April 19, 1932. L. JONES ET AL 1,854,198

TENSION DEVICE

Filed Aug. 2, 1930 2 Sheets-Sheet 1

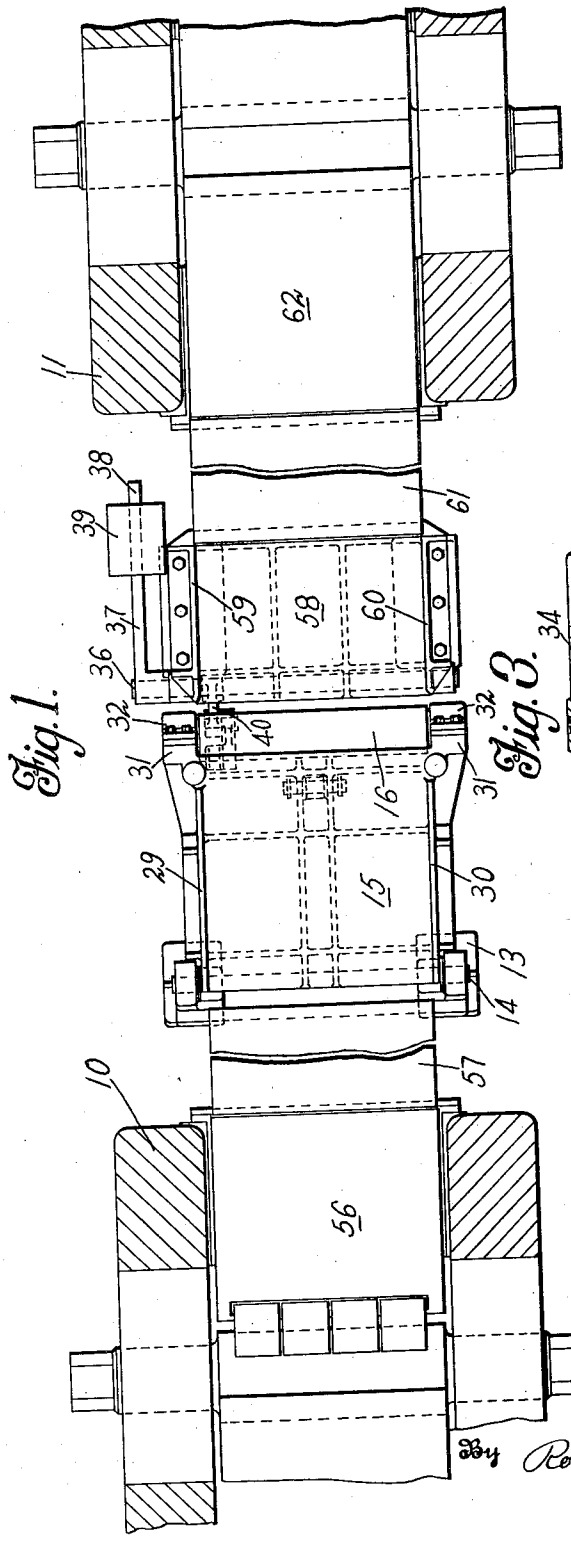


Fig. 1.

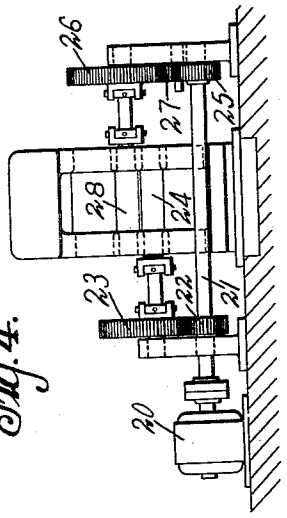


Fig. 4.

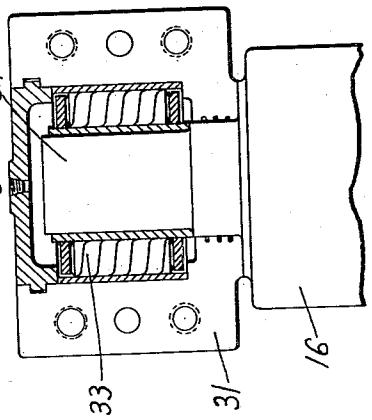


Fig. 3.

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TENSION DEVICE

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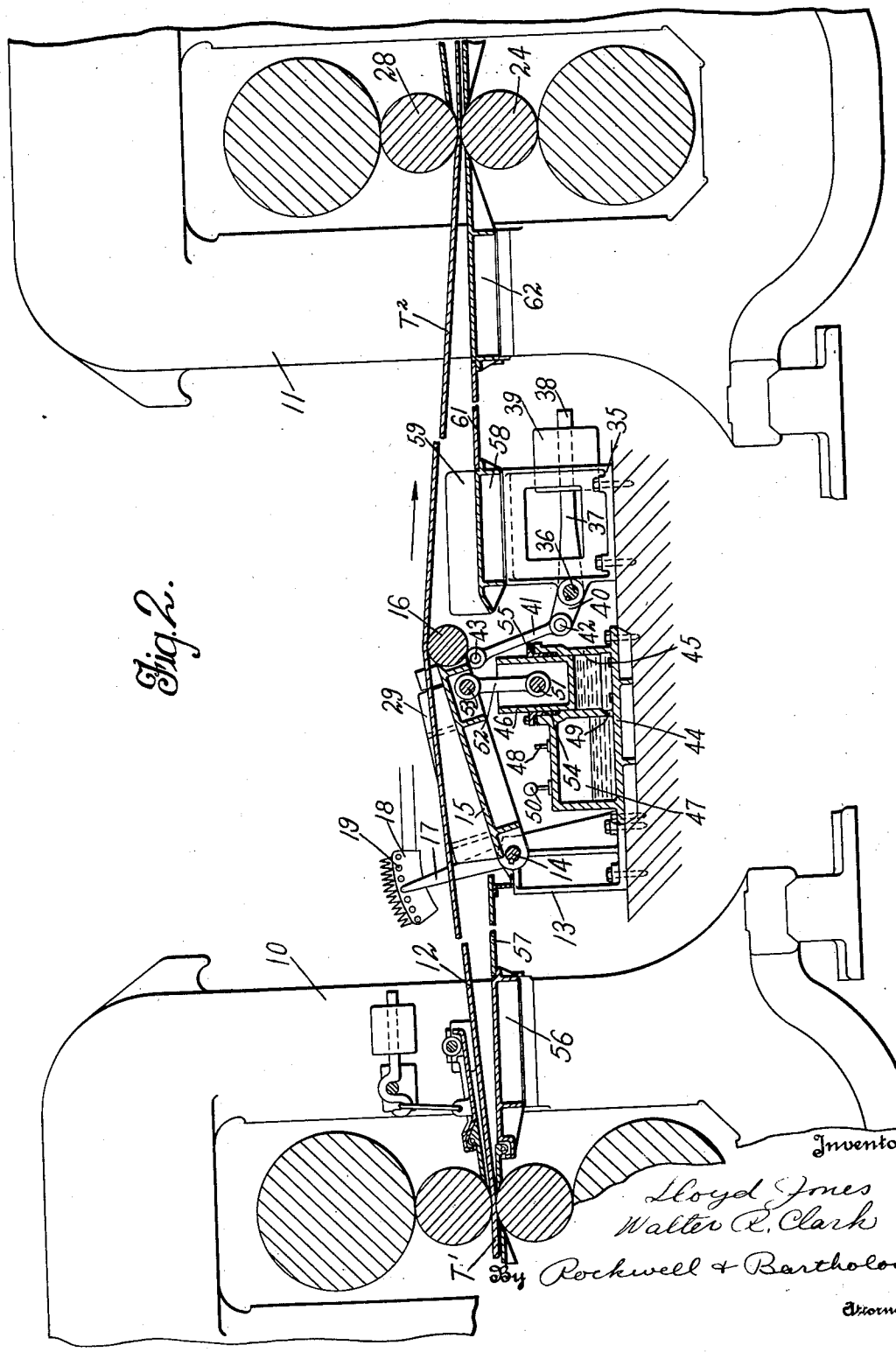


Fig. 2.

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Patented Apr. 19, 1932

1,854,198

UNITED STATES PATENT OFFICE

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TENSION DEVICE

Application filed August 2, 1930. Serial No. 472,651.

Our invention relates to a tension device, and more especially to a mechanism for controlling the relative speeds of rolling mills or other metal working devices arranged in tandem and operating simultaneously on a strip or sheet of metal or the like.

It is somewhat common in rolling practice to pass strips or the like through one or more sets of rolls arranged in tandem, the speeds of the mills being controlled in accordance with the amount of slackness in the strip between the mills. A certain amount of slackness is necessary in order that the metal of the strip may not be stretched or ruptured, while too much slackness is undesirable owing to the tendency of the strip to loop between mills.

It is, in general, an object of the present invention to provide means for controlling the amount of slackness in a strip, sheet, or the like, between the mills or other machines of a tandem, and more especially to provide an arrangement wherein the speeds of the mills or other machines are controlled by the amount of tension or slackness occurring in the stock as it passes from one of the machines to another.

In a more specific aspect, the invention relates to a device of the above characteristics which may be used with sheets or strips of various degrees of thickness or gauge, and adjusted to bring about any desired amount of tension in the stock up to the breaking point of the material.

A feature of the invention resides in an arrangement wherein the stock may pass freely from one mill or other machine of the tandem to the succeeding machine, the material being effectively supported and guided during such passage.

To these and other ends, the invention consists in the novel features and combinations of parts to be hereinafter described and claimed.

In the drawings:

Fig. 1 is a plan view of a pair of rolling mills, having a tension controlling device according to our invention mounted therebetween;

Fig. 2 is a side elevational view of the mills and tension regulating device shown in Fig. 1, partly broken away to show the interior construction;

Fig. 3 is a plan view, partly in section, of a bearing for supporting a roller used in connecting with the tension device, and

Fig. 4 is a front elevational view of one of the mills shown in Figs. 1 and 2.

Referring now to the drawings in which we have illustrated our invention by showing a preferred embodiment of the same, and with special reference to Figs. 1 and 2, the reference numerals 10 and 11 indicate two mills of a tandem (not shown herein in detail), through which a strip 12 passes to be successively reduced, the number of mills in the tandem ordinarily being in excess of two, which are sufficient, however, for the purpose of disclosing the invention. The material enters mill 10 with the initial thickness of T^1 and emerges with a thickness of T^2, whereupon it passes to mill 11 to be further reduced.

The strip increases in length as it is reduced in thickness and in order to prevent the strip from accumulating between mills 10 and 11, it is necessary to drive mill 11 at a greater speed than mill 10. Owing to slippage and other factors incident to the rolling of metal, it is impractical to control the relative speeds of the mill by hand or to have a fixed speed ratio between the mills. In the present instance, the relative speeds of the mills are controlled by the tension existing in the strip as it passes from one mill to the other. For this purpose, a bracket 13 is fixedly mounted between the mills 10 and 11, bracket 13 serving to support a shaft 14 on which is mounted a table 15 which may be swung about the axis of the shaft 14 to bring a roller 16 into contact

with the strip 12, as shown in Fig. 2. Table 15 is keyed or otherwise fixed to shaft 14, the latter being rotatable in bracket 13 and having fixed to one of its ends a rheostat arm 17 of rheostat 18, the latter being provided with a number of contact points 19 by means of which the speed of the motor 20 (Fig. 4) may be controlled in well known manner to bring about the desired speed ratio between the mills and tension in strip 12. It will be obvious that the motor 20 may drive mill 10 or mill 11, the relative speeds of the mills being controlled through the rheostat to provide the desired tension.

In Fig. 4 of the drawings, a single mill is shown somewhat diagrammatically in which the motor 20 is coupled to a shaft 21, having on one end thereof a small gear 22 in mesh with a relatively large gear 23, driving a working roll 24. On the opposite end of shaft 21 is a small gear 25 driving relatively large gear 26 through an idler 27, large gear 26 being coupled to the other working roll 28. The invention may be carried out with any usual form of rolling mill and is not limited to use with four-high mills such as those shown in the drawings.

The table 15 is provided at the opposite side edges thereof with flanged guides 29 and 30 between which the stock passes to mill 11, and at the end opposite the shaft 14 with bearings 31 for roll 16. In the present instance, the bearings 31 are provided with caps 32 which serve to retain roller bearings 33 of any usual or preferred construction, the necks 34 of roll 16 being supported in bearings 33.

Between the end of table 15 and mill 11 is a frame 35 fixedly mounted on any convenient support, frame 35 serving to support a shaft 36 on which is mounted an arm 37, having an end 38 adapted to adjustably support a counterbalance weight 39. Keyed on shaft 36 is an arm 40 connected to a link 41, by means of crank pin 42, the opposite end of link 41 being pivotally supported on table 15 by means of pin 43. The weight 39 serves to counterbalance the weight of table 15 and the associated mechanism and to hold the roller 16 in contact with the lower face of strip 12. If necessary, the weight 39 may be adjusted along the end 38 of arm 37 to bring about a variable pressure of roller 16 on the strip 12.

In order that variations in the tension of the strip 12 may be made in accordance with the thickness thereof, and the character of the material being rolled, a housing 44 is mounted below the table 15, housing 44 having at one end thereof adjacent the roller 16 a cylinder 45 in which is mounted for reciprocation a piston 46 yieldingly forced upwardly by oil or other fluid within the cylinder 45, and an adjacent chamber 47 in housing 44, the oil or other fluid being forced from chamber 47 by air entering therein through pipe 48, connected to any suitable source of supply, not shown herein. The oil passes from the bottom of chamber 47 into cylinder 45, through a port 49, at the lower end of the cylinder 45. A pressure gauge 50 on chamber 47, indicates the pressure in chamber 47 at all times, and furnishes a ready means for determining the amount of upward pressure of roll 16 against strip 12, piston 46 being connected to table 15 by means of wrist pin 51 in piston 46, wrist pin 51 having mounted thereon a connecting rod 52 the opposite end of which is received on crank pin 53, mounted in table 15. Leakage of oil around piston 46 is prevented by packing 54, mounted in cylinder 45 and forced against piston 46 by packing gland 55, in well known manner.

The upward pressure of piston 46 and thus the thrust of roller 16 on the strip 12 may be readily varied to suit the particular strip being rolled, by adjusting the amount of air pressure in chamber 47, the size of the chamber being such that considerable upward and downward movement of the piston 46 may take place without varying the air pressure to any considerable degree and thus producing a substantially uniform tension in the strip 12. Owing to the fact that the air in chamber 47 may be readily compressed, the roller 16 is resiliently urged upwardly against the strip 12 and may quickly respond to changes in the tension thereof or the length of the loop between the mills to bring about the necessary corrections in the mill speeds.

Mounted on the frame or mill 10 in any convenient manner, and having an upper surface in alignment with the pass between the working rolls of the mill is a guide 56. Mounted on the end of guide 56 is a guide-plate 57, the remote end of which is supported from frame 13. Between table 15 and mill 11 is a guide 58, having a flat upper surface in alignment with the upper surface of guide 56, guide 58 being supported on frame 35 and being provided on its side edge portions with flange-like guides 59 and 60, between which the strip passes to a guide-plate 61 having one end supported on guide 58 and the other end supported on a guide 62, mounted on the frame of mill 11. Guides 56, 57, 58, 61 and 62 serve to support the end of the strip 12 as it passes from mill 10 to mill 11, the strip normally being substantially in the position shown in Fig. 2 and having a certain amount of slackness to avoid rupture of the strip in case the latter passes through mill 11 at a greater rate of speed than it is discharged from mill 10.

From the above description of the nature of our invention and its mode of operation, it will be readily understood that the pressure on roller 16 may be adjusted to bring about any desired tension in the strip 12, depending on the pressure in chamber 47, the

amount of slackness in the strip operating to control the relative speed of the mills through the control of the motor 20 by the rheostat 18.

While we have shown and described a preferred embodiment of our invention, it will be understood that it is not to be limited to the details shown but is capable of modification and variation within the spirit of the invention and the scope of the appended claims.

What we claim is:

1. The combination with metal working devices for simultaneous operation on a length of stock of a prime mover for one of said devices, means for varying the tension of the stock between said devices, and means for controlling the operation of the prime mover in accordance with the tension in the stock, said first named means including a roller in contact with said stock, a fluid pressure device for regulating the pressure of said roller on the stock, and means connected to said fluid pressure device for subjecting the latter to a constant predetermined fluid pressure.

2. The combination with metal working devices for simultaneous operation on a length of stock of a prime mover for one of said devices, means for varying the tension of the stock between said devices, and means for controlling the operation of the prime mover in accordance with the tension in the stock, said first named means including a pivoted table, a roller at one end of said table, means for swinging said pivoted table to bring said roller into contact with said stock, and means connected to said table and operated by movement thereof for controlling the operation of the prime mover.

3. The combination with metal working devices for simultaneous operation on a length of stock of a prime mover for one of said devices, means for varying the tension of the stock between said devices, and means for controlling the operation of the prime mover in accordance with the tension in the stock, said first named means including a pivoted table, a roller at one end of the table, and fluid pressure operated means for swinging said table to bring said roller into contact with the stock.

4. The combination with metal working devices for simultaneous operation on a length of stock of a prime mover for one of said devices, means for varying the tension of the stock between said devices, and means for controlling the operation of the prime mover in accordance with the tension in the stock, said first named means including a pivoted table, a roller at one end of said table, a cylinder, a piston in said cylinder, a connection between said cylinder and table, and means for introducing fluid under pressure into said cylinder.

5. The combination with metal working devices for simultaneous operation on a length of stock of a prime mover for one of said devices, means for varying the tension of the stock between said devices, and means for controlling the operation of the prime mover in accordance with the tension in the stock, said first named means including a roller, a cylinder, a piston in said cylinder, a connection between said piston and roller, and means for maintaining a constant predetermined pressure in said cylinder.

6. The combination with metal working devices for simultaneous operation on a length of stock of a prime mover for one of said devices, means for varying the tension of the stock between said devices, and means for controlling the operation of the prime mover in accordance with the tension in the stock, said first named means including a roller, a cylinder, a piston in said cylinder, a connection between said cylinder and roller, and a chamber for fluid under pressure connected to said cylinder.

7. The combination with metal working devices for simultaneous operation on a length of stock of a prime mover for one of said devices, means for varying the tension of the stock between said devices, and means for controlling the operation of the prime mover in accordance with the tension in the stock, said first named means including a roller, a cylinder, a piston in said cylinder, a connection between said cylinder and roller, and a chamber for fluid under pressure connected to said cylinder, and means for indicating the pressure in said chamber.

8. The combination with metal working devices for simultaneous operation on a length of stock of a prime mover for one of said devices, means for varying the tension of the stock between said devices, and means for controlling the operation of the prime mover in accordance with the tension in the stock, said first named means including a pivoted table, a roller at one end of the table, a cylinder, a piston in said cylinder, a connection between said piston and table, and a chamber for fluid under pressure and connected to said cylinder.

9. The combination with metal working devices for simultaneous operation on a length of stock of a prime mover for one of said devices, means for varying the tension of the stock between said devices, and means for controlling the operation of the prime mover in accordance with the tension in the stock, said first named means including a pivoted table, a roller at one end of the table, a cylinder, a piston in said cylinder, a connection between said piston and table, a chamber for fluid under pressure connected to said cylinder, and means for indicating the pressure in said chamber.

10. The combination with metal working

devices for simultaneous operation on a length of stock of a prime mover for one of said devices, means for varying the tension of the stock between said devices, and means for controlling the operation of the prime mover in accordance with the tension in the stock, said first named means including a pivoted table and roller at one end of the table, a housing having a cylinder at one end thereof, a piston in said cylinder, a connection between said piston and table, and a chamber for fluid under pressure connected to said cylinder.

11. The combination with metal working devices for simultaneous operation on a length of stock of a prime mover for one of said devices, means for varying the tension of the stock between said devices, and means for controlling the operation of the prime mover in accordance with the tension in the stock, said first named means including a pivoted table, a roller at one end of the table, a housing having a cylinder at one end thereof, a piston in said cylinder, a connection between said piston and table, and a chamber for fluid under pressure connected to said cylinder, and means for indicating the pressure in said chamber.

12. The combination with metal working devices for simultaneous operation on a length of stock of a prime mover for one of said devices, a pivoted table over which the stock passes, means operatively connected to said table to swing the latter into contact with the stock, and means operatively connected to said table and movable therewith for controlling the operation of the prime mover.

13. The combination with metal working devices for simultaneous operation on a length of stock of a prime mover for one of said devices, a pivoted table over which the stock passes, a roller at one end of said table, fluid pressure means mounted below said table and urging the latter upwardly to bring the roller into contact with the stock, and means operated by the movement of the table for controlling the operation of the prime mover.

14. The combination with metal working devices for simultaneous operation on a length of stock, of a prime mover for one of said devices, a movable table over which the stock passes, fluid pressure means associated with said table and adapted to urge the latter into contact with the stock, and means operated by movement of the table for controlling the operation of the prime mover.

15. The combination with metal working devices for simultaneous operation on a length of stock, of a prime mover for one of said devices, means movable into contact with the stock as the latter passes from one of the devices to the other, a fluid pressure operating device connected to said means and adapted to urge the latter into contact with the stock, and means connected to and operated by movement of said first-named means for controlling the operation of the prime mover.

In witness whereof, I have hereunto set my hand this 28th day of July, 1930.

LLOYD JONES.

In witness whereof, I have hereunto set my hand this 30th day of July, 1930.

WALTER R. CLARK.