July 5, 1932. W. SYKES 1,866,232

ROLLING MILL

Filed Oct. 31, 1931 4 Sheets-Sheet 1

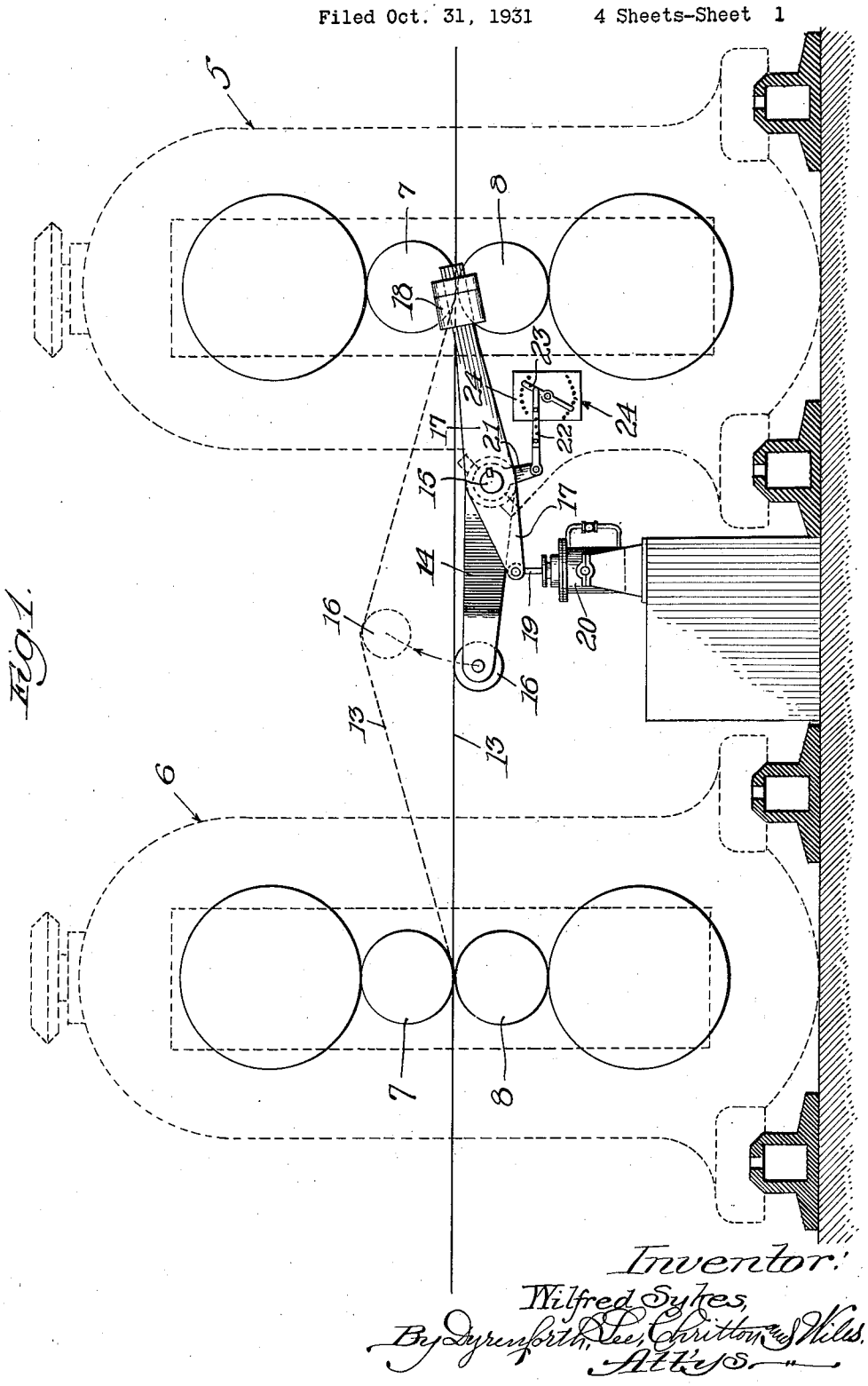


Fig. 1.

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ROLLING MILL

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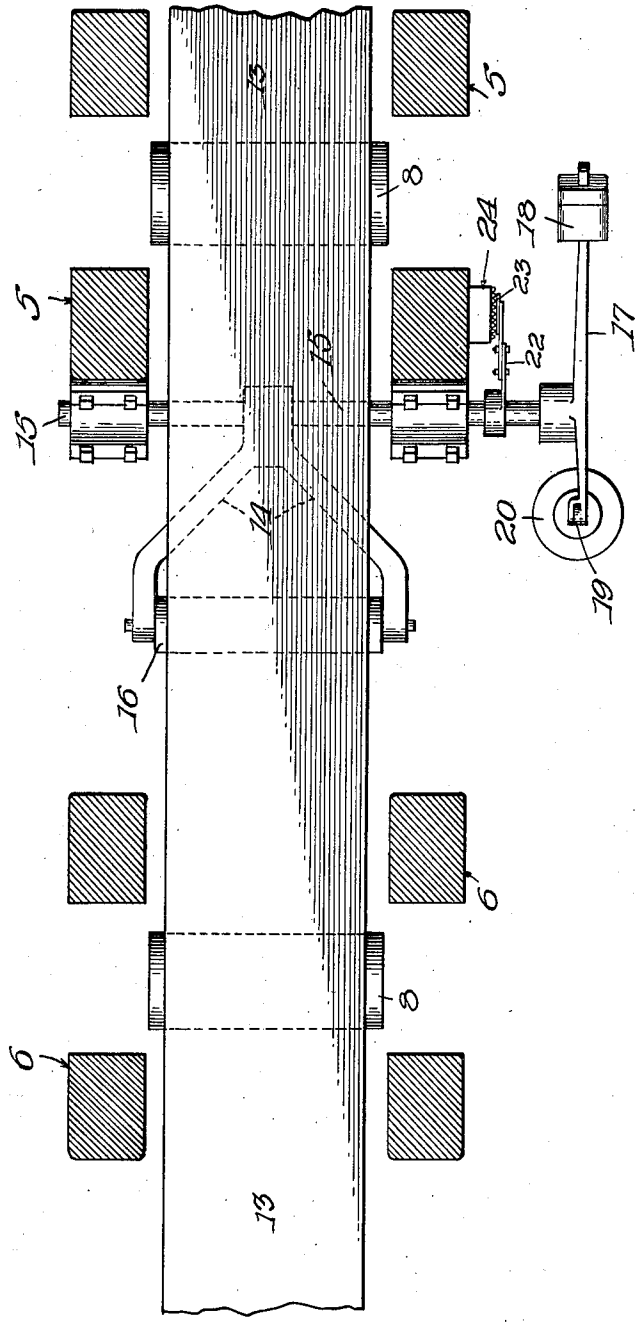


Fig. 2.

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ROLLING MILL

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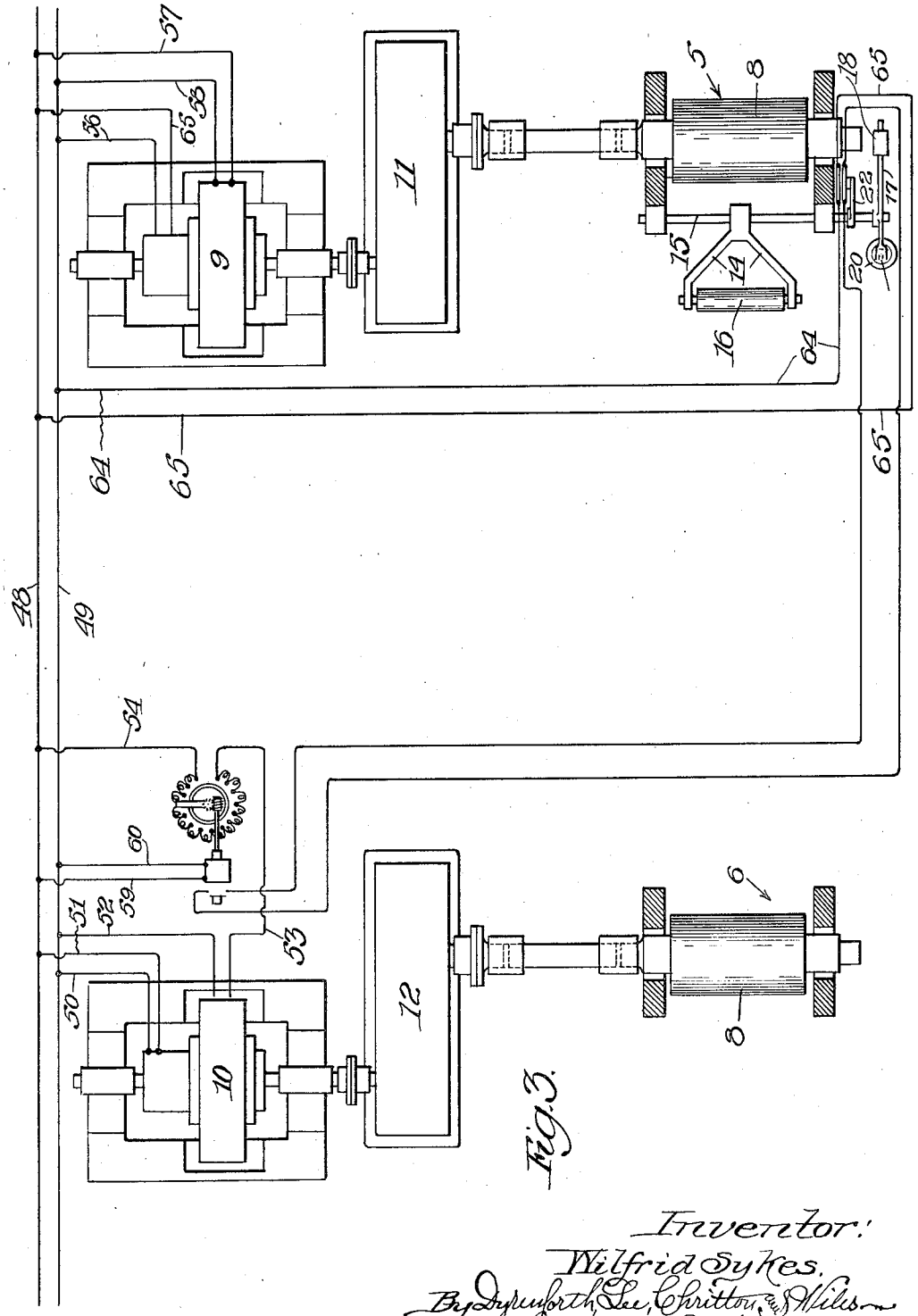


Fig. 3.

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ROLLING MILL

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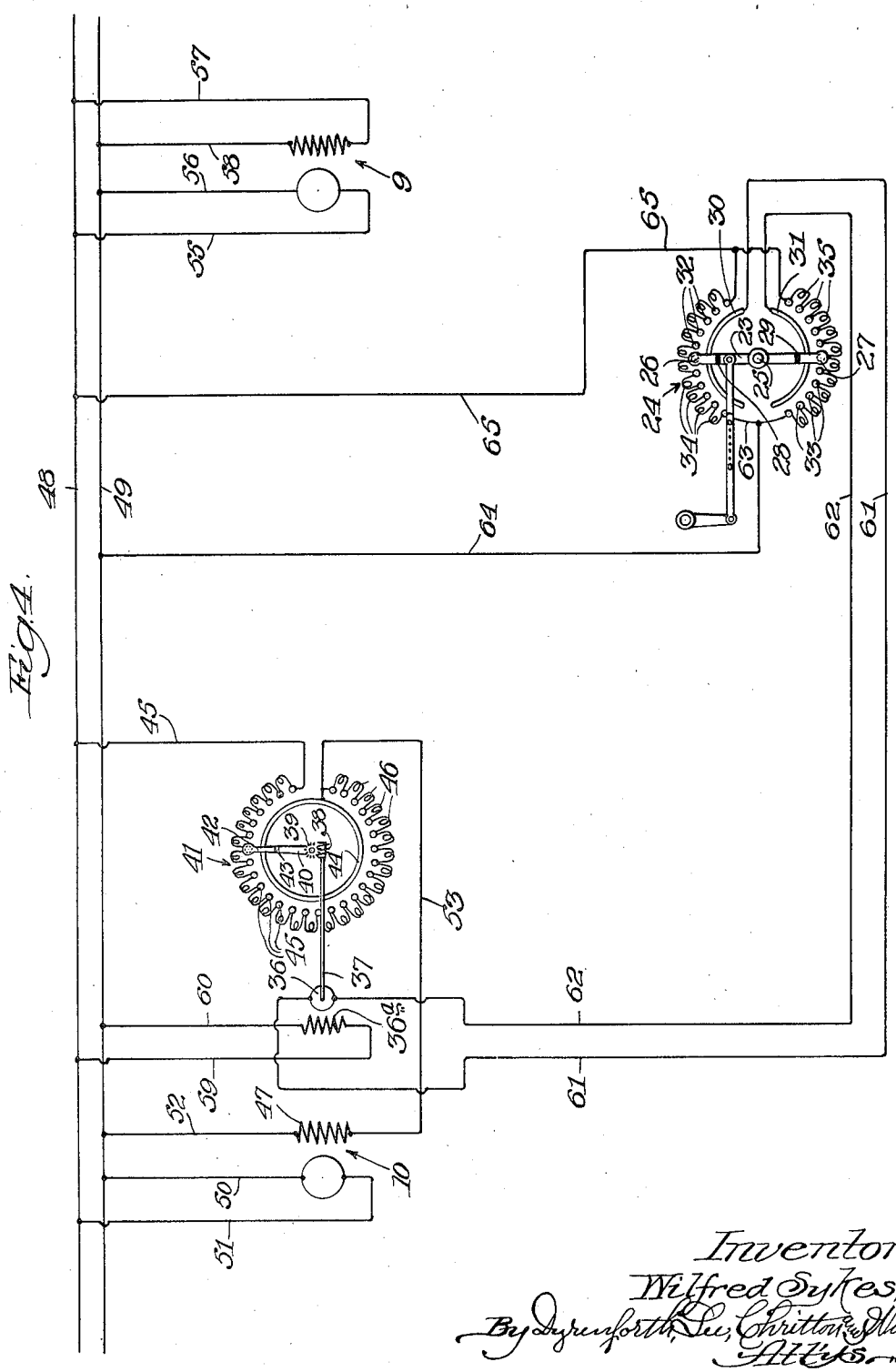


Fig. 4.

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Patented July 5, 1932 1,866,232

UNITED STATES PATENT OFFICE

WILFRED SYKES, OF CHICAGO, ILLINOIS

ROLLING MILL

Application filed October 31, 1931. Serial No. 572,386.

My invention relates more particularly to rolling mills for cold rolling strips or bands of metal.

It is generally necessary in the cold rolling of strips of metal by two or more mills in tandem to maintain a definite uniform tension in the strip between the stands to roll the strip to uniform gage as a variation in the tension with the same setting of the rolls will cause a variation in gage of the finished material.

My primary object is to provide mechanism which will operate automatically to render the tension in the strip between the stands uniform and of the desired degree.

Referring to the accompanying drawings:

Figure 1 is a plan view of a rolling mill comprising two stands and embodying my invention.

Figure 2 is a fragmentary sectional view of the mill, the section being taken coincident with the strip shown in position in the mill.

Figure 3 is a plan sectional diagrammatic view of the mill showing the various electrical connections of the mechanism controlling the tension of the strip; and

Figure 4, a diagrammatic view of the electrical devices used in the control referred to and their electrical connections.

Referring to the particular construction shown, the rolling mill comprises two stands 5 and 6 of rolls the intermediate ones of which are represented at 7 and 8, these sets of rolls being driven, in accordance with common practice, by means of electric motors 9 and 10, respectively, in driving relation thereto through reduction gear mechanism represented at 11 and 12, respectively, the rolls 7 rotating in one direction and the rolls 8 in the opposite direction.

The stands 5 and 6 are spaced apart, the strip which is rolled between the rolls 7 and 8 and represented at 13, spanning the space between the stands and traveling from the right to the left in Fig. 1.

The mill comprises means whereby the tension in the strip 13 between the stands is maintained uniform, these means operating in the event of tendency of the rolls of the stand 6 to decelerate or the tendency of the rolls of stand 5 to accelerate, in either of which events the tension in the strip 13 would be reduced, to increase the speed of the rolls of stand 6 to restore the desired predetermined tension in the strip; and in the event of the tendency of the rolls of stand 6 to accelerate or of the rolls of stand 5 to decelerate, in either of which events the tension in the strip 13 would be increased, to decrease the speed of the rolls of stand 6 and restore the desired predetermined tension in the strip.

These means according to the preferred illustrated embodiment of the invention, comprise a yoke 14 secured to a shaft 15 journaled in the frame of the stand 5, the yoke 14 extending into the space between the stands and having a roller 16 journaled in the arms of the yoke and adapted to bear against the underside of the strip 13 in the movement of the latter through the stands.

The shaft 15 is provided with a lever 17 rigid therewith and having at one end a counterweight 18 tending to rock the shaft 15 in a direction for forcing the roller 16 upwardly against the strip 13, the lever 17 at its opposite end connecting with the stem 19 of a fluid operated piston and cylinder mechanism the cylinder of which is represented at 20 and provided for the purpose of rocking the shaft 15 in counterclockwise direction to lower the roller 16 when desired.

The shaft 15 is also provided with an arm 21 connected by a link 22 with the contact arm 23 of a potentiometer rheostat 24, the link 22 being formed of longitudinally adjustable sections. The arm 23 is rotatably mounted between its ends as represented at 25 to slide at its ends 26 and 27, insulated from the central portion of the arm by insulating material represented at 28 and 29, along contact strips 30 and 31, respectively, and along series 32 and 33 of stationary contacts interposed at intervals in the resistance coils 34 and 35, respectively, of the rheostat 24.

The rheostat 24 is in circuit, as hereinafter described, with a small shunt wound motor 36 the armature shaft 37 of which drives a worm 38 which meshes with a worm wheel

39 to which the movable contact arm 40 of a rheostat 41 is connected, the outer end portion 42 of the arm 40 and insulated from the remainder of this arm by insulation represented at 43, sliding along a contact ring 44 and along a series of stationary contacts 45 interposed at intervals in the resistance coils 46 of the rheostat 41 which latter is connected with the field winding 47 of the motor 10 which drives the rolls of the stand 6.

The circuit connections of the various electrical contacts are as follows: The line wires are represented at 48 and 49. Wires 50 and 51 connect the terminals of the commutator of the motor 10 with the line wires. One of the terminals of the field 47 of motor 10 connects with the line wire 49 by a line wire 52, the other terminal of field 47 being connected with one of the terminals of the resistance coil 46 by a wire 53 the other terminal of which connects with line wire 48 by a wire 54. The commutator terminals of motor 9 connect, by wires 55 and 56, with the line wires 48 and 49, respectively, and the field terminals of this motor connect with the wires 48 and 49 by wires 57 and 58, respectively.

The field winding 36^a of the shunt motor 36 connects by wires 59 and 60 with the line wires 48 and 49, respectively, and the commutator terminals of this motor connect, by wires 61 and 62, with the contact bars 30 and 31, respectively. The adjacent ends of the resistance coils 34 and 35 are connected together by a wire 63, this wire being connected, by a wire 64, with line wire 49. The other ends of the coils 34 and 35 connect, by a wire 65 with the other line wire 48.

The operation of the apparatus is as follows: With a given size of counterweight 18 sufficient to cause the roller 16 to press against the underside of the strip 13 with the necessary force for producing the desired tension in this strip, the sections of link 22 are adjusted to cause the contact arm 23 to assume the neutral position shown in Fig. 4.

Should the motor 10 increase in speed and thereby tend to increase the tension in the strip 13 the pressure of the strip against the roller 16 will lower the latter thereby rocking the yoke 14 in counterclockwise direction in Fig. 1 and cause the contact arm 23 to assume such a position relative to the resistance coils 32 and 33 that voltage will be applied to the armature of motor 36 driving this motor in a direction to shift the rheostat arm 40 into such a position that the resistance in the circuit of field 47 of motor 10 decreases, thus slowing down the motor to a speed relieving the excess tension in the strip 13, the roller 16, yoke 14, and contact arm 23, returning to their original positions. The same operation as that above described would take place in the event that the speed of the motor 9 decreased, the increased tension in the strip 13 re-acting against the roller 16 and causing a slowing down of the speed of the motor 10 to restore the original tension in the strip.

Should the speed of the motor 10 become decreased relative to the speed of the motor 9 or the speed of the motor 9 become increased relative to the speed of the motor 10, the roller 16 will assume a higher position thereby moving the contact arm 23 into such a position relative to the resistance coils 31 and 32 that voltage will be applied to the armature of motor 36 driving this motor in a direction to shift the rheostat arm 40 into such a position that the resistance in the circuit of field 47 increases and speeds up the motor 10 to restore the original degree of tension in the strip 13.

As will be understood, the tension on the strip 13 may be regulated either by adjusting the position of the counterweight 18 on the arm 17, or by selecting a counterweight of the desired size, or by adjusting the linkage between the shaft 15 and the contact arm 23, as by relatively lengthwise adjusting the sections of the link 22.

When more than two stands of rolls are employed it would be desirable to provide strip tension regulating means as described for cooperation with the strip between each adjacent stand. Thus assuming that three stands of rolls are employed the third one being located to the left of the stand 6 in Fig. 1, the controlling mechanism for the motor 10 and involving the potentiometer rheostat 24 together with the means for actuating it responsive to variations in tension in the strip 13 and the rheostat 41 controlled by the motor 36, in turn controlled by the potentiometer rheostat 24, would be duplicated for the motor of this third stand of rolls. In other words, for each additional stand, control mechanism as above described would be provided for controlling the motor driving the rollers of the stand.

While I have illustrated and described a particular construction embodying my invention, I do not wish to be understood as intending to limit it thereto as the same may be variously modified and altered without departing from the spirit of my invention.

What I claim as new, and desire to secure by Letters Patent, is:

1. In a rolling mill, the combination of a plurality of roll stands through which the strip being rolled passes in succession, drive means for said stands, respectively, and means controlling the speed of operation of one of said drive means relative to the other of said drive means to maintain the degree of tension in the strip between said stands substantially a constant comprising a movable member adapted to bear against a face of the strip, a potentiometer rheostat controlled by said movable member, a second rheostat controlling the speed of operation of

the said controllable one of said drive means, and means controllable by said potentiometer rheostat for controlling said second rheostat.

2. In a rolling mill, the combination of a plurality of roll stands through which the strip being rolled passes in succession, drive means for said stands, respectively, and means controlling the speed of operation of one of said drive means relative to the other of said drive means to maintain the degree of tension in the strip between said stands substantially a constant comprising a movable member adapted to bear against a face of the strip, a potentiometer rheostat controlled by said movable member, a second rheostat controlling the speed of operation of the said controllable one of said drive means, and a motor controllable by said potentiometer rheostat for controlling said second rheostat.

3. In a rolling mill, the combination of a plurality of roll stands through which the strip being rolled passes in succession, electric motors operatively connected with rolls of said stands, respectively, for operating said rolls, and means controlling the speed of operation of one of said motors relative to the other thereof to maintain the degree of tension in said strip between said stands substantially a constant comprising a movable member adapted to bear against a face of the strip, a potentiometer rheostat controlled by said movable member, a second rheostat controlling the speed of operation of the said controllable one of said motors, and means controllable by said potentiometer rheostat for controlling said second rheostat.

4. In a rolling mill, the combination of a plurality of roll stands through which the strip being rolled passes in succession, electric motors operatively connected with rolls of said stands, respectively, for operating said rolls, and means controlling the speed of operation of one of said motors relative to the other thereof to maintain the degree of tension in said strip between said stands substantially a constant comprising a movable member adapted to bear against a face of the strip, a potentiometer rheostat controlled by said movable member, a second rheostat controlling the speed of operation of the said controllable one of said motors, and a motor controllable by said potentiometer rheostat for controlling said second rheostat.

WILFRED SYKES.