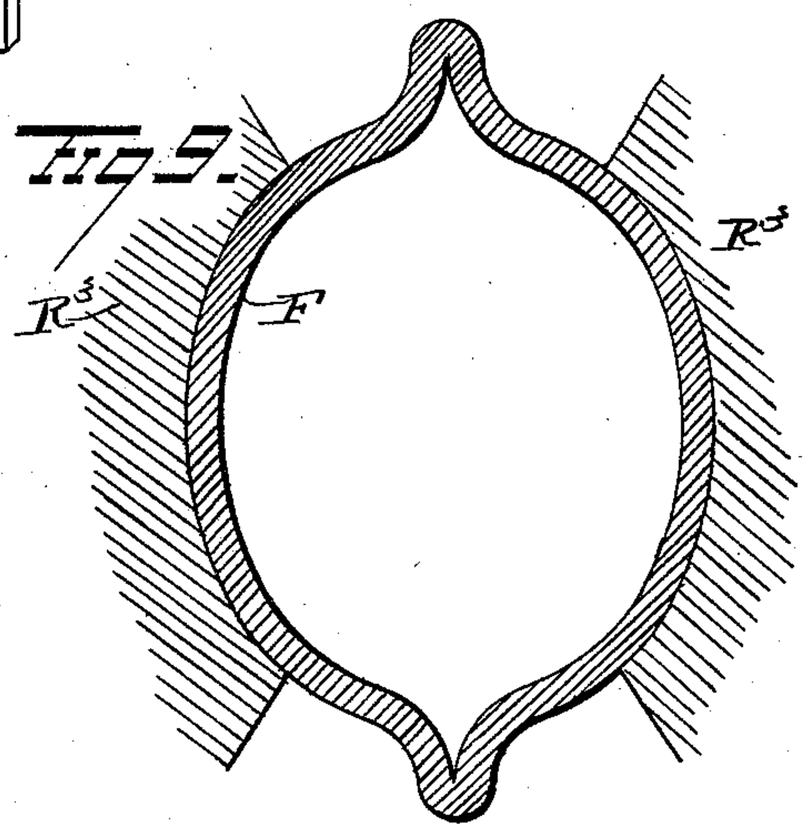


FIG. 9.

Witnesses
G. F. Downing
V. E. Hodges.

Inventor
Chas A. Marshall

By his Attorney
H. A. Seymour

UNITED STATES PATENT OFFICE.

CHARLES A. MARSHALL, OF JOHNSTOWN, PENNSYLVANIA.

PROCESS OF OPENING AND SHAPING TUBE-BLANKS.

SPECIFICATION forming part of Letters Patent No. 389,586, dated September 18, 1888.

Application filed January 30, 1888. Serial No. 262,334. (No model.)

To all whom it may concern:

Be it known that I, CHARLES A. MARSHALL, of Johnstown, in the county of Cambria and State of Pennsylvania, have invented certain new and useful Improvements in the Process of Opening and Shaping Tube-Blanks; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to an improvement in process of opening flat metallic tube-blanks, and is applicable to blanks of any metal—such as brass, ingot-iron, or steel—and is designed more particularly to shape hot solid-steel tube-blanks to approximately round or oval shapes, so that they may be drawn over a mandrel or ball with least friction and wear of ball and least distortion of metal blank.

In the accompanying drawings, Figure 1 is a view in vertical section showing the blank in side elevation. Fig. 2 is a view in cross-section of the blank before opening. Figs. 3, 4, and 5 are cross-sections showing successive forms assumed by the blank at different stages of the process. Fig. 6 is a view in end elevation of the rolls. Fig. 7 is a view in horizontal section of both rolls and blank. Fig. 8 is a view illustrating how the blank opens by edge pressure alone. Fig. 9 is a view in cross-section through the rolls R^3 and tube.

In application Serial No. 197,194, "process of making seamless tubes," I have shown and described opening flat tube-blanks by passing them edgewise between pressure-rolls, and mentioned that with wide tube-blanks guides may be used to advantage in the process. In opening by edge pressure without the use of guides it is not easy to open the blanks quite up to the crease or end of slit, or, if open at all up to that point, the angle of opening is very small, requiring a portion of the crease to be opened or spread through a wide angle by the subsequent mandreling operations. This causes severe wear on the mandrel at those places coming in contact with and lying aside the inwardly-curving and the unopened parts near edge of blank, and adds to the resistance against passage of tube over the mandrel, tending to cause the blank to "stick" on the ball or mandrel. Among tube-makers failures or wasters from this cause are known as "stickers," and are a source of great loss unless guarded against with all care.

This application more fully sets forth the mode of operation and best manner of using of guides. The guides shown in the drawings consist of short rolls R^2 R^3, having their axes parallel to the plane of axes of edgewise pressure rolls R'; but other forms of guides may be used—for example, fixed surfaces—this invention consisting more particularly in the mode of application of pressure to the blank as it passes through. Roller-guides R^2 R^3 may or may not be driven. Generally speaking, it will not be necessary to drive them. Edge-pressure rolls R' R' are driven.

R^2 R^2 are the entering-guides. These are placed close enough to rolls R' to embrace and laterally support the sides of blank F where it is partially open. This will preferably be at a point a little closer to bite of rolls R' than would be that point where they would just touch a blank which was being opened without the use of guides R^2. The blank, having been started open at one end, by wedging or other means, for a few inches in length, to form approximately as in Fig. 3, preferably not quite so wide, is inserted between R^2 R^2 to engage R' R'. The guides R^2 R^2 perform two offices, one being to hold the entering blank straight and central, the other being to press inward the separated sides, and thus cause a thrusting strain from edge to edge of the blank. If guides R^2 R^2 were not used, the distance from C C, Fig. 1, to where the blank would have width *w'*, Fig. 3, would be greater than that shown, so that by their use in applying pressure to sides I prevent the blank from opening freely as far back as it otherwise would do.

Guides R^3 R^3, on leaving side of rolls, operate in substantially the same way as just described. In order to understand the action of the guides more clearly we will first examine the condition of the blank at bite of rolls, (C C, Fig. 1.) Here there is pressure against the edges of blank exerted by grooves *g' g'* of rolls R', and for as great a distance from edges as the trend of the metal is, substantially in the plane of the grooves *g' g'*, this pressure is transmitted across the metal of blank as a com-

pressive stress; but this distance or parallel part of blank is very short, and if we suppose the middle portion unrestrained sidewise the reaction against pressure of rolls is supplied ultimately in part by the resistance of the central metal to bending outward. Now such thin sheets are capable of but small resistance against bending when already as much bent as is necessary in order to open the blank satisfactorily. The resistance against bending likewise is less as width w^2, Fig. 1, is greater. I have said that the resistance is in part supplied thus. Another and perhaps greater part is supplied by the resistance of the edges and unopened portions against bending as they approach closer together from depth h at A A to depth h^2 at C C. Also, there is a certain amount of compression from edge to edge carried around the sides while the blank is yet opened only to, say, form of Fig. 3. This compression, I have above stated, is preferably to be increased by action of guides R^2 R^2. Now, turning to guides R^3 R^3, they are so set as to restrain the sides, so that w^3 is less than w^2, or less than the width of the blank would be if it were opened by edge pressure alone to depth h^2 without restraining the sides. This sets up compression in the four inclined quarters of blank q q, Fig. 3, making these parts act as A-braces, their resultant pressures tending to throw the edges of blank farther from each other, and so cause depth h^3 to be greater than depth h^2. It is to be observed that this action may not always throw the edge of the blank farther apart, but may expend itself in producing a sharper bend in the metal close to the edges, thus increasing the dihedral angle at the crease. It is thus seen that the edges of blank are held apart at B B by guides R^2 R^2 and at D D by guides R^3 R^3, so that each angular portion of blank next to crease is relatively to the rolls R′ R′ suspended as a beam and bent by the rolls at C C. A very simple experiment will convince one that this is a favorable condition for spreading the blank up to the extremity of the crease or slit. Thus, crease a strip of paper to the form of an inverted V (∧) in cross-section and support it so creased at the extremities of its length, then press down in the middle, when the tendency of the dihedral angle to become larger in the middle will be apparent.

It will be observed that by restraining the sides of blank near to the bite of rolls, as described, the width w^2 is less than it would be were such restraint removed. This is favorable to my object, and might be attained by guides placed opposite to bite of rolls R′ R′. In my application Serial No. 197,194 I have shown a way of shaping the grooves in rolls R′ R′, substantially by making large grooves, having smaller grooves at bottom of said large grooves, to correspond with the small grooves g' g' of the drawings accompanying this application, which may well accomplish the same purpose as guides placed at bite of rolls, though a further effect of such grooves is to scratch and otherwise mark or injure the external surface of the blank.

The guides R^3 R^3 are preferably recessed, as shown, Fig. 9, of such shape as to support and restrain the sides of blank for a considerable portion of depth at and near middle, and also to restrain the quarter-points q' q', Fig. 9, from assuming a position too near the horizontal, which would weaken the reaction from edge to edge. Restraint only in the middle—as, for example, by guides with plane surfaces or right cylindrical surfaces—might result in a good general form of opened blank, which is preferably an oblong with its longer axis in direction of the edges; yet the freedom to bend at the quarter-points would result in diminishing the reactions which tend to throw the edges apart, and hence render the effect of edging-rolls R′ R′ less perfect and the dihedral angle at crease smaller.

For small sizes of blanks the guides R^2 R^2 may well be dispensed with, since the distance from bite of rolls to unopened part of blank is short in case of such small blanks, and one chief function of guides R^2 R^2—namely, to sustain edges apart at a point close to bite of rolls—is therefore unnecessary; also, there is little or no danger of both sides of small blanks ever buckling the same way when once started to buckle in opposite directions.

In the above description I have referred to the operation of the parts in connection with a flat unopened blank; but it is evident that the same steps can be employed with a partly-opened blank or with a blank previously opened by edge pressure alone; and it is also evident that either set of rollers R^2 R^3 may be dispensed with and the advantages of the use of the other set retained, and hence I would have it understood that I do not confine myself to the construction and combinations of parts shown, as it is evident that numerous changes and modifications might be resorted to without departing from the spirit of my invention.

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

1. In the process of making tubes, the following steps, viz: passing the blank between edge-pressure rolls and supporting the sides of the blank while the latter is being opened by the edge-pressure rolls.

2. The process of opening and shaping tube-blanks, consisting, essentially, in passing the blank through a series of rolls adapted to exert pressure against four sides of the blank.

3. The process of opening and shaping tube-blanks, consisting, essentially, in passing the blank between edge-pressure rolls for opening the blank and supporting and shaping the sides of the blank as the latter leaves the edge-pressure rolls, substantially as set forth.

4. The process of opening and shaping tube-blanks, consisting, essentially, in passing the blank between edge-pressure rolls for opening the blank and supporting the sides of the blank at a point on the entering side a short distance

from the bite of the edge-pressure rolls, substantially as set forth.

5. The process of opening and shaping tube-blanks, consisting in passing the blank between edge-pressure rolls and supporting and shaping the blank as it enters and leaves the rolls at short distances from the bite of the rolls.

6. The process of increasing the angle of opening at edges of a previously-flat or partially-opened blank, consisting in applying pressure to the edges, whereby the latter are caused to aproach each other, and restraining the approach of the metal adjacent to the edges by external pressure applied to the sides of the blank.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

CHAS. A. MARSHALL.

Witnesses:
G. F. DOWNING,
S. G. NOTTINGHAM.