Nov. 4 , 1924. 1,514,178

J. W. SHEPERDSON

ROLLING MILL DRIVE

Filed Oct. 2, 1919 2 Sheets-Sheet 1

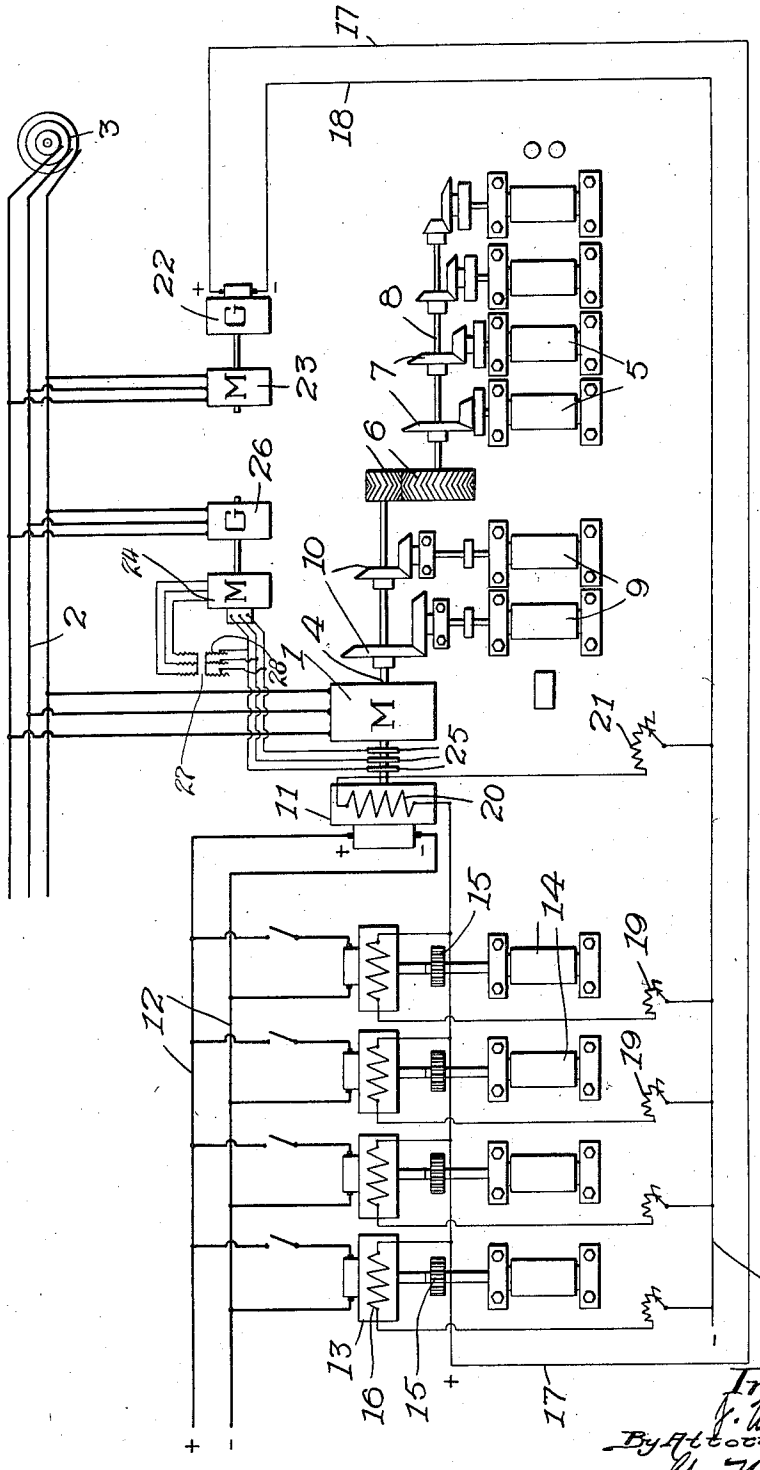


Fig. 1.

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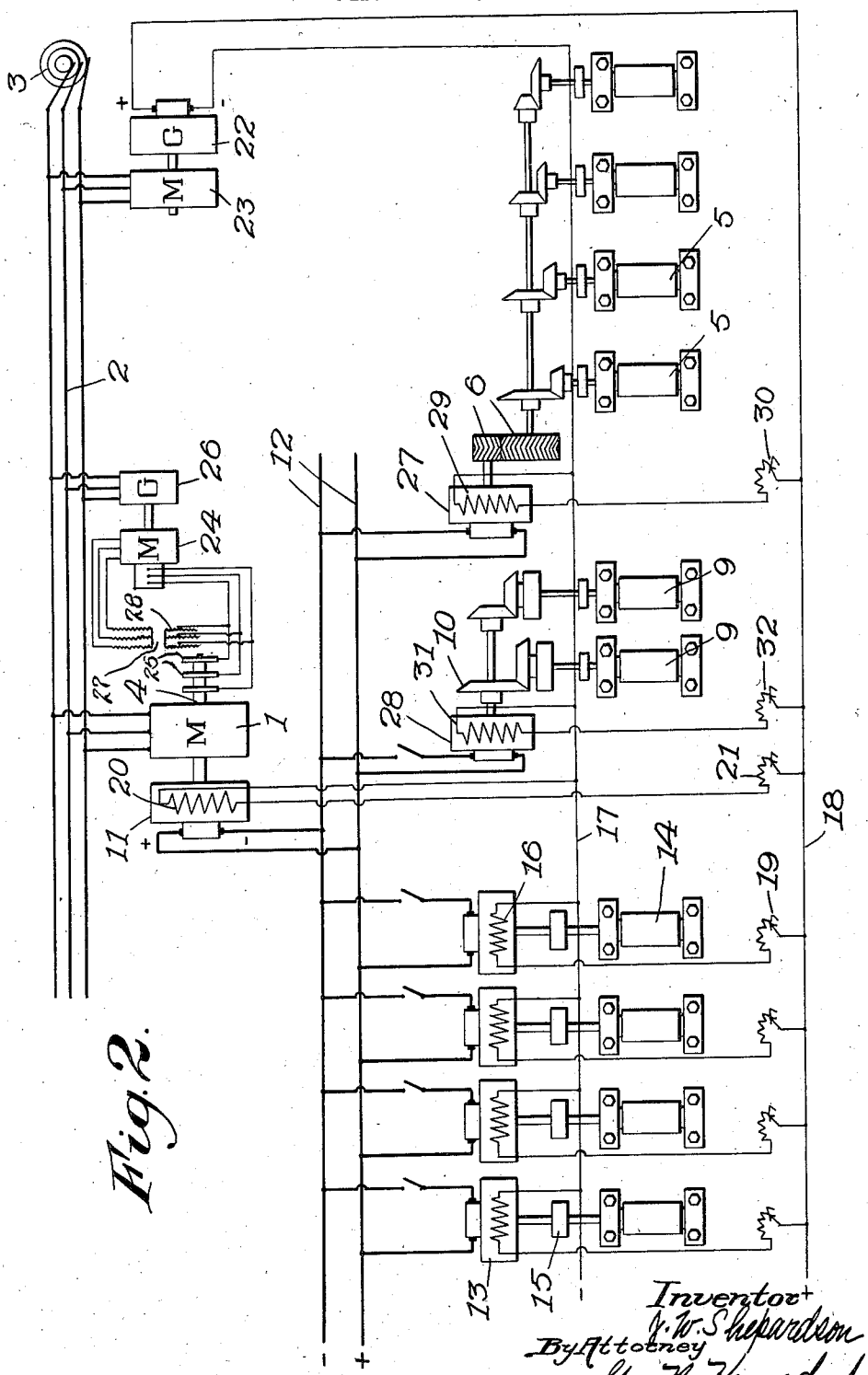


Fig. 2.

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UNITED STATES PATENT OFFICE.

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ROLLING-MILL DRIVE.

Application filed October 2, 1919. Serial No. 328,059.

To all whom it may concern:

Be it known that I, JOHN W. SHEPERDSON, a subject of the Kingdom of Great Britain, residing at Worcester, in the county of Worcester and Commonwealth of Massachusetts, have invented a new and useful Improvement in a Rolling-Mill Drive, of which the following, together with the accompanying drawings, is a specification.

My invention relates to rolling mill drives and has particular reference to the adaptation of electrical apparatus for driving the several trains of rolls of a continuous mill.

The object of my invention is to provide a novel arrangement of electrical apparatus in connection with the rolls, whereby reliability in the continuous operation of the mill, as a whole, is increased, and whereby the speed of operation of the different trains of rolls may be readily controlled in order to vary both the form of product and the rate of production of the mill.

In the operation of rolling mills it is well known that while the rolls of the several passes must be driven at different speeds, nevertheless it is most essential that the ratio between the speeds of the individual rolls must remain the same while material of a given form and cross section is being passed through the rolls. It is also well known that when it is desired to roll stock into different forms and cross sections, provision must be made whereby either the speed of the mill as a whole may be adjusted or the speed of the individual rolls may be adjusted to obtain an entirely new speed relation between the trains. In the latter case it is esential that the new speed ratios must be maintained during operation of the mill, as before.

By my invetnion I propose to obtain all of the above described advantageous results in a continuous mill by driving all of the rolls from an adjustable speed electric motor, and so distributing the power of the motor to the rolls that individual speed adjustment of certain of the rolls may be obtained, where desired, without disturbing the operation of the mill as a whole.

In the accompanying drawings, Figure 1 is a diagrammatic view of the rolls of a mill with electrical apparatus connected thereto in accordance with my invention.

Figure 2 is a modification in the arrangement of the apparatus shown in Fig. 1.

Similar reference characters refer to similar parts in the different figures.

Referring to Fig. 1, a main motor 1, shown as of the induction type, is connected to supply mains 2 that are energized from a suitable alternating current source, such as a poly-phase generator 3. The shaft 4 of the motor 1 is adapted to drive a series of roughing rolls 5 through reduction gearing 6, and a series of bevel gears 7 arranged on a countershaft 8. The motor 1 is also adapted to drive a series of intermediate rolls 9 through bevel gearing 10 carried on the motor shaft 4. The exact arrangement of the rolls and of the gearing forms no part of the present invention, and is only shown diagrammatically, it being understood that any other suitable arrangement of rolls may be employed.

A direct current generator 11 is also connected to the shaft 4 of the motor 1 and is adapted to energize supply means 12. A plurality of roll motors 13 are respectively connected to the supply mains 12 and are adapted to drive a series of finishing rolls 14 through suitable pinions 15. The motors 13 are preferably of the constant speed type and are respectively provided with a field winding 16, one terminal of which is connected to one bus-bar 17 of a constant potential field energizing circuit, and the other terminal of which is connected to the other bus-bar 18 through an adjustable field rheostat 19. The field winding 20 of the generator 11 is also connected across the bus-bars 17 and 18 through an adjustable field rheostate 21. The bus-bars 17 and 18 are connected to the terminals of a direct current exciter 22 that is direct connected to an alternating current motor 23 supplied from the mains 2.

The speed of the motor 1 is adapted to be adjusted by means of a suitable speed regulating set, which is here shown as comprising a poly-phase commutator motor 24 connected to the rotor of the main motor 1 through slip rings 25, and mounted on the

same shaft with an asynchronous generator 26 connected to the supply mains 2. The greater the amount of electrical energy absorbed by the motor 24, the lower will be the speed of the motor 1, and in order to properly regulate the amount of energy transformed by the regulating set, a transformer 27 having adjustable taps 28 is provided. It is to be understood that other suitable means may be employed in order to adjust the speed of the motor 1.

Having described the arrangement of apparatus entering into my invention the operation thereof is as follows:—When the rolls 5 and 9 are driven directly by the motor 1, the finishing rolls 14 are simultaneously driven by the motors 13 at speeds having a fixed relation to the speeds of the other rolls, owing to the fact that the direct current motors 13 receive their field excitation from a source of constant voltage. When it is desired to change the speed of the mill, as a whole, without changing the speed ratios between the trains or the individual rolls, the speed of the motor 1 is adjusted by means of its speed regulating set. The motor 1 thereupon drives the roughing train at an increased or decreased speed. As the speed of the generator 20 changes, the voltage impressed across the supply mains 12, and consequently the speeds of the motors 13 change in the same proportion. Changes in the speed ratio between the various finishing rolls 14 or between the finishing train and the other trains, are accomplished by adjustment of the field rheostats 19 of the individual roll motors 13 or of the field rheostat 21 of the generator 11.

Referring now to Fig. 2 the arrangement of the main motor 1 and of the finishing roll motors 13 is the same as shown in Fig. 1. Direct current motors 27 and 28 are provided to drive the trains of rolls 5 and 9 through gearing 6, 7, and 10, in the same manner as shown in Fig. 1. The motor 27 is provided with a field winding 29 and a field rheostat 30, and the motor 28 is provided with a field winding 31 and a field rheostat 32, all connected between the bus-bars 17 and 18. With this arrangement of apparatus, the general scheme of operation is the same as described with respect to Fig. 1, with the exception that additional adjustments of the speeds of the roughing and intermediate trains are obtainable.

A consideration of the above described modes of operation shows that the mill is capable of adjustment in a number of different ways, without changing the arrangement of apparatus, which may be briefly stated as follows:—(1) The speed of the mill, as a whole, may be changed by adjustment of the speed of the main motor 1. (2) The speeds of all of the motors may be changed, independently of the main motor, by adjustment of the voltage of the generator 11. (3) The speed relation between different trains, or groups, of rolls may be changed by adjustment of the speeds of the train motors 27 and 28. (4) The speed relation between different rolls may be changed by adjustment of the speeds of the individual roll motors 13. (5) The mill is capable of various other adjustments by combining two or more single adjustments. For example, a change in the speed of the mill, as a whole, may be obtained by combining (1) and (2) in order to secure a mill speed not obtainable by the use of either (1) or (2) alone. Thus, the speed of the main motor 1 might be increased twenty-five per cent at the same time the voltage of the generator 11 is lowered ten per cent; the resulting mill speed being determined by the combined effect of the two changes with respect to the operating characteristics of the electrical apparatus.

From the foregoing it is apparent that a continuous mill equipped with apparatus arranged in accordance with my invention is adapted for the production of a wide range of forms, thus securing a flexibility and freedom of operation not heretofore obtained in continuous mills in which the speed relation between different rolls and trains is permanently fixed.

While I have shown my invention as applied to a particular arrangement of rolls, it is obvious that the same arrangement of electrical apparatus can also be applied to other mills of the same general type without departing from the spirit and scope of my invention. I desire therefore that only such limitations be placed thereon as come within the scope of the appended claims.

I claim,

1. In a rolling mill drive, the combination with a plurality of rolls arranged in separate trains, and a single source of electrical energy, of an electric motor connected to said source and adapted to provide power for driving said rolls with a predetermined speed relation between the trains, certain of said rolls being capable of individual speed adjustment independently of said motor and of the speed relation between the other trains of rolls.

2. In a rolling mill drive, the combination with a plurality of rolls arranged in separate trains, and a single source of electrical energy, of an electric motor connected to said source and adapted to provide power for driving said rolls with a predetermined speed relation between the trains, and means for independently varying the speed relation between certain of the trains and between certain of the individual rolls.

3. In a rolling mill drive, the combination with a plurality of rolls, a source of alter-

nating current and a variable speed main motor connected to said source, of a generator driven by said motor for supplying electrical energy to constant speed motors driving said rolls, whereby the speeds of said roll motors vary directly with the speed of the main motor, and means for independently controlling the speed of each of said roll motors.

4. In a rolling mill drive, the combination with a plurality of rolls, a source of alternating current, an adjustable speed motor connected to said source, and a direct current generator driven by said motor for supplying energy to shunt wound motors driving said rolls with a predetermined speed relation therebetween, of an independent source of direct current for providing the entire field excitation to said generator and to said roll motors.

5. In a rolling mill drive, the combination with a plurality of rolls, a source of alternating current, an adjustable speed motor connected to said source, and a direct current generator driven by said motor for supplying energy to constant speed motors driving said rolls with a predetermined speed relation therebetween, of means for providing the entire field excitation for said generator and said roll motors at constant voltage, and further means for independently controlling the operation of each of said roll motors.

6. A hot mill for rolling metal including a plurality of roughing-roll stands and a plurality of finishing-roll stands, a common motor driving the rolls of the several roughing roll stands, a plurality of motors corresponding in number with the finishing-roll stands and connected operatively, one to each of said finishing-roll stands, and a common source of power for all of said motors.

7. A hot mill for rolling metal including a plurality of roughing-roll stands and a plurality of finishing-roll stands, a common motor driving the rolls of the several roughing-roll stands, a plurality of motors corresponding in number with the finishing-roll stands and connected operatively, one to each of said finishing-roll stands, and means for operating all of said motors from a common source of power, the fluctuations of which affect all of the driven units equally.

Dated this 20th day of September, 1919.

JOHN W. SHEPERDSON.

Witnesses:
NELLIE WHALEN,
PENELOPE COMBERBACH.