No. 876,895. PATENTED JAN. 14, 1908.

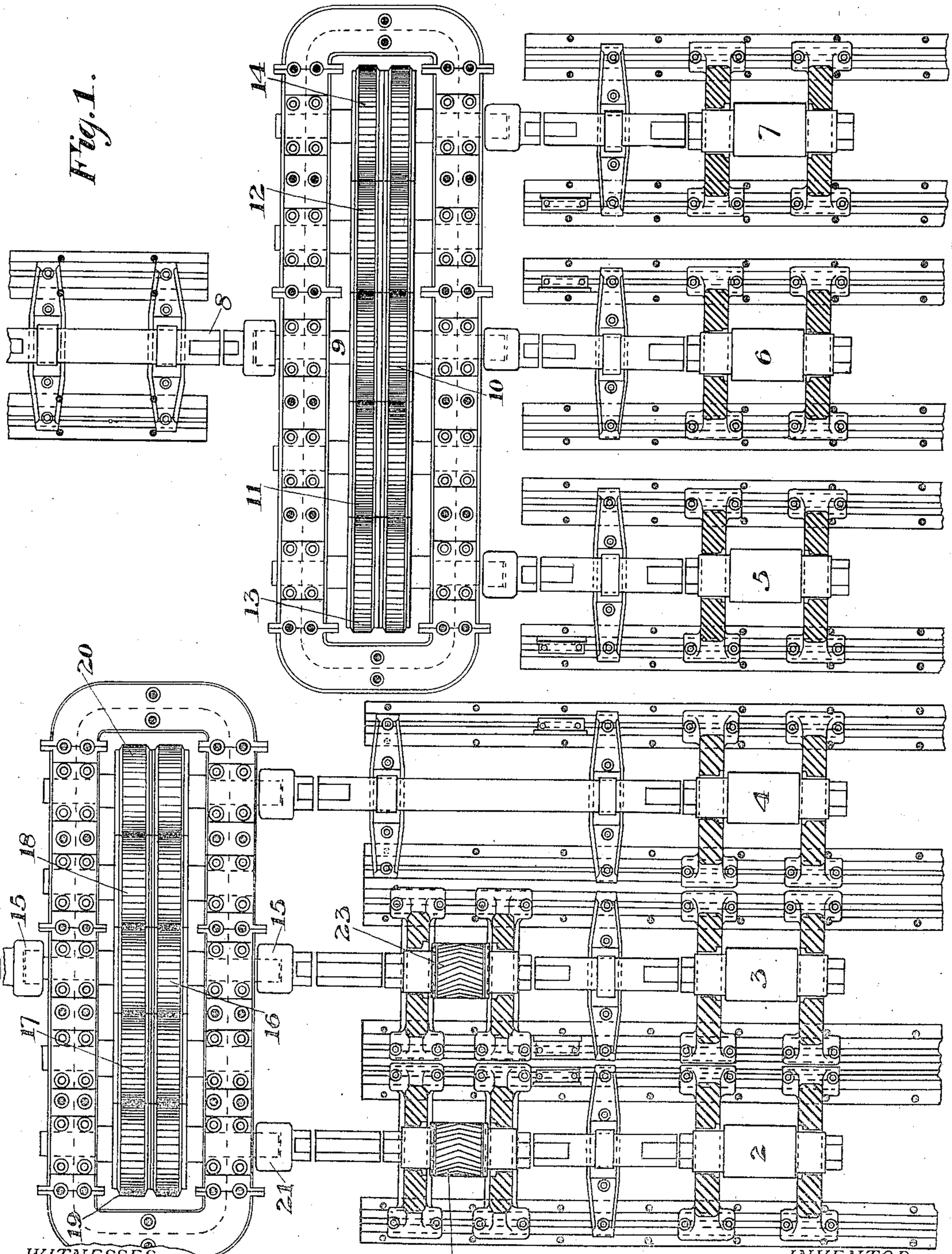
C. W. BRAY.

TANDEM MILL.

APPLICATION FILED FEB. 9, 1905.

3 SHEETS—SHEET 1.

Fig. 1.



WITNESSES

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3 SHEETS—SHEET 2.

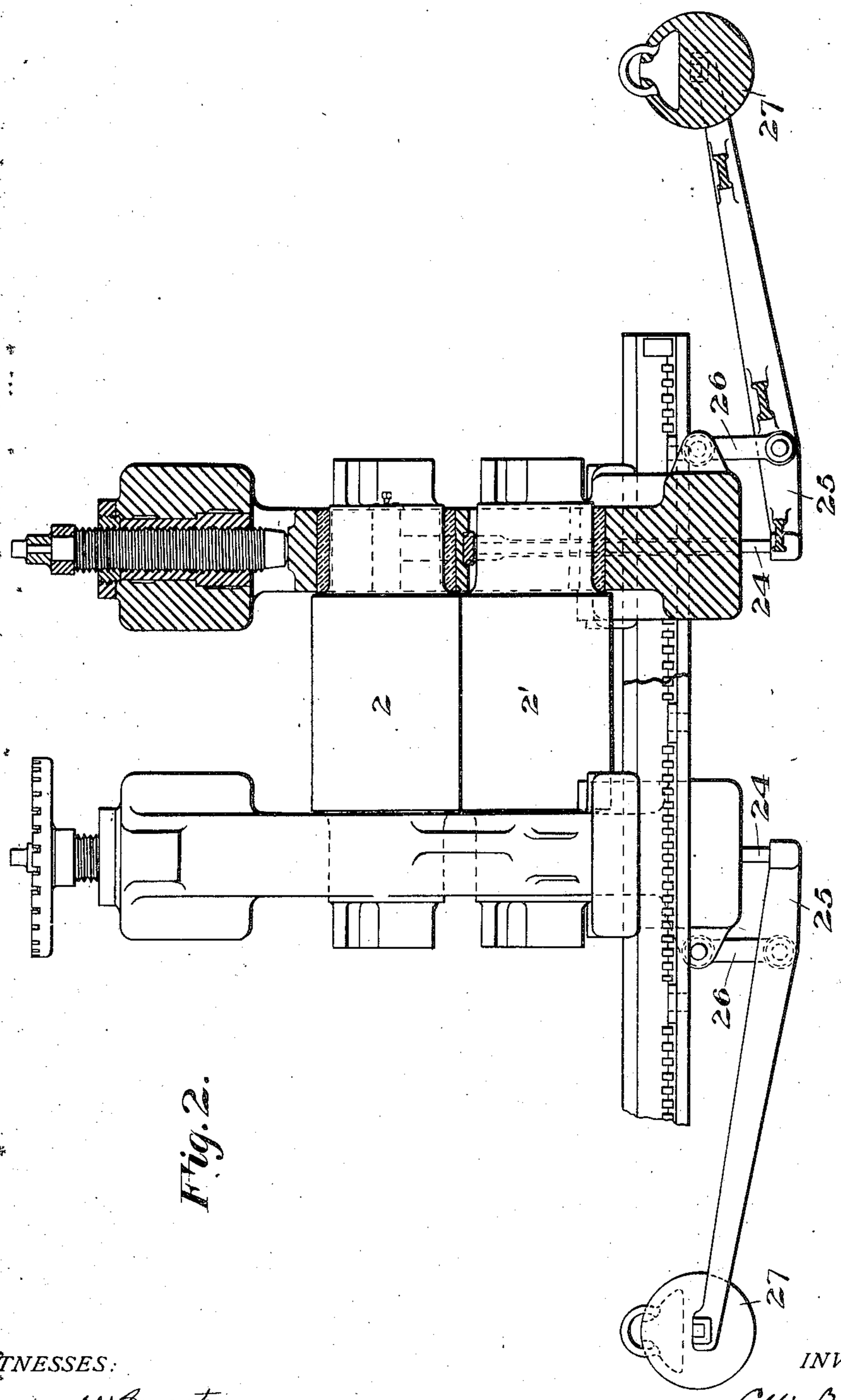

Fig. 2.

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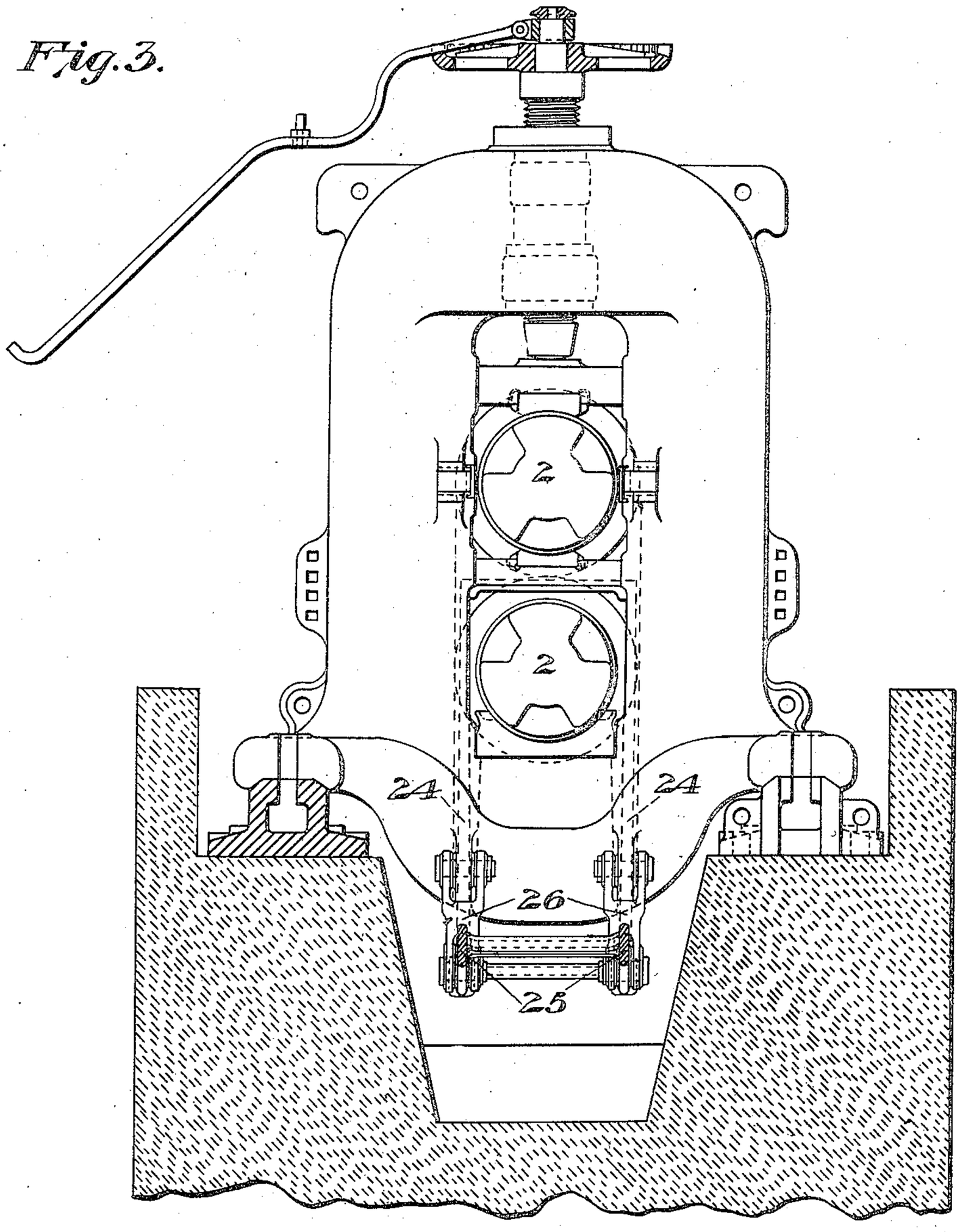
3 SHEETS—SHEET 3.

Fig. 3.



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UNITED STATES PATENT OFFICE.

CHARLES W. BRAY, OF PITTSBURG, PENNSYLVANIA, ASSIGNOR TO AMERICAN SHEET & TIN PLATE COMPANY, OF PITTSBURG, PENNSYLVANIA, A CORPORATION OF NEW JERSEY.

TANDEM MILL.

No. 876,895. Specification of Letters Patent. Patented Jan. 14, 1908.

Application filed February 9, 1905. Serial No. 244,869.

To all whom it may concern:

Be it known that I, CHARLES W. BRAY, of Pittsburg, Allegheny county, Pennsylvania, have invented a new and useful Tandem Mill, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification, in which,—

Figure 1 is a sectional plan view showing a tandem mill for rolling sheets or plates from sheet bars or tin bars, constructed in accordance with my invention; Fig. 2 is a sectional front elevation of one of the balanced mills; and Fig. 3 is an end elevation of the same.

My invention relates to the rolling of sheets or plates from bars or slabs in tandem mills, and is designed to overcome certain difficulties which have been experienced in the use of tandem mills for such purpose.

Heretofore in using tandem mills for rolling sheets or plates from slabs, sheet bars, tin bars, and similar articles, the lower roll of each set has been positively driven, while the upper roll is a jump roll driven only by friction, having no positive driving connections. In such mills, I have found in practice that owing to the thickness of the metal passing through the first sets of rolls there is an excessive amount of back-lash and slipping as the bar or slab enters the set of rolls. In this type of mill, the jump roll normally rests upon and is driven frictionally by the lower positively-driven roll, and when the slab or bar is fed in, the upper roll is forced up and the bar or slab stops momentarily, producing excessive shocks and jars on the driving connections for the lower rolls; at the same time the speed of the upper roll is reduced and as it then picks up its speed it slips upon the metal passing through, since the metal is at this time feeding at a higher rate of speed than the speed of the upper roll.

My invention overcomes these difficulties, and it consists in providing a tandem mill in which the top and bottom rolls of at least the first set or sets of rolls are both positively driven, and the upper roll is preferably counter-balanced, the succeeding rolls being preferably of the ordinary jump roll type.

All of the sets of rolls of the tandem mill may be arranged in the same manner as the first set or sets, both rolls of the set being positively driven, though this will add somewhat to the expense of the mill.

In the drawings, I show a tandem mill having six sets of rolls, 2, 3, 4, 5, 6, and 7. I have shown these sets as divided into two groups of three each, each group being driven from a common shaft. Thus the sets of rolls 5, 6 and 7 are driven from the common shaft 8 having wabbler connections with the shaft 9 carrying the gear 10. This gear intermeshes with idler gears 11, 12, which in turn engage the driving gears 13 and 14. The shaft 9 of the gear 10 has a wabbler connection with the lower roll of the set 6, while the shafts of the gears 13 and 14 have corresponding connections with the lower rolls of the sets 5 and 7 respectively. The other group is driven from the shaft 15 having the gear 16 intermeshing with the idler gears 17 and 18. These idler gears intermesh with the driving gears 19 and 20. The gear 20 is directly connected to the lower roll of the set 4 through the wabbler connections. The shaft 15 of the gear 16 and the shaft 21 of the gear 19 have wabbler connections with the lower pinions of the pinion sets 22 and 23. The lower pinion of each set has wabbler connection with the lower roll of one of the first two sets of rolls, while the upper pinion is similarly connected to the corresponding upper roll. I thus positively drive both the upper and lower rolls of the first two sets. The apparatus shown is specially designed for the rolling of sheet bars into sheets; and it will be understood that the number of sets of rolls in which both the upper and lower rolls are positively driven may be more or less than shown, and may comprise each set of the mill.

Each set of rolls 2 and 3 is of the type shown in Figs. 2 and 3, in which I illustrate the first set. The upper roll 2 of each of these sets is carried in bearings which are connected by pairs of vertical rods 24 with a lever frame 25 pivoted on links 26 pivotally connected to the bottom portions of the housings. The rods 24 are loosely connected with the inner end of the frame, while the outer end of the frame is provided with a counter-balancing weight 27. These weights are of sufficient size to hold the upper roll apart from the lower roll when the screws are positioned to allow it. In other words, the weights cause the bearings of the upper roll to follow the screws.

In using the apparatus the slabs, sheet bars or tin bars are fed singly and succes-

sively through the tandem sets of rolls. A number of bars will be in the mill at the same time, so that part of the bars will be passing through the balanced mill at the same time that others are passing through the jump rolls. When a slab or bar is fed into the first set of rolls 2 there will be no momentary stoppage or slipping such as in the jump roll type, since the top roll is positively driven and the rolls therefore act upon both faces of the plate to feed it forward and reduce it. The counter-balancing aids in preventing jars and shocks upon the driving connections, since the upper roll is not forced vertically by the metal as it enters, except to a very small degree. After passing through the sets of positively driven rolls, the metal is reduced to such a thickness that it can enter the set of rolls 4 without any serious slipping or jars. From this point on through the successive rolls the jump rolls act in the ordinary manner, if such are used.

The advantages of my invention result from using sets of rolls in which both the top and bottom rolls are positively driven for at least the first sets of a tandem mill. I thus avoid the troubles resulting from the jumping of rolls under the action of a heavy piece of metal, making the mill longer lived, and decreasing the amount of breakage and repairs. The mill runs more smoothly and with better results and uniformity.

All of the sets of the mill may be arranged with positively driven top and bottom rolls, the counter-balancing feature may be used or not as desired, and many other variations may be made in the form and arrangement of the rolls and their connections without departing from my invention.

I claim:—

1. A tandem sheet or plate mill having a series of two-high sets of plain-faced rolls, at least one of the first sets having positively driven upper and lower rolls; substantially as described.

2. A tandem sheet or plate mill having a series of two-high sets of plain-faced rolls, at least two of the first sets having positively driven upper and lower rolls; substantially as described.

3. A tandem sheet or plate mill having a plurality of two-high sets of plain-faced rolls, each set having positive driving connections for the upper and lower roll, the upper roll being counter-balanced; substantially as described.

4. A tandem sheet or plate mill consisting of two-high sets of rolls, having at least one of the first sets provided with positive driving connections for the upper and lower rolls, and succeeding sets having a positively-driven lower roll and an upper jump roll, said rolls being plain-faced; substantially as described.

5. A tandem sheet or plate mill having at least two two-high sets of plain-faced rolls with intermeshing driving gears common to both, at least one of said sets having positively-driven upper and lower rolls; substantially as described.

6. A tandem sheet or plate mill having a two-high set of rolls with positively driven upper and lower plain-faced rolls and a succeeding two-high set with a positively-driven lower roll and an upper jump roll, a gear having direct connections to the lower roll of the second set and a gear connected to driving pinions which in turn are connected to the upper and lower rolls of the first set; substantially as described.

In testimony whereof, I have hereunto set my hand.

CHARLES W. BRAY.

Witnesses:
G. C. KIMBALL,
S. A. DAVIS.