(No Model.)

2 Sheets—Sheet 1.

R. A. CARTER.

ROLLING MILL.

No. 406,701. Patented July 9, 1889.

FIG. 1.

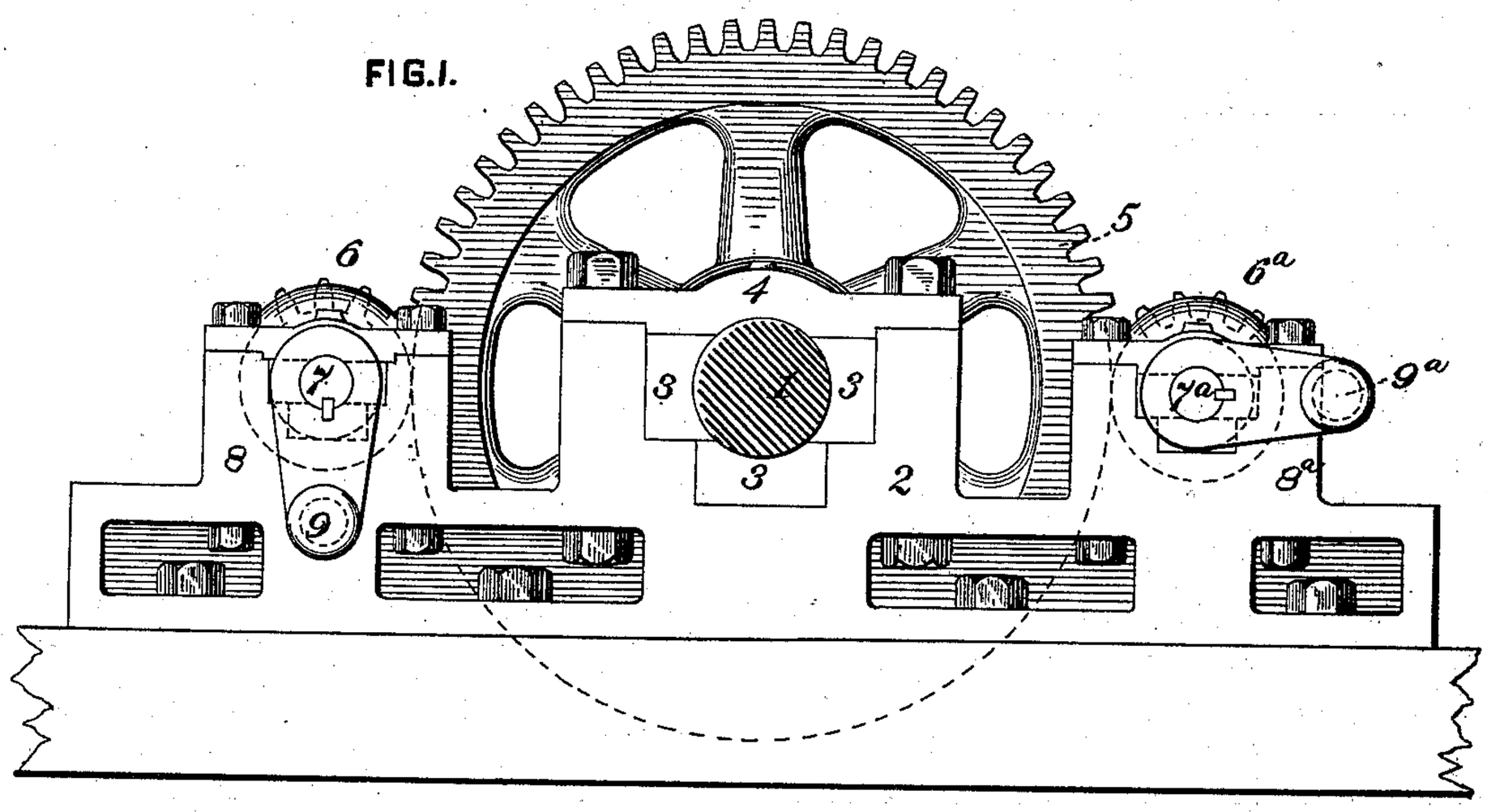
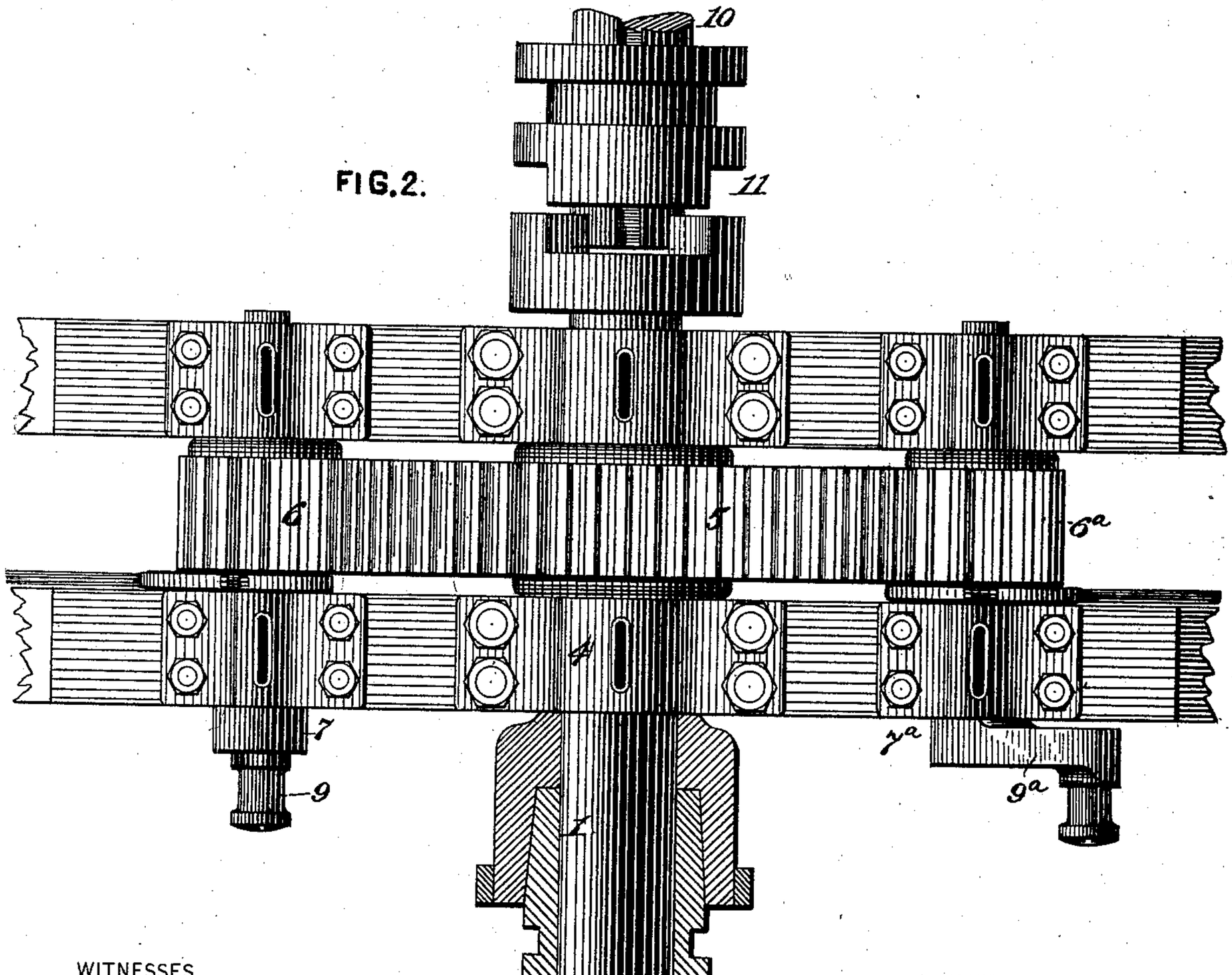


FIG. 2.



WITNESSES.

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(No Model.) 2 Sheets—Sheet 2.

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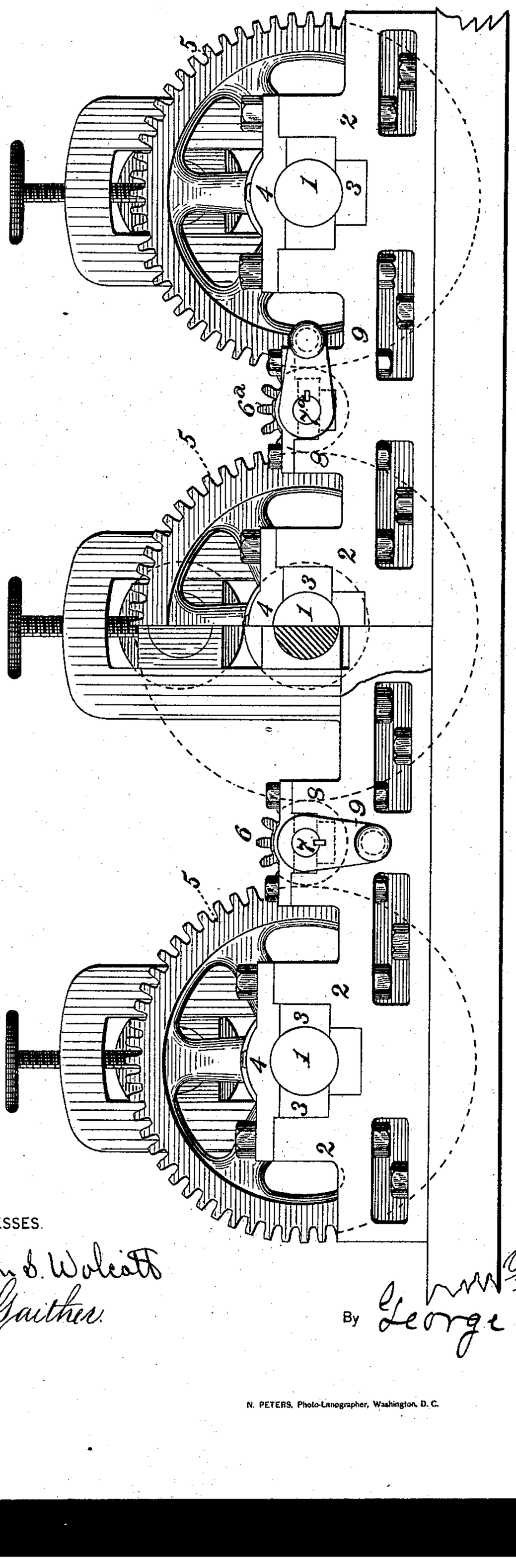

FIG. 3.

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ROBERT A. CARTER, OF PITTSBURG, PENNSYLVANIA.

ROLLING-MILL.

SPECIFICATION forming part of Letters Patent No. 406,701, dated July 9, 1889.

Application filed December 13, 1888. Serial No. 293,454. (No model.)

To all whom it may concern:

Be it known that I, ROBERT A. CARTER, a citizen of the United States, residing at Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented or discovered a certain new and useful Improvement in Rolling-Mills, of which improvement the following is a specification.

The invention described herein relates to certain improvements in driving mechanism for reversible rolling-mills and other geared machinery reversible at frequent intervals.

It has been customary in rolling-mill practice and elsewhere to connect the engine or engines where two are employed to the main or fly-wheel shaft, which in turn is connected either directly by suitable couplings to one of the rolls to be driven or by means of intermeshing gearing. This manner of connecting the engine or engines is objectionable on account of the shocks or jars imparted to the bearings or pillow-blocks as the crank-pin of the engine passes the dead-center, such shocks or jars being greatly increased if metal is fed to the rolls as the crank passes either of its dead-centers; and, further, this manner of connecting the engine is objectionable on account of the unequal wearing of the journal-boxes.

The object of the invention described herein is to provide for the application of power to the main or fly-wheel shaft or shafts through such an arrangement of interposed mechanism as will insure a steady uniform movement of the rolls and other machinery and their connections under all conditions of work, thereby avoiding any shocks or jars to the pillow-blocks and foundations and the unequal wear of the journal-blocks.

In the accompanying drawings, forming a part of this specification, Figure 1 is a view in elevation showing the manner of applying my invention to a pair or train of rolls. Fig. 2 is a top plan view of the same, and Fig. 3 is a view in elevation showing my invention applied to a continuous mill.

The main or fly-wheel shaft 1 is mounted in suitable pillow-blocks 2, provided with journal-boxes 3, the shaft and journal-boxes being held in position by the cap-plates 4. On the shaft 1 is keyed a gear-wheel 5, with which pinions 6 6^a intermesh, said pinions being arranged on opposite sides of the gear-wheel. These pinions 6 6^a are keyed to short shafts 7 7^a, mounted in pillow-blocks 8 8^a, and the outer ends of each shaft are provided with a crank-arm 9. The pinions 6 6^a and the crank-arms 9 9^a are so arranged with reference to each other that the cranks shall operate at right angles to each other, thereby insuring a constant application of power to the gear-wheel.

It will be readily understood that by applying power to opposite sides of the gear-wheel its pillow-blocks will not be subjected to the shocks and jars incident to the old practice, and as the power is thus applied in opposite directions and equally the wear upon the journal-boxes will be practically the same on all sides; and, further, the arrangement of the cranks at right angles to each other will prevent such jars as arise from feeding metal to the rolls or other load suddenly applied while the crank is passing its dead-centers, as hereinbefore stated.

By applying the power on opposite sides of the gear-wheel I am enabled to employ two small engines, which can be run at a speed considerably higher than that required in the rolls, and reducing such speed between the engines and the rolls by properly proportioning the diameters of the gear-wheel 5 and pinions 6 6^a, as will be readily understood by those skilled in the art.

The shaft 1 is connected to the neck 10 of the rolls by a clutch mechanism 11, as shown in Fig. 2.

In Fig. 3 I have shown the manner of applying my invention to the operation of continuous mills. As now practiced, continuous mills are driven by an engine connected to one set of rolls, power being transmitted to the other sets composing the mill by suitable gearing, and any inequality of movement at one point in the line of gearing is transmitted throughout the entire train; but by arranging pinion 6, driven directly by an engine between each set of rolls, and having the pinions intermesh with gear-wheels 5 on opposite sides thereof, each gear-wheel being adapted to transmit power to one set of rolls, I am enabled to prevent or correct any such inequality of movement. The pinions and

gear-wheels are so proportioned that high-speed engines may be employed, and in order to compensate for the elongation effected in each pass or by each set of rolls the driving gear-wheel of the next succeeding set of rolls is made of such diameter that its rolls are driven at an increased rate of speed proportional to the preceding reduction and consequent elongation.

In employing two small engines in lieu of one large engine, and transmitting their motion to the gear-wheel at two opposite points, the gear-wheel is not subjected to such unequal and great strains, each of the small engines being only about half the horse-power of the large engine; and, further, I am enabled to effect a considerable economy in fuel in employing two small high-speed engines, as they will not require as large a quantity of steam for their operation as a single engine of a horse-power equal to the combined horse-power of the small engines.

It is well known that two intermeshing gear-wheels tend in their rotation to separate the one from the other, and hence when motion is imparted to the driving gear-wheel by one pinion only the journal-boxes of the shafts of the gear-wheel and pinion will be subjected to a greater wear on one side of each shaft than the other; but by employing two pinions arranged on opposite sides of the gear-wheel the shaft of the latter will be held in equilibrium, as it were.

A frequent cause of stoppages in operating rolling-mills and other machinery is the breaking of the teeth of the gear-wheel and pinion, caused by the great strains to which the teeth are subjected when power is applied at one point only but by applying the power at two points the teeth are subjected to only half the strains.

Power may be applied to the driving gear-wheel at two, three, or more points, if desired, care being taken to arrange the transmitting-pinions at approximately equal distances apart in order to obtain the counterbalancing effects hereinbefore set forth.

I am aware that in connection with a rolling-mill wherein the reversibility of the rolls was not required as a means of securing or effecting the reverse pass, a main driving gear-wheel with two independently-driven pinions engaging the same on opposite sides is not new, as in English Patent No. 804 of 1853, but in the construction therein described and shown each pinion-shaft is provided with a fly-wheel, and the presence of such fly-wheels renders reversibility practically impossible, even if the machine were in other respects organized with reference thereto. My invention differs from that thus described and shown, first, in the fundamental or underlying principle of the reversibility of the roll-train with each pass, and, second, in the organization of apparatus which dispenses with the fly-wheel and still enables this operation to be performed.

I claim herein as my invention—

1. As a mechanism for operating roll-trains and other geared machinery normally reversible at frequent intervals and in which a fly-wheel is dispensed with, the combination of a main gear-wheel mounted on the shaft through which reversibility is effected, and two or more independently-driven pinions (but without fly-wheels) arranged to engage the main gear-wheel at equal or approximately equal distances around its periphery, substantially as set forth.

2. As a mechanism for operating roll-trains and other geared machinery normally reversible at frequent intervals and in which a fly-wheel is dispensed with, the combination of two or more main gear-wheels mounted on the shaft through which reversibility is effected, and two or more independently-driven pinions alternating with the main gear-wheels, each pinion intermeshing with the main gear-wheels on each side thereof, substantially as set forth.

In testimony whereof I have hereunto set my hand.

ROBERT A. CARTER.

Witnesses:

DARWIN S. WOLCOTT,

W. B. CORWIN.