(No Model.) 4 Sheets—Sheet 1.

J. FAWELL & J. HEMPHILL.

ROLLING MILL.

No. 382,035. Patented May 1, 1888.

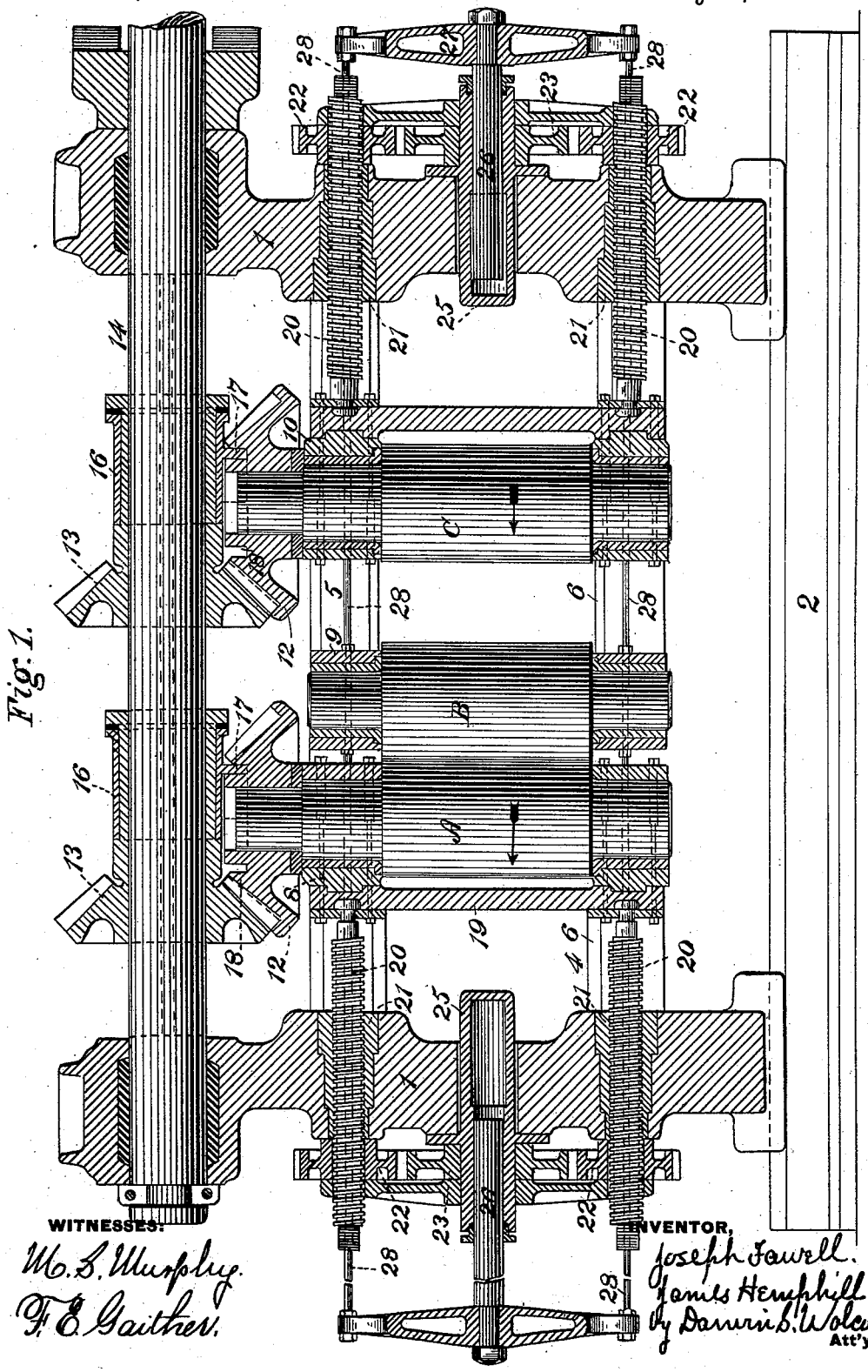

Fig. 1.

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(No Model.) 4 Sheets—Sheet 2.

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ROLLING MILL.

No. 382,035. Patented May 1, 1888.

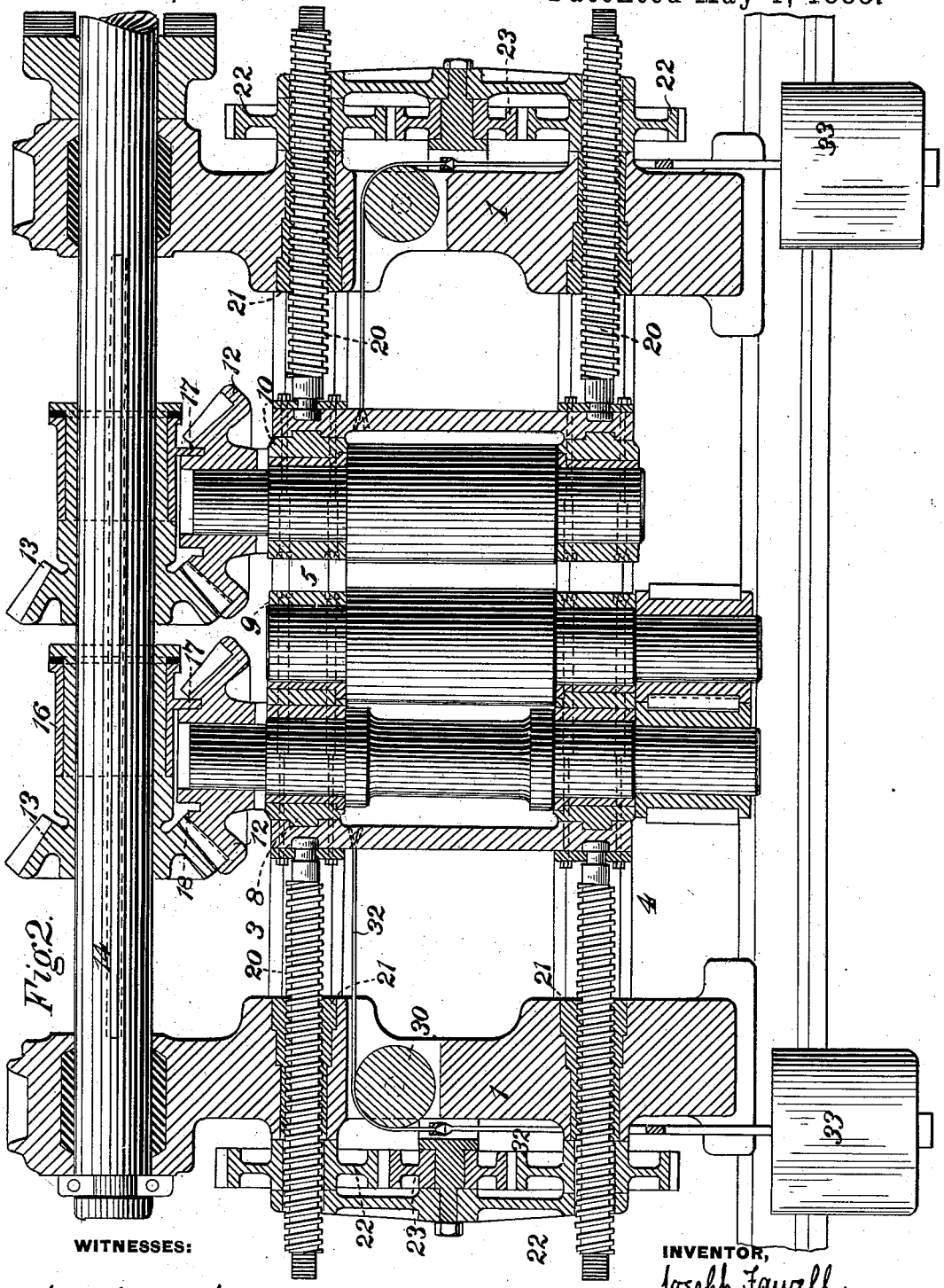

Fig. 2.

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4 Sheets—Sheet 3.

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ROLLING MILL.

No. 382,035. Patented May 1, 1888.

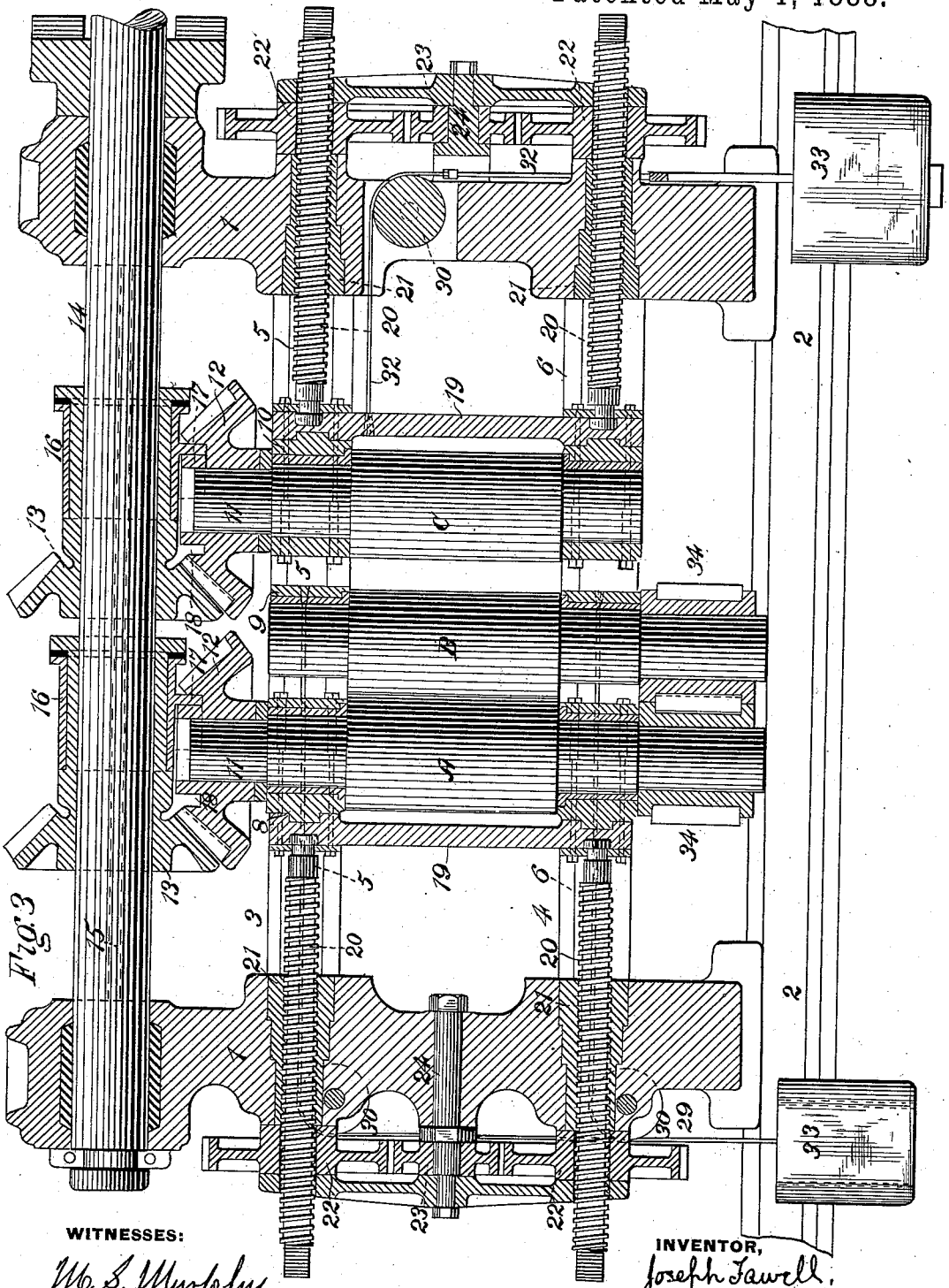

Fig. 3.

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4 Sheets—Sheet 4.

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ROLLING MILL.

No. 382,035. Patented May 1, 1888.

Fig. 4.

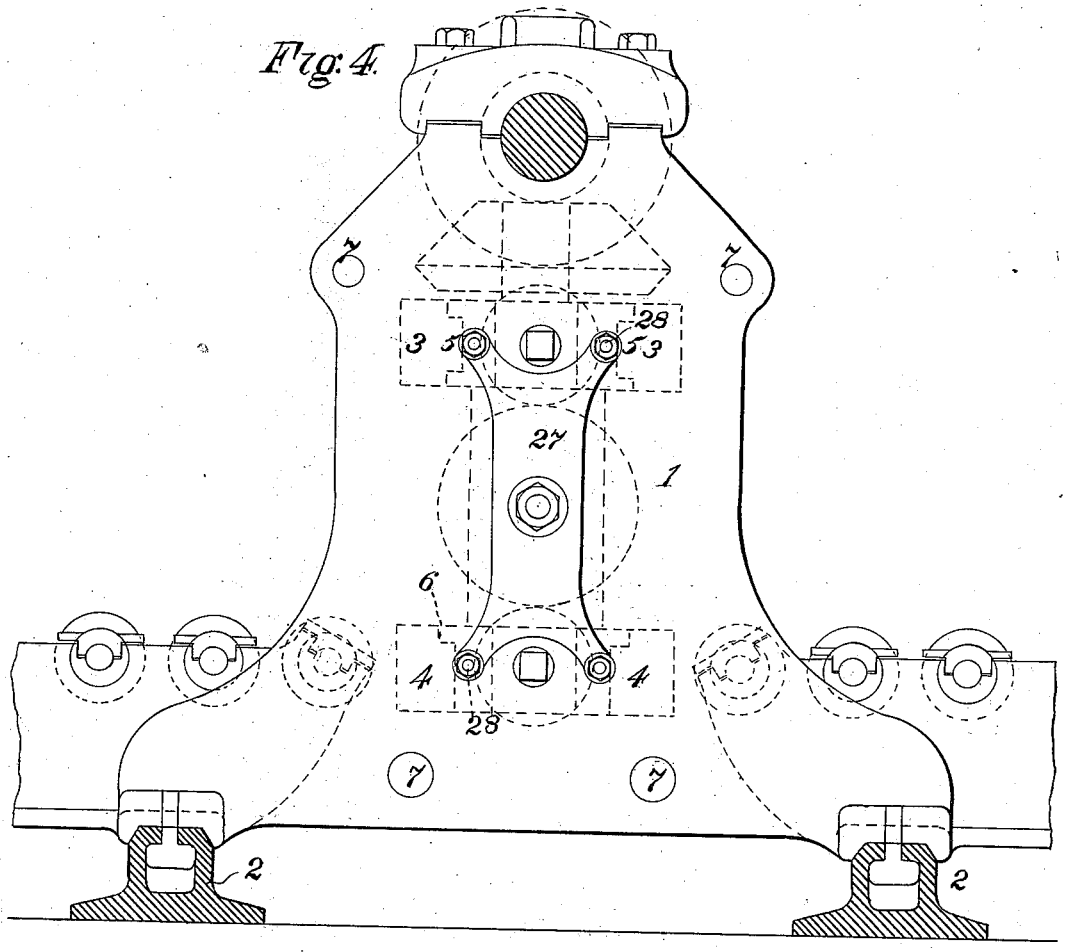


Fig. 5.

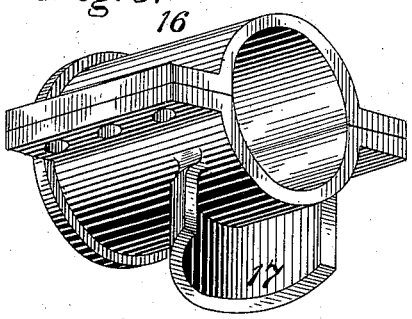
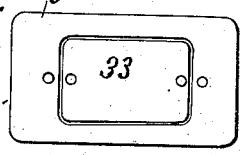


Fig. 6.



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UNITED STATES PATENT OFFICE.

JOSEPH FAWELL AND JAMES HEMPHILL, OF PITTSBURG, PENNSYLVANIA.

ROLLING-MILL.

SPECIFICATION forming part of Letters Patent No. 382,035, dated May 1, 1888.

Application filed January 4, 1888. Serial No. 259,765. (No model.)

To all whom it may concern:

Be it known that we, JOSEPH FAWELL and JAMES HEMPHILL, citizens of the United States, residing at Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented or discovered certain new and useful Improvements in Rolling-Mills, of which improvements the following is a specification.

In universal mills as heretofore constructed it has been customary to drive the edging or vertical rolls from their upper ends, in order to render the driving mechanism readily accessible and to prevent its clogging and cutting from the scale and other material. Such an arrangement of the driving mechanism is objectionable, as limiting the capacity of the mill for operation on narrow material, or else necessitating the employment of small gearing on the vertical rolls to permit their close approach to each other. Such small gearing, however, requires greater power to drive the rolls, and is less likely to withstand such increased power.

The object of the invention herein is to provide for the close adjustment of the vertical rolls as to permit of their operation on the smallest material and the arrangement of the driving mechanism so that the same shall be readily accessible for repairs and free from all liability of being clogged or cut by scale, &c.

In general terms, the invention consists in the construction and combination of devices or mechanism, all as more fully hereinafter described and claimed.

In the accompanying drawings, forming a part of this specification, Figure 1 is a sectional elevation of that portion of a universal mill embodying our invention. Figs. 2 and 3 are similar views of modifications of the same. Fig. 4 is an end view of that portion of the mill; and Figs. 5 and 6 are detail views of the sleeve for holding the driving-gears in engagement and of one of the roll-shifting weights, respectively.

In the practice of our invention the standards or housings 1 are secured in the shoes 2 in the usual manner, and in these housings are supported the ends of the horizontal beams 3 and 4, the beams 3 being provided on their inner sides with ribs 5, forming ways or supports for the upper journal-boxes of the rolls, and the beams 4 having grooves 6 formed therein to guide and support the lower journal-boxes. The housings are tied together by rods 7, passing therethrough. Journal-boxes 8, 9, and 10 are arranged between and supported by the beams 3 and 4, as above stated, and in these journal-boxes are mounted the trunnions 11 of the rolls A, B, and C. As shown in several views, the trunnions at the upper ends of the rolls A and C are extended for the reception of the bevel gear-wheels 12, which are keyed thereto. These gear-wheels 12 intermesh with correspondingly-shaped gear-wheels 13 on the power-shaft 14, mounted in suitable bearings in the upper ends of the housings 1. Along this shaft 14 is formed a feather or rib, 15, which engages grooves in the wheels 13 and causes them to rotate therewith, while permitting of their longitudinal movement therealong. Around the hubs of the wheels 13 are secured sleeves 16, formed in two parts. (See Figs. 1, 2, 3, and 5.) The lower parts of said sleeves have semicircular ribs 17 formed thereon, said ribs projecting down into circular grooves 18, formed in the hubs of the gear-wheels 12, thereby locking the gear-wheels 12 and 13 together and keeping them constantly in engagement with each other, the wheels 13 being moved along the shaft 14 by the wheels 12 in their movements.

Bearing or adjusting plates 19 are bolted to the outer sides of the journal-boxes 8 and 10 of the rolls A and C, and to these bearing-plates the ends of the adjusting-screws 20 are loosely connected, said screws passing through nuts 21, arranged in the housings 1, as shown. On the outer ends of the screws 20 are mounted the pinions 22, which are provided with keys or feathers engaging longitudinal grooves in the screws, whereby the screws are caused to rotate with the pinions, but are free to move through them. One of the pinions 22, at each end of the mill, is driven by any suitably-arranged mechanism, the motion of the driven pinions being transmitted to the other pinions by idlers 23, loosely mounted on suitable pins or journals, 24, secured to the housings.

In the housings at each end of the mill are arranged single-acting fluid-pressure cylinders 25, having pistons 26, connected to cross-heads 27, to which the outer ends of the rods 28 are secured. The inner ends of these rods are con-

nected to journal-boxes 9 of the intermediate roll, B. By operating these fluid-pressure mechanisms alternately the roll B is shifted and held in contact with one or the other of the rolls A C, which are driven by the mechanism above described and impart their motion to the roll B when held in firm contact with either of them.

It will be observed that the rolls A and C are driven in the same direction, as indicated by the arrows in Fig. 1, and hence by shifting the intermediate roll from one to the other of the driven rolls the operation of the mill is reversed, and back and forth passes can be made without reversing the rolls A and C. This construction and operation of the vertical rolls permits of the use in a universal mill of three-high horizontal rolls, in lieu of the two-high rolls ordinarily employed.

When employing two-high horizontal rolls, it is not generally necessary to shift the intermediate roll, as above described; but it is held normally against one or the other of the outside rolls, and hence the fluid-pressure mechanism need be employed only at one end for the purpose of holding the intermediate roll in contact with one of the driven rolls.

In lieu of the fluid-pressure mechanism for holding the intermediate roll against one of the outer rolls, weights may be employed, and in such case wire ropes 29, or other flexible devices, are attached to the journal-boxes 9 of the intermediate roll, and, passing around guide-pulleys 30, mounted on the housings 1, are attached to the weights 33, which serve to hold the intermediate roll in sufficiently firm contact with the outer roll.

When, as above stated, it is not desired to shift the intermediate roll for the purpose of reversing the mill, that one of the outside rolls which is designed to be directly operative in rolling is held against its adjusting-screws either by a fluid-pressure mechanism, as above described, or by a wire rope, 32, and weight 33, as shown in Figs. 2 and 3.

In cases where it may be desirable to drive the intermediate roll positively the trunnions at the lower ends of the intermediate roll and of that outside roll by which it is to be driven are extended, as shown in Fig. 2, and intermeshing pinions 34 are keyed thereon. The driving of the roll B may be effected entirely through these pinions 34, in which case the roll A serves merely as a transmitting-shaft, as shown in Fig. 2; or the operations of the pinions may be assisted by the roll A, which is held in contact with the rolls B, as above described, and is made slightly larger in diameter than the roll B, so that it will tend to drive the roll B a little faster than the pinions 34, and hence will relieve the pinions of a considerable portion of the strain to which they would be otherwise subjected. When the roll B is driven entirely by the pinions 34, the journal-boxes of the rolls A and B can be bolted together, as shown in Fig. 2.

The weights 33 are arranged one inside of the other, as shown in Fig. 6, thereby making them practically one weight, in so far as convenience in operating around the mill and a saving in space is concerned.

The principal characteristic of the invention herein is the interposition of a roll between rolls generally used and driven by or from the outer positively-driven rolls, thereby permitting of the employment of larger and stronger driving-gear in a position where the same are readily accessible and removable for change or repairs; and, further, the interposition of the movable roll B renders it possible to employ three-high rolls in lieu of two-high in a universal mill, thereby avoiding the necessity of reversing the entire mill for the back and forth passes. The construction shown in Fig. 1, whereby the reversing of the vertical rolls is avoided, can be employed in connection with reversing two-high horizontal rolls, if desired, the operative surfaces of such horizontal rolls being increased in length an amount equal to the diameter of the intermediate roll.

The mill with which the invention herein is to be incorporated being of the usual construction, and the construction and operation of the three-high rolls being also so well known, it is not deemed necessary to illustrate such well-known constructions.

We claim herein as our invention—

1. In a universal mill, the combination of three vertical rolls, the outer rolls being positively driven and the intermediate roll being driven by or from one of the outer rolls, substantially as set forth.

2. In a universal mill, the combination of three vertical rolls, driving mechanism connected to the upper ends of the outer rolls, and the intermediate roll driven by or from one of the outer rolls, substantially as set forth.

3. In a universal mill, the combination of three vertical rolls, bevel gear-wheels secured to the upper ends of the outer rolls, correspondingly-shaped gears secured to the power, as described, and semicircular ribs connected to the gear-wheels on the power-shaft and engaging grooves in the gear-wheels on the rolls, substantially as set forth.

4. In a universal mill, the combination of three vertical rolls, the outer rolls being positively driven and the intermediate roll being movable and driven by or from either of the outer rolls, substantially as set forth.

5. In a universal mill, the combination of three vertical rolls, the outer rolls being positively driven and the intermediate rolls held in frictional contact with one of the outer rolls and driven thereby, substantially as set forth.

6. In a universal mill, the combination of two positively-driven vertical rolls and an intermediate roll held in frictional contact with one of the outer rolls, said outer roll and the intermediate roll being provided with intermeshing pinions, substantially as set forth.

7. In a universal mill, the combination of two positively-driven vertical rolls, an intermediate roll, and a fluid-pressure mechanism for shifting and holding the intermediate roll in frictional contact with the outer rolls alternately, substantially as set forth.

8. In a universal mill, the combination of three-high horizontal rolls and three vertical rolls, the intermediate roll thereof being driven by or from one of the outer rolls, substantially as set forth.

In testimony whereof we have hereunto set our hands.

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JAMES HEMPHILL.

Witnesses:
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DARWIN S. WOLCOTT.