No. 786,794. PATENTED APR. 11, 1905.

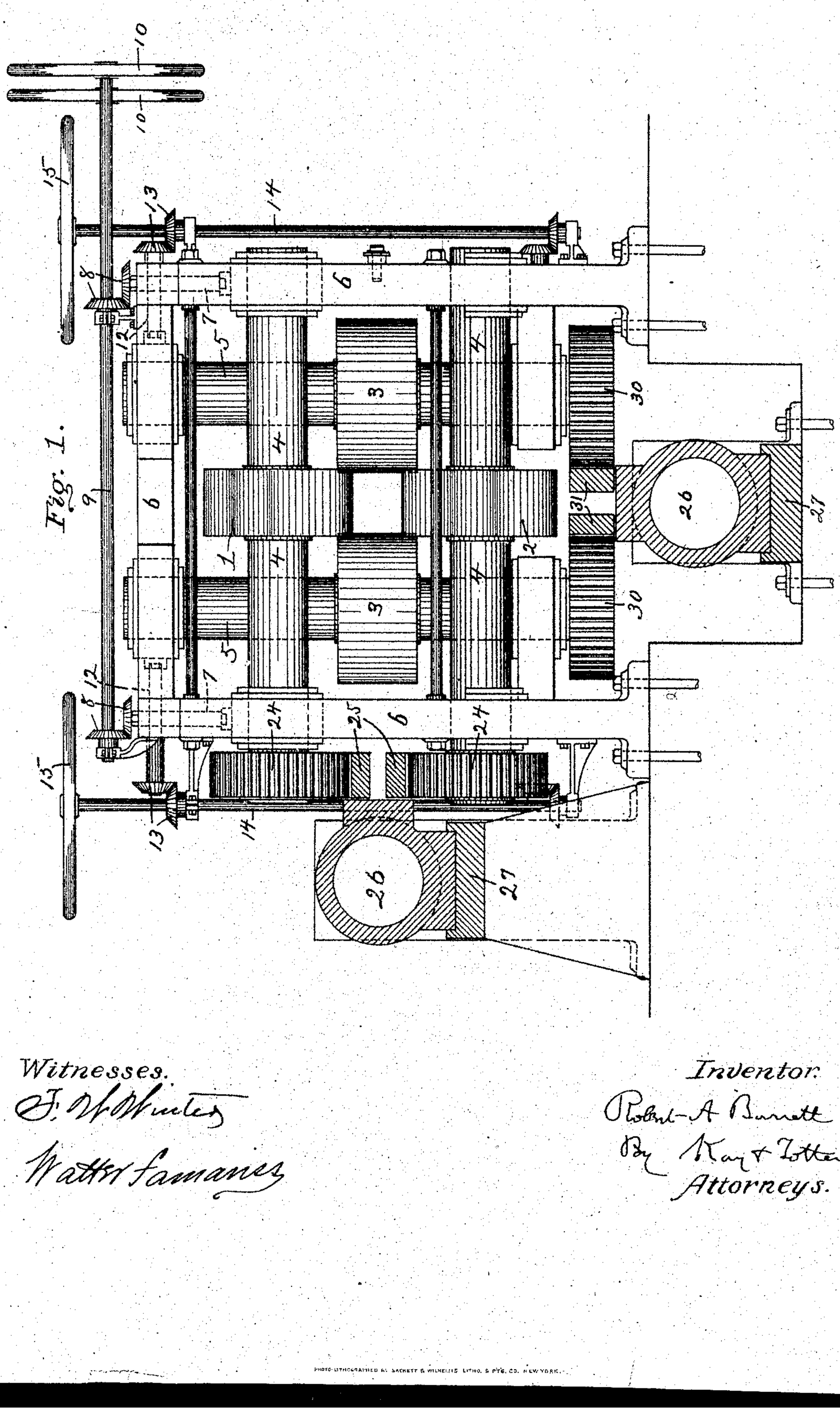
R. A. BARRETT.

APPARATUS FOR MAKING SERPENTINE BOILER HEADERS.

APPLICATION FILED SEPT. 3, 1901.

3 SHEETS—SHEET 1.

Fig. 1.



Witnesses.
J. D. Whiteley
Walter Famanes

Inventor:
Robert A Barrett
By Kay & Totten
Attorneys.

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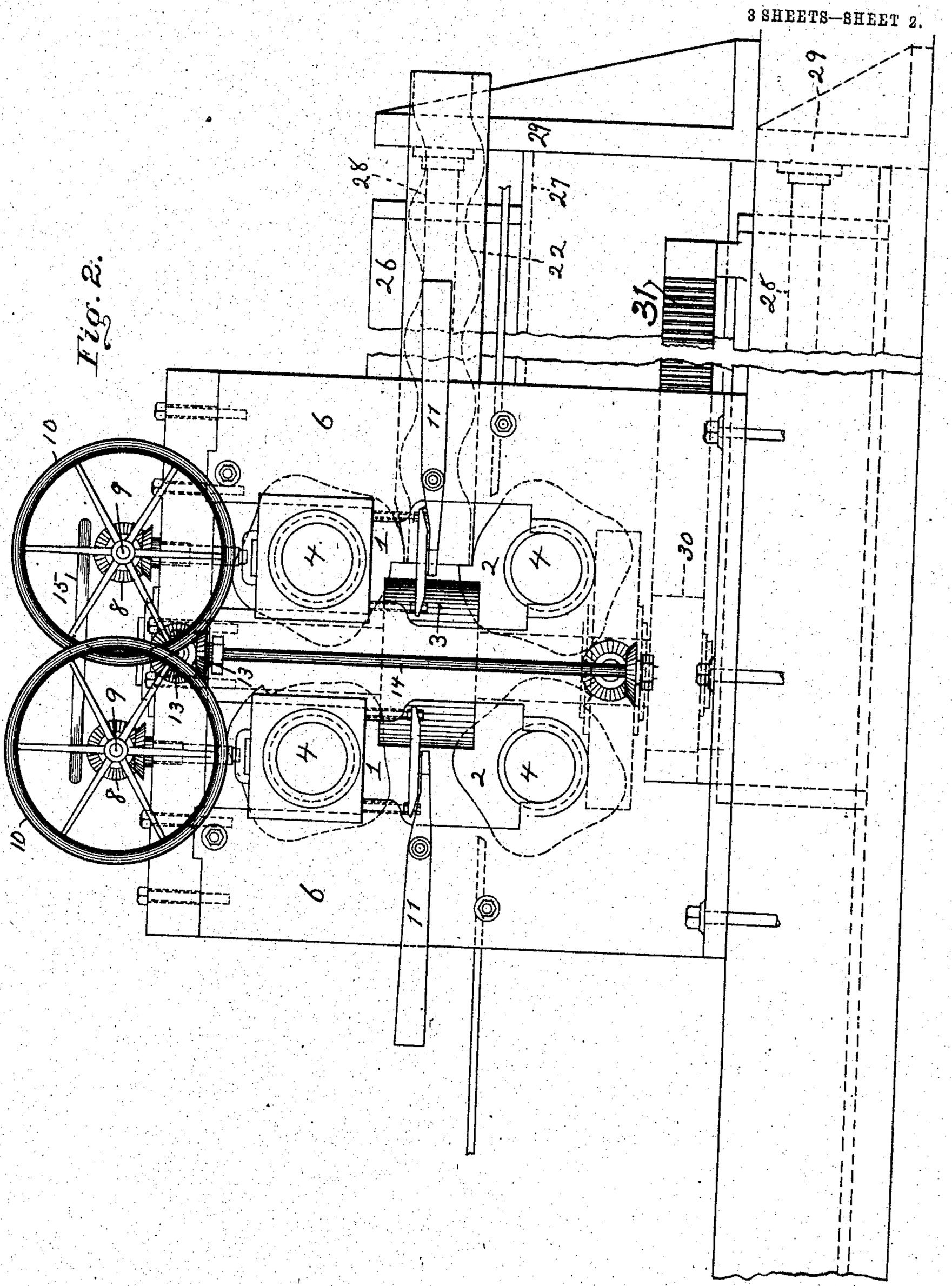
3 SHEETS—SHEET 2.

Fig. 2.



Witnesses.
J. W. Hanley
Walter Famariss

Inventor.
Robert A Barrett
By Kay & Potter
Attorneys.

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3 SHEETS—SHEET 3.

Fig. 4.

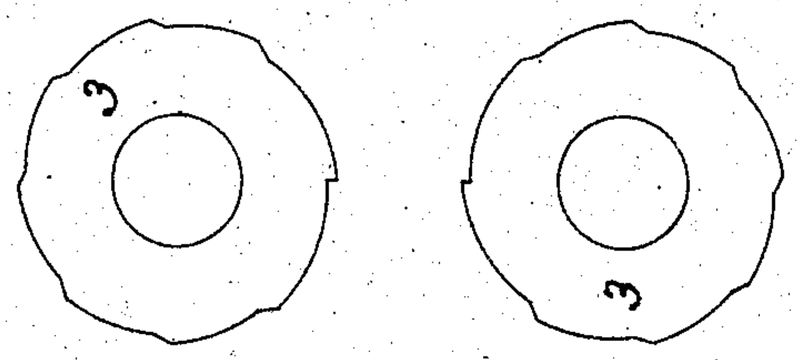
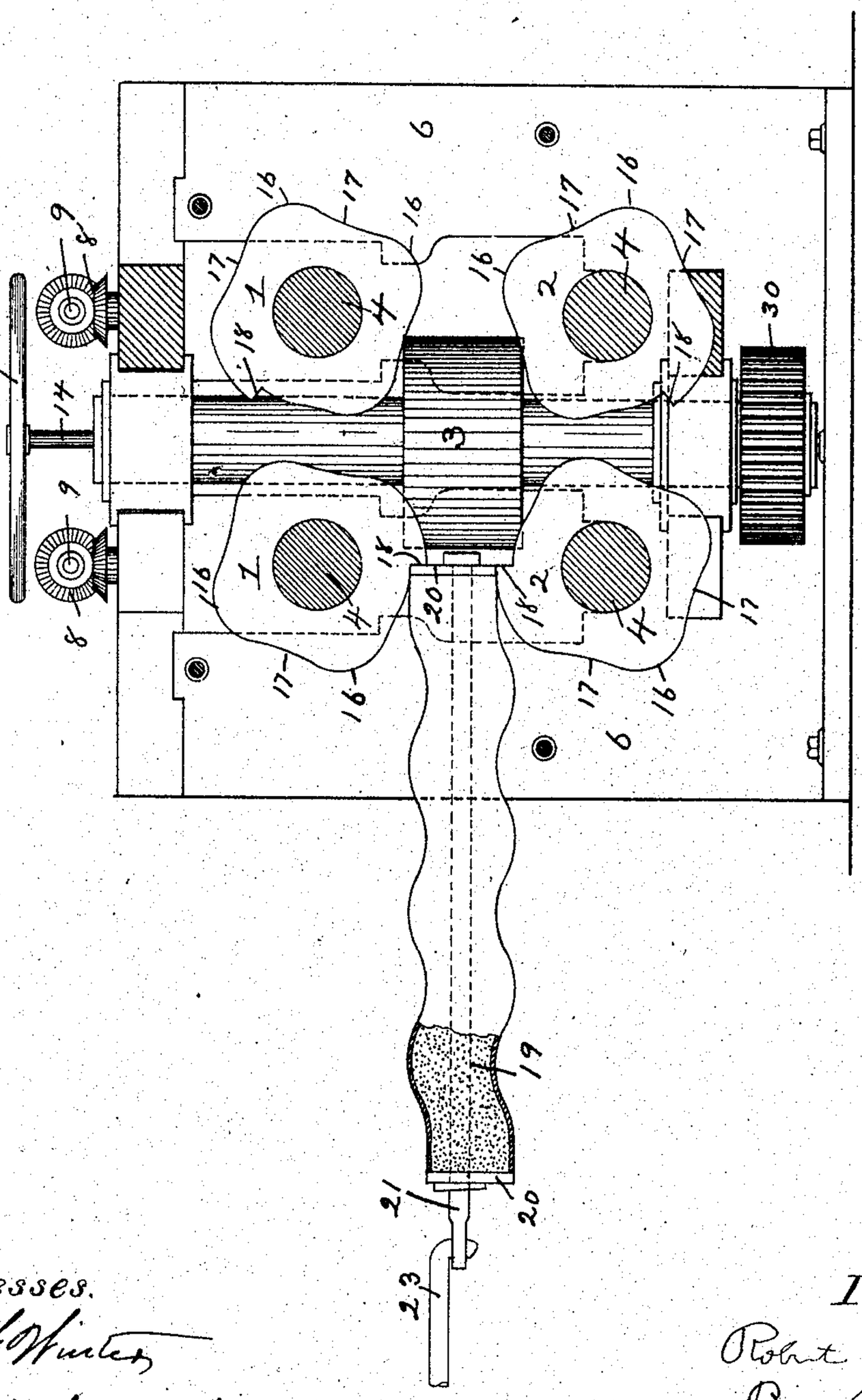


Fig. 3.



Witnesses.
J. W. Winter
Walter Famariss

Inventor.
Robert A. Barrett
By Kay & Potter
Attorneys.

No. 786,794. Patented April 11, 1905.

UNITED STATES PATENT OFFICE.

ROBERT A. BARRETT, OF BARBERTON, OHIO, ASSIGNOR TO THE STIRLING COMPANY, OF JERSEY CITY, NEW JERSEY, A CORPORATION OF NEW JERSEY.

APPARATUS FOR MAKING SERPENTINE BOILER-HEADERS.

SPECIFICATION forming part of Letters Patent No. 786,794, dated April 11, 1905.

Application filed September 3, 1901. Serial No. 74,201.

To all whom it may concern:

Be it known that I, ROBERT A. BARRETT, a resident of Barberton, in the county of Summit and State of Ohio, have invented a new and useful Improvement in Apparatus for Making Serpentine Boiler-Headers; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to apparatus for shaping hollow or tubular metal articles of irregular outline longitudinally, such as serpentine boiler-headers and the like.

Serpentine boiler-headers and similar articles are made from comparatively heavy metal, and as such articles are irregular in shape considerable difficulty has been experienced in forming them of wrought iron or steel. By reason of the thickness of the metal composing such articles it requires heavy pressure to shape the same, and in order to prevent the collapsing of the tube during the shaping process it is necessary to use an internal support or mandrel for the same. This mandrel or internal support must offer sufficient resistance to the action of the external forging or shaping means and nevertheless be capable of being withdrawn or removed from the header or other article after the same is shaped.

It is the object of my invention to provide apparatus for shaping serpentine boiler-headers and similar articles which is simple, strong, and efficient and by means of which the header or other article can be accurately shaped and without danger of collapsing the same.

To this end my invention comprises, generally stated, the use of a pair of oppositely-disposed rolls arranged to revolve adjacent to each other and provided with longitudinal corrugations on their faces, which are adapted to form the transverse corrugations in the header, and a mandrel, which is adapted to support the inner faces of the tube between the rolls during the shaping process.

In the accompanying drawings, Figure 1 is a front elevation, partly in section, of my improved apparatus. Fig. 2 is a side elevation of the same. Fig. 3 is a sectional side view of the apparatus slightly modified and showing the header as it emerges from the rolls, and Fig. 4 is a diagrammatic plan view of the vertical rolls.

In the use of my apparatus it is necessary to use at least one pair of oppositely-disposed rolls provided with longitudinal corrugations on their faces; but I prefer to use two pairs of such rolls arranged tandem and through which the blank passes in succession, said rolls being preferably arranged horizontally. I also prefer to use in conjunction with such rolls a pair of vertical rolls which are adapted to confine and shape the side faces of the header. In the drawings, accordingly, I have shown the preferred form of my apparatus—namely, with two pairs of horizontal longitudinally-corrugated rolls and a pair of vertical side rolls—although I wish it understood that my invention is not limited in these particulars.

The longitudinally-corrugated rolls are shown at 1 and 2 and the side rolls at 3. The rolls 1 and 2 are mounted on suitable horizontal shafts 4, and the side rolls are mounted on suitable vertical shafts 5, all of these shafts being mounted in suitable journal-boxes in the housing or frame 6, which may be of any desired or necessary construction. The journal-boxes of the lower horizontal rolls 2 are mounted stationary in the housings or frame 6, while the journal-boxes of the upper horizontal rolls 1 are adjustable by any approved means, as the screws 7, which are actuated by bevel-gears 8, shafts 9, and hand-wheels 10, as will be readily understood. The journal-boxes of the upper rolls are supported on the levers 11, the outer ends of which are suitably counterweighted (not shown) to hold the upper rolls away from the lower rolls to normally maintain the pass between the said rolls open, the adjusting-screws 7 serving to lower the said top rolls against the counterbalances on the levers 11. The side rolls 3 are also adjustable by any approved means, as the screws 12, which are actuated by the bevel-gears 13, shafts 14, and hand-wheels 15, as will be readily understood.

The faces of the rolls 1 and 2 are provided

with the longitudinal projections or corrugations 16 and flattened or grooved portions 17 and with the radial shoulders 18, the latter indicating the beginning and end of the header. The number and shape of the corrugations on the faces of the rolls will depend upon the length and particular contour to be given to the header or other tubular article, and preferably the rolls will be of sufficient size so that a single revolution thereof will shape the entire length of the header. In the particular machine illustrated I have shown each of the rolls as provided with four projections and corresponding depressions, and the resultant header which is formed thereby is shown in dotted lines in Fig. 2 and in full lines in Fig. 3. In shaping said header or other tubular article the end of the tubular blank is inserted into the first pair of rolls, as shown in Fig. 2, with its end abutting against the shoulder 18 on the bottom roll 2, and said blank is then passed through the said rolls and enters the second set of rolls in the same way, also passing through the same and finally emerging in finished shape, as shown in Fig. 3. At the same time the vertical side rolls 3 3 confine the side walls of the header during the shaping of the top and bottom walls by means of the rolls 1 and 2. In case the side faces of the header are to be plain the rolls 3 will of course be plain; but for a header which is to be used with inclined water-tubes it is necessary to form the side faces stepped or jogged, so as to form faces which will be substantially at right angles to the inclined water-tubes. In that event the faces of the side rolls 3 will be so shaped as to give the desired contour to the side walls of the header, as shown, for instance, in Fig. 4. In shaping the header or other tubular body between the rolls as thus described it is essential that the walls of the tube be supported internally during the shaping operation to prevent collapsing of the tube. Any suitable form of support or mandrel may be used for this purpose—such, for instance, as a sand or similar mandrel or one formed in sections, so that it can be removed from the irregular article after it is shaped, or a frangible mandrel which can afterward be broken out. In Fig. 3 I have shown a mandrel or support composed of dry sand, dry brick-dust, or similar material 19, tamped into the tubular blank and confined therein by the caps 20 and the tie-rod 21. I may, however, use some form of frangible mandrel which will form a rigid support for the article while it is being shaped, and thus absolutely guard against its collapsing at one or more points and which shall be of a shape conforming to the shape of the article to be made and adapted to have the tube pressed down upon the same by means of the rolls. As a suitable form of such frangible mandrel I have in Fig. 2 shown a hollow cast-iron mandrel 22, which is the invention of James P. Sneddon, as described and claimed in his application filed April 12, 1901, Serial No. 55,541. I do not, however, claim such mandred specifically, as any form of mandrel suitable for the purpose is within the scope of my invention, the essential feature of which is the forming of the tubular article on or over an internal support or mandel by means of the longitudinally-corrugated rolls.

In order to feed the blank through the rolls, it is preferred to positively drive said rolls, although the rolls may be permitted to run idly and the blank or mandrel and blank be drawn or pushed through said rolls, as shown, for instance, in Fig. 3, in which the blank and mandrel are engaged by a hook or link 23, connected to any power mechanism, preferably the piston-rod of a hydraulic cylinder, but may be connected to any other suitable reciprocating rod. As above stated, I prefer, however, to positively drive the rolls 1, 2, and 3 so that the blank or the blank and mandrel together will be fed positively through the rolls, as in an ordinary rolling-mill. Any suitable mechanism may be used to drive these rolls; but I have shown them as being driven by means of reciprocating racks, which are adapted to engage gears on the shafts 4 and 5. The shafts 4 are shown as provided with gears 24, which are engaged by the racks 25, the racks being reciprocated by any suitable mechanism, that shown being a power-cylinder 26, which is adapted to slide in the ways 27 and is secured directly to said racks 25. The piston-rod 28 of the cylinder is fixed—as, for instance, to the abutment 29—so that when water or other fluid pressure is admitted to the cylinder 26 the latter will be reciprocated, thereby carrying with it the racks 25 and through the gears 24 rotating the shafts 4 and rolls 1 and 2. The shafts 5 are provided with similar gears 30, which are engaged by the racks 31, and these in turn may be reciprocated by any suitable mechanism, and in this case I have shown a similar hydraulic cylinder 26, with fixed piston-rod 28. It is preferable and desirable that the rolls 1, 2, and 3 rotate in unison, and consequently the reciprocating racks 25 and 31 should be actuated in unison and at the same speed. It is desirable, therefore, that the hydraulic cylinders 26 be connected to a single pipe and that a single valve be used to admit the water to said cylinders. It may also be desirable to connect the racks 25 and 31 by some mechanical means, so that they will travel at the same speed. Any suitable mechanism or connecting means may be used for this purpose—such, for instance, as yokes or spiders connecting the two racks, or suitable gearing may be interposed between them—all of which will be readily understood.

In the use of the apparatus the tubular blank is heated to the desired temperature

after being filled with sand or similar material, or with other forms of mandrel it is heated and then placed over the mandrel. With the specific form of mandrel illustrated in Fig. 2 the end of the blank will preferably be swaged down onto the end of the mandrel. The blank and mandrel are then fed through the rolls either by the positive action of the rolls themselves or by being drawn or pushed therethrough. In any event the rolls 1 and 2 press the top and bottom walls of the tube down upon the mandrel and shape the same, while the side walls of the mandrel are properly confined and, if necessary, shaped by the side rolls 3.

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

1. In apparatus for shaping wrought-metal headers or other tubular bodies of irregular outline longitudinally, the combination of rolls arranged to revolve adjacent to each other and having longitudinal corrugations on their faces, and a mandrel adapted to support the inner faces of the tube between the rolls during the shaping process.

2. In apparatus for shaping wrought-metal headers or other tubular bodies of irregular outline longitudinally, the combination of oppositely-disposed rolls having longitudinal corrugations on their faces and arranged to revolve adjacent to each other with the corrugations of the rolls alternating, and a mandrel adapted to support the inner faces of the tube between the rolls during the shaping process.

3. In apparatus for shaping wrought-metal headers or other tubular bodies of irregular outline longitudinally, the combination of rolls arranged to revolve adjacent to each other and having longitudinal corrugations on their faces, and a mandrel conforming to the shape of the finished article and adapted to be inserted in and support the walls of the tube between the rolls during the shaping process.

4. In apparatus for shaping wrought-metal headers or other tubular bodies of irregular outline longitudinally, the combination of rolls arranged to revolve adjacent to each other and having longitudinal corrugations on their faces, and a mandrel adapted to be inserted in the tubular blank, have the latter pressed down thereupon, supporting the inner face of the tube between the rolls during this shaping process and to be then removed therefrom.

5. In apparatus for shaping wrought-metal headers or other tubular bodies of irregular outline longitudinally, the combination of rolls arranged to revolve adjacent to each other and having longitudinal corrugations on their faces, a mandrel adapted to support the inner faces of the tube between the rolls during the shaping process, and means for actuating said mandrel.

6. In apparatus for shaping wrought-metal headers or other tubular bodies of irregular outline longitudinally, the combination of rolls arranged to revolve adjacent to each other and having longitudinal corrugations on their faces, of other rolls for confining and shaping the sides of the tubular article, and a mandrel adapted to support the inner faces of the tube between the rolls during the shaping process.

7. In apparatus for shaping wrought-metal headers or other tubular bodies of irregular outline longitudinally, the combination with rolls arranged to revolve adjacent to each other and having longitudinal corrugations on their faces, of other rolls for confining and shaping the sides of the header, means for positively driving said rolls in unison, and a mandrel adapted to support the inner faces of the tube between the rolls during the shaping process.

8. A machine for forming tubes into longitudinal serpentine shape consisting of oppositely-disposed fluted rolls arranged to revolve in relation to each other so that the interdental spaces of the rolls alternate, combined with a mandrel supporting the inner face of the tube located between the rolls, having a bearing capable of meshing with the interdental spaces of the rolls and coöperating therewith to progressively produce the serpentine shape of the tube, as set forth.

9. In a machine for forming tubes into longitudinal serpentine shape, the combination with a set of rolls acting upon the exterior of opposite sides of the tube and adapted to form progressive depressions therein, of a mandrel acting upon the interior sides of the tube and coöperating with said rolls.

In testimony whereof I, the said ROBERT A. BARRETT, have hereunto set my hand.

ROBERT A. BARRETT.

Witnesses:

ROBERT C. TOTTEN,

WALTER FAMARISS.