

(No Model.)

2 Sheets—Sheet 1.

J. H. FLAGLER.
TUBE ROLLING MILL.

No. 371,835.

Patented Oct. 18, 1887.

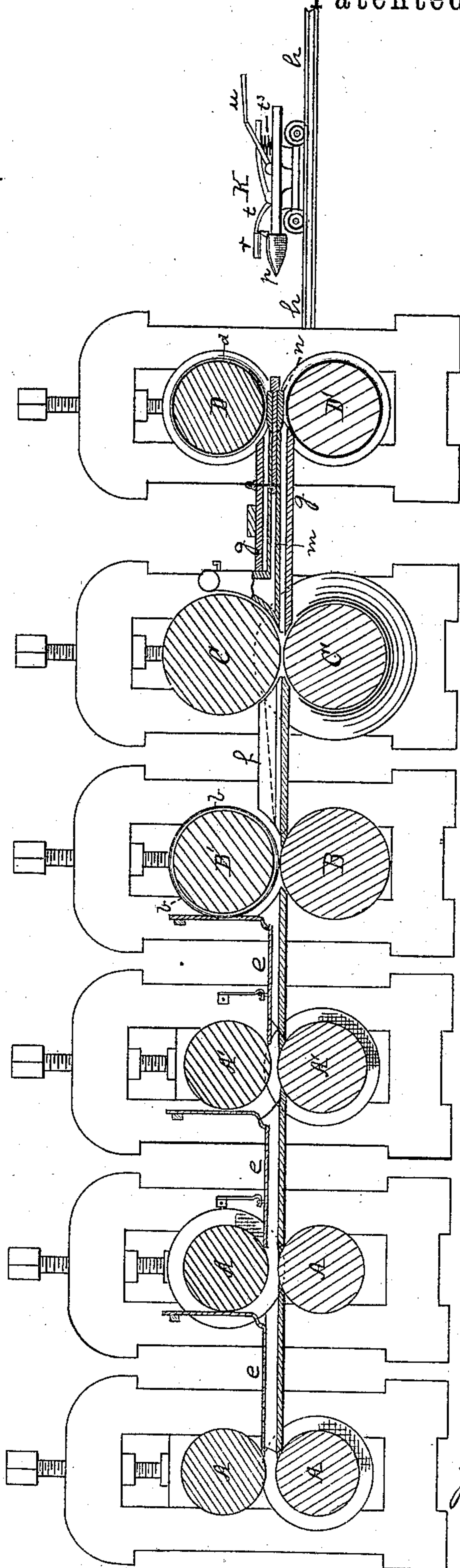


Fig. 1.

Witnesses.

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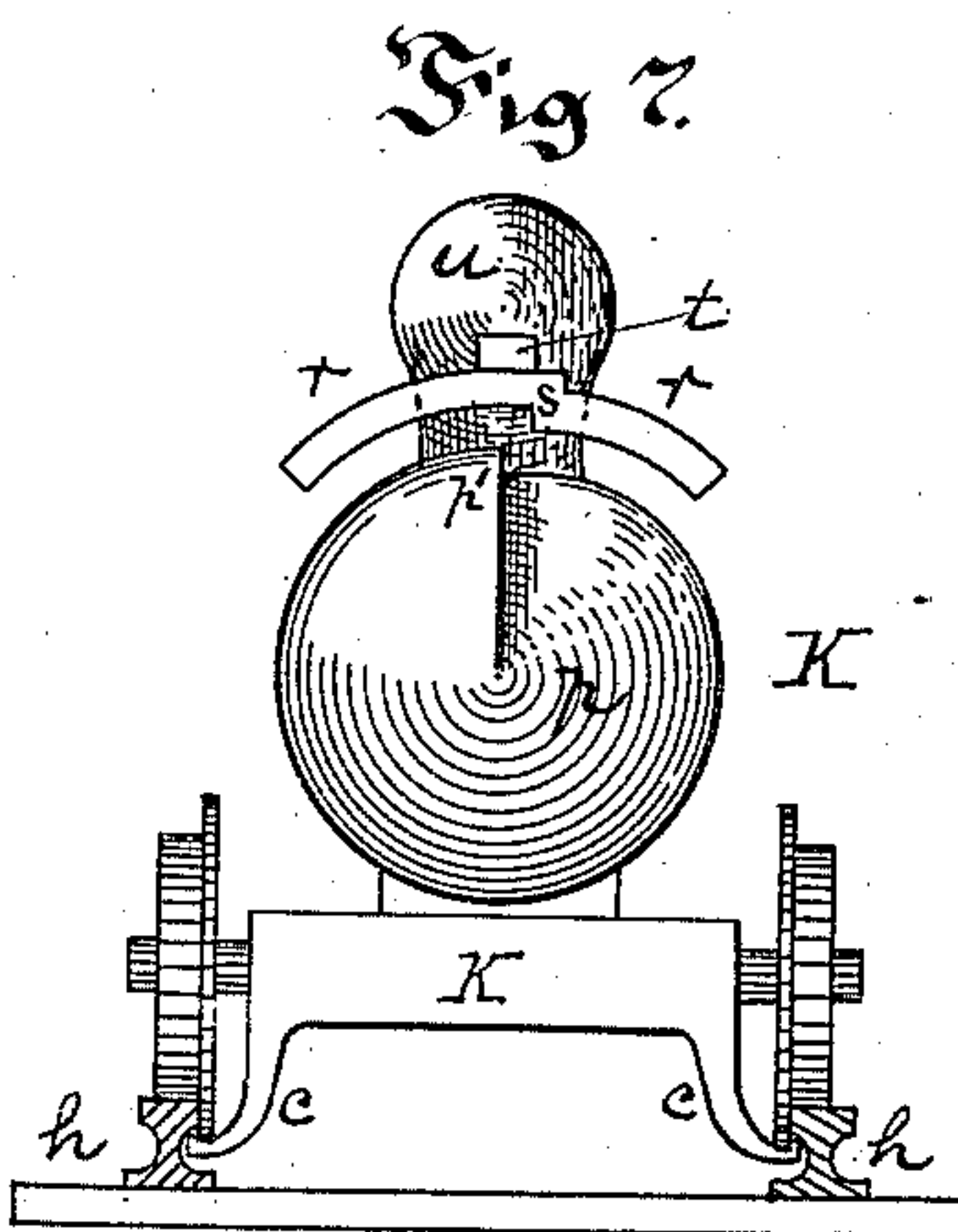
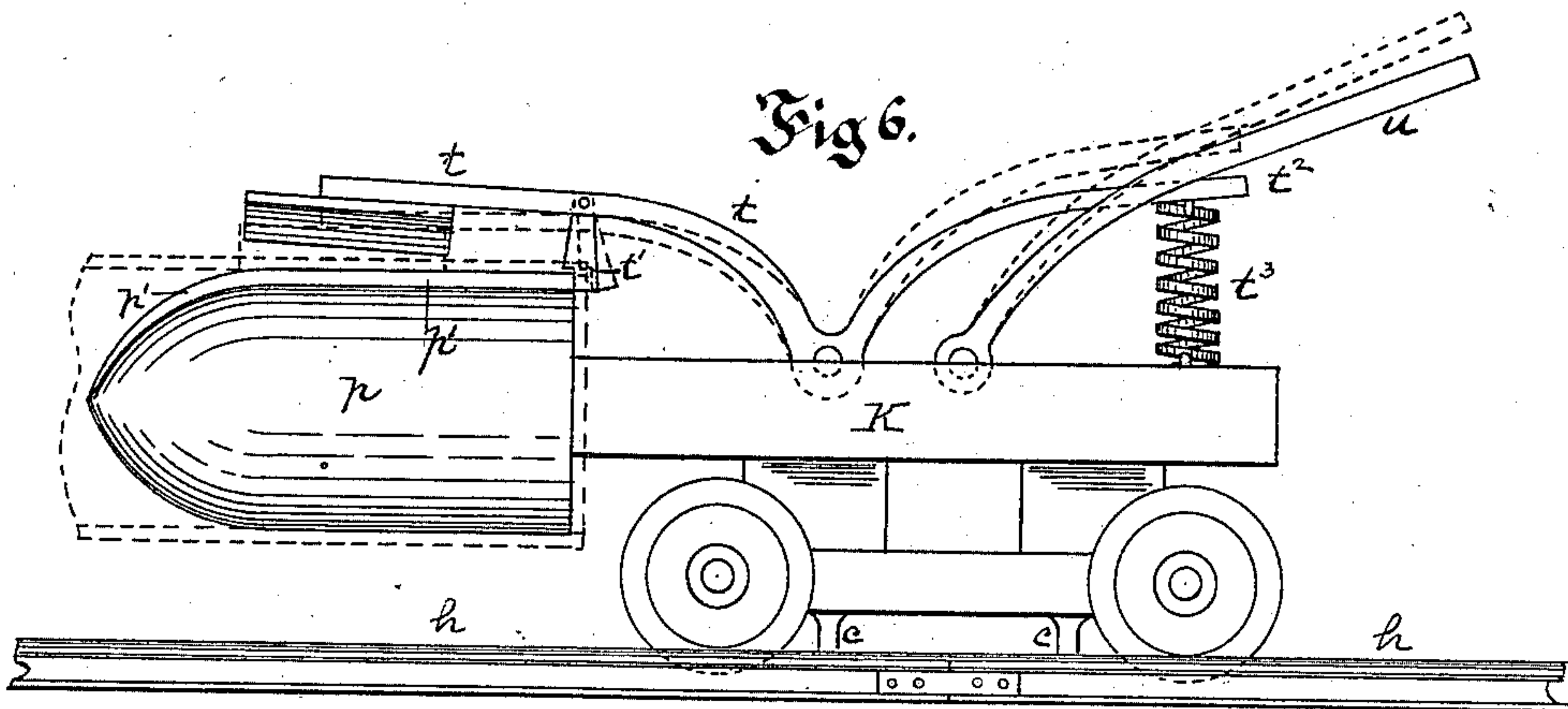
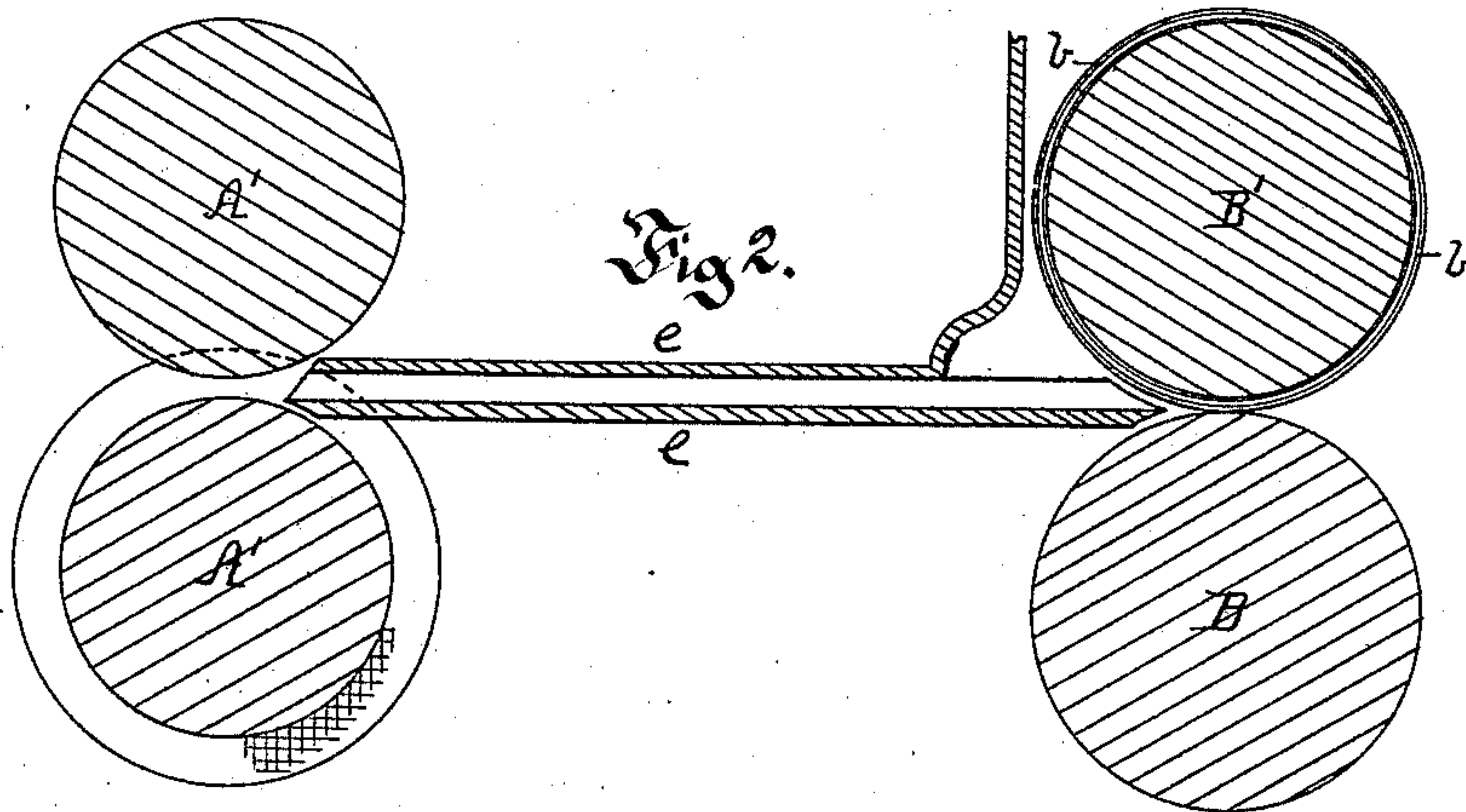
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2 Sheets—Sheet 2.

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Witnesses

J. Cooke
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UNITED STATES PATENT OFFICE.

JOHN H. FLAGLER, OF NEW YORK, N. Y.

TUBE-ROLLING MILL.

SPECIFICATION forming part of Letters Patent No. 371,835, dated October 18, 1887.

Application filed March 10, 1883. Serial No. 87,697. (No model.)

To all whom it may concern:

Be it known that I, JOHN H. FLAGLER, of New York, in the county of New York and State of New York, have invented a new and
5 useful Improvement in Apparatus for Rolling Tube-Skelp; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to the manufacture of
10 the tube-skelp employed for forming wrought-metal tubing. The usual method of forming this tube-skelp has been to first roll the metal plate from a heated pile of muck-bar, then scarf or bevel the edges in planing-machines,
15 and finally to reheat the plate and bend it in what are termed "skelping-dies." Machines have also been formed for rolling the scarf or bevel on the reheated plates and at the same time bending it into proper form for welding. It
20 has also been attempted to form tube-skelp from the billet or pile at one heat, the metal being fed back and forward through the rolls until brought to the proper gage, and then fed by the operator into bending apparatus to be
25 formed into skelp. The first two methods stated require the reheating of the metal and its manipulation several times, and the last has never been practically and successfully accomplished, because the metal would lose
30 its heat during the several handlings in feeding it to the different apparatus and become too stiff for bending before the skelp was bent to shape, in many instances cracking and breaking during the bending operation and
35 rendering the skelp useless. Difficulty has also been experienced in rolling the scarfed edges on the plates in the apparatus heretofore employed, because the rolls would only bite upon the edges of the plate and would elongate
40 the edge without elongating the body, so forming waving or buckled scarfing edges, which would not weld properly.

The principal objects of my invention are to render practicable the formation of the
45 tube-skelp from the billet or pile at one heat and to improve the formation of the rolled scarfing-edge on the plate from which the tube-skelp is bent.

My invention consists, first, in a continuous
50 rolling mill or machine for reducing a pile or billet to plate, scarfing it, and bending it into tube-skelp, formed of a series of two or more

reducing-rolls, scarfing rolls, bending-rolls, and lapping-rolls mounted in common line of feed and having suitable guides or conductors be- 55
tween them, so that the heated billets or pile is fed to the reducing-rolls and passes directly through the mill, being first reduced to proper gage and scarfed and then bent up into tubulate skelp, the operation being continuous and 60
the plate being bent into tubulate form before it is too cool for bending; second, in combining with the reducing-mill a pair of reducing and scarfing rolls, whereby the plate is reduced and elongated at the time of scarfing, and there- 65
fore any surplus metal from the scarfed edges is forced into the body of the plate and a straight scarf formed along the plate; third, in mounting behind the lapping-rolls of the continuous mill a buggy or carriage having 70
devices to catch the tubulate skelp as it is delivered from the mill, and adapted to travel back with the skelp and prevent its twisting, and finally in other details hereinafter specifically set forth. 75

To enable others skilled in the art to make and use my invention, I will describe its construction and operation, referring for that purpose to the accompanying drawings, in which—

Figure 1 is a longitudinal central section of 80
my improved continuous mill, the buggy at the end being shown in full line. Fig. 2 is a like view, enlarged, of the last pair of reducing-rolls and the reducing and scarfing rolls. Fig. 3 is a cross-section of the plate as delivered 85
from the last pair of reducing-rolls. Fig. 4 is a cross-section of the scarf-plate as delivered from the reducing and scarfing rolls. Fig. 5 is a cross-section of the tube-skelp formed. Fig. 6 is a side view of the improved buggy, 90
and Fig. 7 is a face view of the buggy.

Like letters of reference indicate like parts in each of the figures.

In the drawings referred to, A A indicate three pairs of reducing-rolls of a reducing- 95
mill, the rolls shown being tongue-and-groove rolls. The reducing-mill may be formed of any desired number of passes and any form of rolls, whether plain-faced, with or without intermediate vertical rolls, groove-rolls, or 100
tongue-and-groove rolls, the rolls preferred being tongue-and-groove rolls with the tongue and groove of the intermediate pairs reversed, as the metal is entirely confined in these rolls,

and the fins formed in one pass are rolled off in the next. The last pass A' of the reducing-mill is of such width as to leave the plate somewhat thicker than the required thickness of the plate to be formed into tube-skelp.

B B' are the reducing and scarfing rolls, the lower roll, B, being plain and the upper roll having a groove, *b*, corresponding in depth to the desired gage or thickness of the metal plate to be formed into skelp. The sides of this groove are beveled according to the bevel of the scarf to be formed on the plate, so that the plate, as it passes from the rolls A' A' through the rolls B B', is both reduced to the proper gage for the skelp and is properly scarfed and ready for the bending operation. This is fully illustrated in the enlarged view, Fig. 2, and the views of the plates, Figs. 3 and 4.

C C' are the bending-rolls, the lower roll, C', being concave or trough-shaped and the upper roll, C, being correspondingly convex, so that the pass between them is trough-shaped and the metal plate is bent by them into an approximately U shape.

D D' are the lapping-rolls, which are both concave and are adapted to bend over the sides of the U-shaped plate formed in the rolls C C' into tubular or skelp form. The upper roll, D, of the lapping-rolls has an annular ridge, *d*, against which the upper lip of the skelp fits, and by means of which the skelp is prevented from lapping too far, and the tubular skelp is delivered straight from the rolls.

Suitable conductors are employed between the several sets of rolls. The conductors *e* between the several sets of reducing-rolls and the last pair of reducing-rolls and the reducing and scarfing rolls B B' are of the ordinary construction employed in continuous reducing-mills, according to the form of the rolls. The conductor *f* between the rolls B B' and the bending-rolls C C' is preferably made flat at the entrance and concavo-convex at the discharge, so that it will receive the flat scarfed plate and impart to it a slight bend, which will cause it to feed more easily into the bending-rolls. Between the bending-rolls C C' and lapping-rolls D D' is a bending-box, *g*, within which the U-shaped plate enters after leaving the rolls C C', and by which it is bent over into proper shape for feeding into the lapping-rolls. Within the bending-box is the mandrel-bar *m*, supported by an extension above the box on the housings of the bending-rolls, and this mandrel-bar supports the mandrel or ball *n* between the lapping-rolls, this mandrel being removably secured to the mandrel-bar, so that it can be changed if desired. The mandrel-bar is formed hollow and water is forced through it, being discharged around the mandrel and against the lapping-rolls, so as to keep the apparatus cool.

At the end of the continuous mill is a suitable railroad-track, *h*, which extends out in line with the mill a suitable distance, accord-

ing to the length of the skelp formed therein. Running on this track is the buggy K, for catching the skelp as it leaves the rolls, guiding it back in a straight course, and preventing its twisting. I find this buggy necessary, because it is essential that the welding-edges of the skelp be straight to form a perfect weld, and where so long a skelp is delivered from the apparatus with its end free it has a tendency to twist, and consequently cause the welding-edges to extend spirally around the skelp. The buggy is free to run on the track *h*, and is pushed back by the skelp as it is delivered from the mill. If desired, it may be provided with hooks *c*, extending down from the buggy K and fitting under the head of the rail to prevent the skelp from twisting it off in case the twisting force is strong. The buggy may catch the skelp by any device proper for the purpose, such as tongs which bite upon and hold the lower part of the skelp, a hollow head having a longitudinal ridge therein, within which the end of the tube-skelp enters, the ridge within the head catching the upper lip of the skelp and preventing its turning, or a mandrel to fit within the skelp. This last apparatus is illustrated in the drawings. Secured at the front of the buggy is the mandrel or ball *p*, which is of proper size to fit within the skelp delivered from the mill, and has a longitudinal shoulder, *p'*, against which the inner lip of the tube-skelp fits, and by means of which it is held and prevented from twisting in one direction. Supported above the ball *p* is the holding-plate *r*, which conforms substantially to the shape of the skelp at and near the lapping edges and has a longitudinal ridge, *s*, which fits against the outer or upper lip of the skelp, and so holds it from turning in the other direction. The inner faces of this holding-plate are curved to substantially the same shape as the parts of the ball opposite them, so that the upper end of the skelp is firmly held between the ball and plate. The holding-plate *r* is rigidly secured to the frame *t*, pivoted on the buggy K and having an arm, *t'*, which extends back over a spiral or other spring, *t''*, secured between it and the buggy, by which the holding-plate *r* is pressed down upon the skelp. Pivoted on the frame *t* at the back of the mandrel *p* is the trigger or pawl *t'*, this trigger catching on the mandrel and supporting the holding-plate *r* above it, so that the tube skelp may pass over the mandrel, and, coming against the trigger, knock it off the mandrel, and thus permit the spring *t''* to press the holding-plate *r* down onto the skelp and hold it firmly between the plate and mandrel. A slide or any other suitable tripping device may be employed instead of the trigger. The holding-plate *r* is raised by means of the lever *u*, pivoted to the table and extending over the arm *t'* of the frame *t*, so that by pressing on the lever the plate *r* is raised, and the trigger *t'* will then swing for-

ward and catch on the mandrel, thus supporting it above the mandrel in position to receive another skelp.

The operation of my improved apparatus is as follows: The rolls are geared to run at the proper speeds, the surface speed of the rolls in the reducing-mills being increased according to the reduction and elongation of the metal, and the surface speed of the reducing and scarfing rolls being increased according to the reduction therein. As the metal is not reduced in the bending-rolls or lapping-rolls, they are geared to run at the same surface speed as the scarfing-rolls. The buggy K is run along the track *h* close up to the continuous mill and the holding-plate *r* raised until the trigger *t'* catches on the mandrel and holds the plate above the mandrel. The pile or billet is brought to the proper heat, being preferably highly heated, on account of the work on the metal, at the one heat, and it is then fed to the continuous mill. It then passes through the reducing-mill and is rolled therein to nearly the gage desired, and passes from the reducing-rolls A' A' to the reducing and scarfing rolls B B', where it is both reduced to the proper gage and scarf. As the plate is entirely confined by and is reduced in these rolls as well as scarfed, the extra metal rolled off the edges in beveling or scarfing them is pressed into the body of the plate, and for this reason a straight and proper scarf is formed along the edges instead of the plate being only elongated at the edges, and therefore formed waved or buckled at the scarf edges, as is the case where the rolls do not operate on the body of the plate. After leaving the rolls B B' the plate enters the conductor *f*, where it is given a slight or initial bend and is fed into the bending-rolls C C'. These rolls impart to the plate an approximately U shape, bending up the sides of the scarfed plate in proper shape to be afterward bent over by the bending-box *g*, when such box is employed, or by the lapping-rolls. Where the bending-box is employed the sides of the plate are bent over so that they almost lap and are in proper shape to be lapped around the mandrel *n* by the lapping-rolls D D'. As the plate passes through these rolls the upper or outer edge of the plate fits against the annular ridge *d* in the roll D, and the lower or inner edge is pressed under this edge, thus forming the tubular skelps. The ridge *d* of the upper roll also serves to deliver the skelp straight from the rolls and feeds it forward in proper position to pass over the mandrel *p* on the buggy K. As soon as the tubular skelp comes against the trigger *t'* it knocks it off the mandrel, and the holding-plate then clasps the skelp against the mandrel. As the inner edge of the skelp fits against the shoulder *p'* on the mandrel and the longitudinal ridge *s* on the holding-plate fits against its outer edge, the skelp is held straight and prevented from twisting by the buggy and the buggy is pushed back along the track by the skelp until

the finished skelp is delivered from the continuous mill. The holding-plate *r* is then raised, the buggy run back from the skelp, which is removed from the track, when the buggy is run up in position at the end of the mill, and the apparatus is ready for forming another skelp. The finished skelp is allowed to cool and then sawed into proper lengths, reheated, and welded into tubing in the usual or any approved manner.

As the operation is continuous from the pile or billet to the tube-skelp, the operation requires so little time that the plate is hot enough for bending into skelp without liability to splitting, cracking, or breaking even though reduced to thin plate from a thick pile or billet, and as fine skelp is formed as where the plate is reheated and rolled or drawn in the apparatus heretofore employed. I am thus enabled to save the cost and labor of reheating of the plate and prevent the consequent deterioration of the metal, which has never heretofore been accomplished in such way as to be practically employed. I also form tube-skelp having rolled scarfing edges which are perfect in form and adapted to weld properly. I also form tube-skelp having straight welding edges extending longitudinally along it, which has been found difficult in all apparatus for rolling tube-skelp.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. A continuous rolling-mill for forming tube-skelp from the billet or pile, having mounted in common line of feed a series of two or more reducing-rolls, a pair of scarfing-rolls, bending-rolls, and lapping-rolls; and having suitable guides or conductors between the several sets of rolls, the whole being combined together substantially as set forth.

2. In continuous rolling-mills, the combination, with a series of reducing-rolls, of a pair of reducing and scarfing rolls having a pass of less width than the pass of the last pair of reducing-rolls, whereby they are adapted to both scarf the plate and reduce it to the proper gage, substantially as and for the purposes set forth.

3. In combination with a continuous mill for rolling tube-skelp, a track at the end thereof, and a buggy running on said track and having devices to catch upon or within the skelp as it is delivered from the mill, and adapted to travel back with it and prevent its twisting, substantially as set forth.

4. In apparatus for grasping tube-skelp, the combination, with the buggy, of the mandrel *p*, having the shoulder *p'*, and the holding-plate *r*, having the ridge or shoulder *s*, substantially as set forth.

5. In apparatus for grasping tube-skelp, the combination, with the buggy, of the mandrel *p*, the holding-plate *r*, and the trigger *t'*, substantially as and for the purposes set forth.

6. In apparatus for grasping tube-skelp, the combination, with the buggy, of the mandrel *p*, the pivoted frame *t*, carrying the holding-

plate *r*, and spring *t*³, substantially as and for the purposes set forth.

7. In apparatus for grasping tube-skelp, the combination, with the buggy, of the mandrel
5 *p*, pivoted frame *t*, carrying the holding-plate *r*, spring *t*³, and lever *u*, substantially as and for the purposes set forth.

In testimony whereof I, the said JOHN H. FLAGLER, have hereunto set my hand.

JOHN H. FLAGLER.

Witnesses:

JAMES I. KAY,

J. N. COOKE.