Sept. 23, 1930. K. YOUNGHUSBAND 1,776,607

HEATING OF THE ROLLS OF METAL ROLLING MILLS

Filed Dec. 1, 1928 2 Sheets-Sheet 1

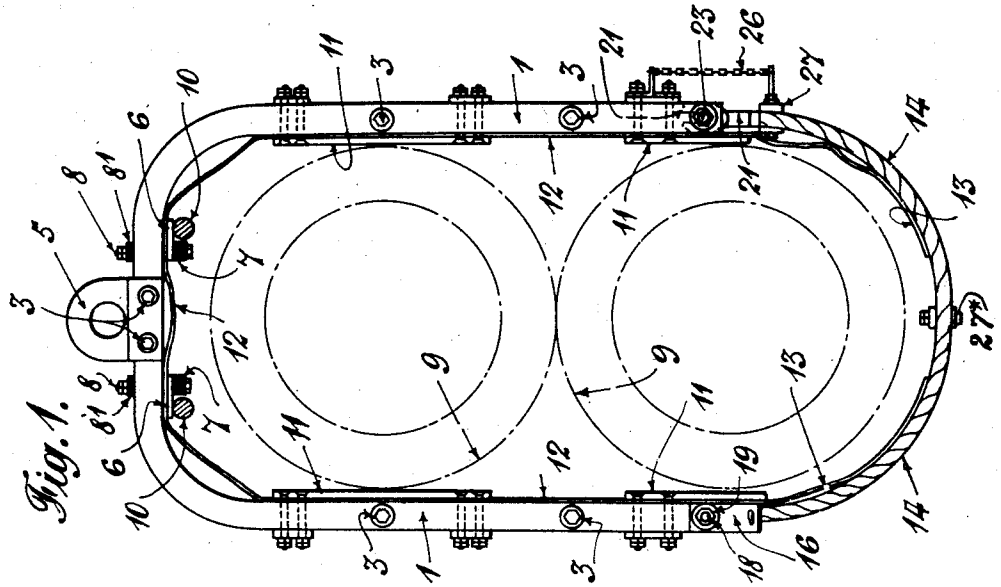


Fig. 1.

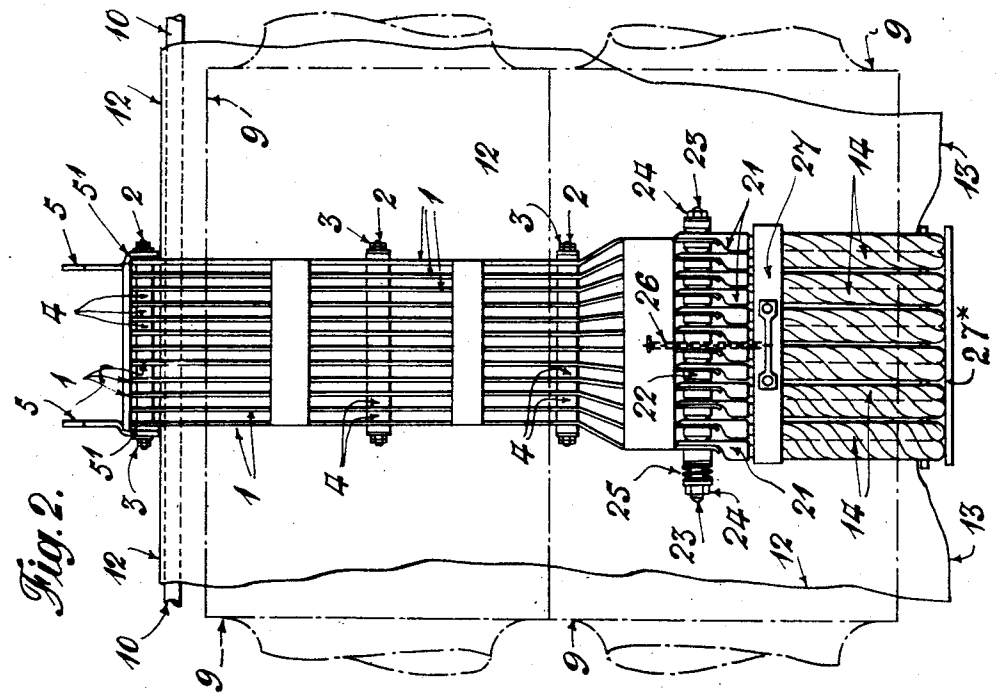


Fig. 2.

INVENTOR:-
Kenneth Younghusband

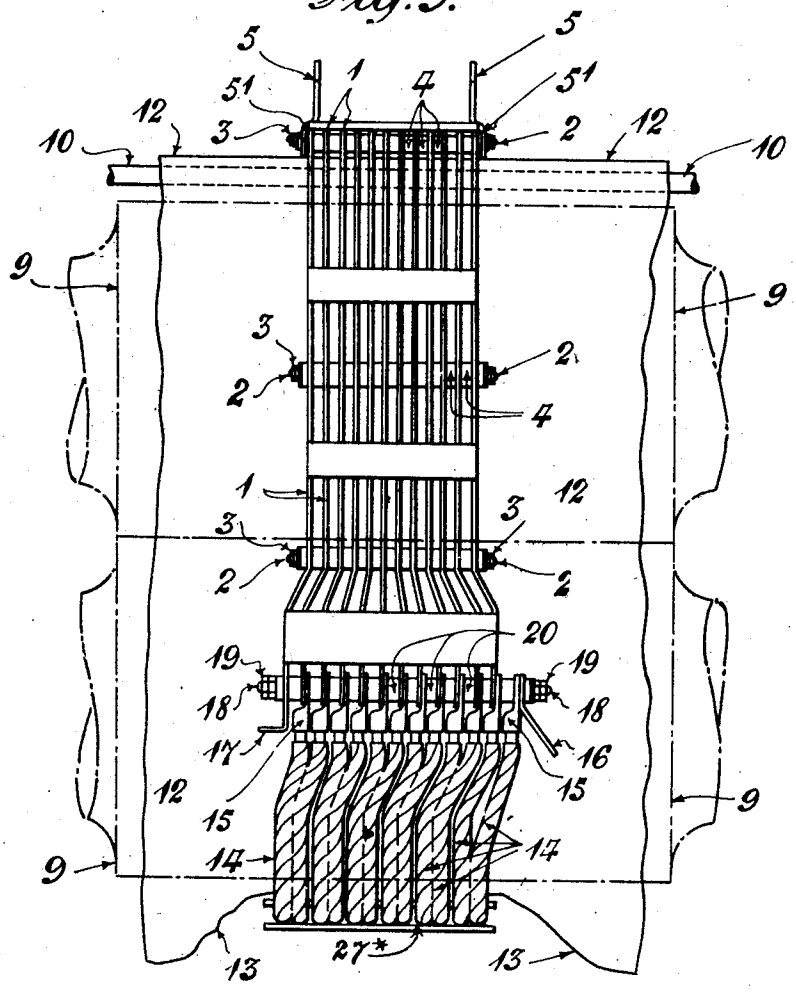
BY HIS ATTORNEYS:-

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Filed Dec. 1, 1928 2 Sheets-Sheet 2

Fig. 3.



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UNITED STATES PATENT OFFICE

KENNETH YOUNGHUSBAND, OF HAWARDEN, WALES

HEATING OF THE ROLLS OF METAL-ROLLING MILLS

Application filed December 1, 1928, Serial No. 323,129, and in Great Britain December 19, 1927.

This invention relates to the heating of the rolls of metal rolling mills during a time when rolling is not taking place. It is known from experience obtained in connection with certain industrial processes that a relatively large body of iron or steel in the form of a long cylinder (amongst other forms) can be effectively heated by subjecting it to the action of an alternating magnetic field produced by alternating current in a tubular coil surrounding the cylinder. In such known cases it is possible to deal with the cylinder as a body which is relatively isolated magnetically and is also free in relation to external bodies to a sufficient extent to permit of the coil being applied to it as a complete coil, for instance, by sliding it over one end of the cylinder. The conditions in the case of the rolls of a rolling mill are quite different both as regards their relation to external bodies and to the presence of magnetic material. The rolls are here mounted one above the other close together and are supported at each end in bearings carried by a frame, usually of magnetic material for example steel, the two frames usually being interconnected by base plates also of magnetic material. There is further the condition that it is generally required to produce by the preliminary heating a condition similar to that which is maintained during the rolling processes in which the centre parts of the rolls are at a materially higher temperature than the end parts. The present invention consists in an apparatus whereby effective heating in accordance with these conditions can be obtained in a manner analogous to that above referred to in connection with separate cylinders, that is by enclosing the rolls in a helix carrying alternating current for the purpose of creating heat in the rolls.

In accordance with the invention the rolls are surrounded by a coil carrying alternating current each turn of which can be opened and closed for the purpose of readily permitting the coil to be placed in position around the rolls without disturbing the latter or their housings. For this purpose, in a preferred and illustrative embodiment of the invention, the coil forms an integral part of a U shaped frame and there is provided in each turn of the coil a portion which is movable for connecting and disconnecting, as for example a flexible piece, which permits of the turn being opened so that the U-shaped frame can be placed over the rolls after which the coil may be completed by remaking the connections of the movable parts so as to form a complete spiral through which the alternating current can be fed. The rolls thus form a magnetic core lying within a coil fed with alternating current which is found to produce by the action of the alternating magnetic field heating of the rolls in the manner required. The rolls should be free to turn if required during the heating period and therefore the construction and disposition of the U-shaped frame may be such as to provide the necessary clearances. Further according to the invention, the U-shaped frame is preferably made to carry an enclosing wall of heat resisting material for example asbestos for the purpose of retaining the heat in the rolls and for protecting the conductors and associated parts from the heat.

The preferred embodiment of the invention will now be described by way of example and with reference to the accompanying drawings.

Figure 1 shows an end elevation of the embodiment in position for heating a pair of rolls.

Figures 2 and 3 show respectively elevations of the right and left sides of Figure 1.

The U-shaped frame comprises copper U-shaped strips 1 held rigidly together by insulated bolts 2 which pass through holes in the strips and are tightened up by nuts 3. Spacing washers 4 of insulating material are threaded upon the bolts 2 between adjacent strips 1. Two lifting lugs 5 insulated from the adjacent strips 1 by plates 5^1 of insulating material are provided as shown at the top of the structure as well as the insulating strips 6 and 7 secured by bolts 8 for the purpose of supporting the weight of the frame when placed in position over the rolls 9 upon the cross-bars 10 which may themselves be supported from the roll housings. The bolts 8 are covered with electrically insulating ma-

terial and used with washers 8[1] also of electrically insulating material. Plates 11 of strong electrically insulating and heat resisting material are bolted to the insides of the strips 1 partly for the purpose of re-inforcing the frame structure and also to space the strips from the rolls. A flexible envelope 12 of asbestos sheet is suitably secured to the frame by the insulating plates 6 and 11 and also extends from the sides to cover the length of the rolls in such a way that it envelops both rolls as closely as possible and retains the heat therein. When the apparatus is in operation the side extensions of the envelope 12 rests on the rolls and the middle portions of the lower flaps 13 of that envelope 12 are brought close to the rolls by the flexible cables 14. At other times these flexible portions 13 hang down so as not to impede the placing of the frame in position over the rolls or its removal therefrom.

The coil is formed by the strips 1 and by the flexible asbestos insulated cable lengths 14, which are arranged to pass under the U-shaped frame and to connect the ends of the strips together to form the coil. The one end strip is connected by flexible cable under the frame to a terminal lug 15 and terminal plate 16. The other terminal plate 17 is connected to the end of the other end strip as shown. As shown in Figure 3 the flexible cable lengths are permanently connected at one of their ends through terminal lugs to the ends of their respective strips and are secured in position by means of an insulated through bolt 18 and nuts 19 in conjunction with insulating spacing washers 20. As shown in Figure 2 the flexible cable lengths are detachably connected at their other ends through slotted terminal lugs 21 to the ends of their respective strips by means of an insulated bolt 23 and nuts 24 in conjunction with bevelled insulating spacing washers 22 and a spring 25 subjected to compression by means of the nut 24. The flexible cable ends are all held permanently together in correct relationship by means of the clamping bar 27 which ordinarily is supported in the manner shown by the chain 26, and an additional clamp 27* may be provided for keeping the mid-portions of the flexible cables in their proper positions.

To place the frame in position on the rolls the nuts 24 are loosened, thereby permitting the tension of the spring 25 to be relaxed so that the slotted lugs 21 are no longer tightly gripped between the strips and washers 22. The chain 26 is then unhooked and the bar 27 together with its associated flexible cable ends is allowed to hang straight downwards. The frame can now be lifted and placed over the rolls after which the cable ends are lifted by the chain 26 and clamped again in their operative positions.

The U-shaped frame is preferably made as shown in Figure 2 so that the coil comprising the copper strips 1 extends over the centre part only of the length of the rolls 9. It may also be advantageous, particularly in the case of short rolls, to place the strips closer together near the centre of the coil than near the outer parts thereof.

The embodiment described above with reference to the accompanying drawings forms a very robust and practical form of frame suitable for the conditions under which it has to operate. The invention can, however, be put into practice by utilizing other constructional forms of frames and connections movable for connection and disconnection.

What I do claim as my invention and desire to secure by Letters Patent is:

1. An apparatus for heating rolling mill rolls, comprising a coil of a plurality of turns in series to carry alternating current having each turn contrived to be opened and closed to allow the coil to be made to surround and to be removed from a plurality of rolls and the current carrying turns of the coil to be made to surround rolls to be heated whereby the rolls themselves when surrounded by the coil are made each to form a core therefor and so are subjected to alternating magnetization, to electric eddy currents and to hysteresis, and thereby caused to become heated.

2. An apparatus for heating rolling mill rolls, comprising a coil of a plurality of turns in series to carry alternating current having in each turn a portion movable into and out of connection with another portion and means for connecting said portions enabling the turns to be opened and closed to allow the coil to be made to surround and to be removed from a plurality of rolls and the current carrying turns of the coil to be made to surround rolls to be heated whereby the rolls themselves when surrounded by the coil are made each to form a core therefor and so are subjected to alternating magnetization, to electric eddy currents and to hysteresis, and thereby caused to become heated.

3. An apparatus for heating rolling mill rolls, comprising a coil of a plurality of turns in series to carry alternating current having in each turn a movable portion movable at one end into and out of connection with another portion and means for connecting said end of the movable portion to the other portion mentioned, enabling the turns to be opened and closed to allow the coil to be made to surround and to be removed from a plurality of rolls and the current carrying turns of the coil to be made to surround rolls to be heated whereby the rolls themselves when surrounded by the coil are made each to form a core therefor and so are subjected to alternating magnetization, to electric eddy currents and to hysteresis, and thereby caused to become heated.

4. An apparatus for heating rolling mill rolls, comprising a coil of a plurality of turns

in series to carry alternating current having in each turn a flexible portion in connection at one end with one end of another part and at its other end movable into and out of connection with the other end of an adjacent part and means for connecting the connectible and disconnectible ends of said flexible portions and other parts, enabling the turns to be opened and closed to allow the coil to be made to surround and to be removed from a plurality of rolls and the current carrying turns of the coil to be made to surround rolls to be heated whereby the rolls themselves when surrounded by the coil are made each to form a core therefor and so are subjected to alternating magnetization, to electric eddy currents and to hysteresis, and thereby caused to become heated.

5. An apparatus for heating rolling mill rolls, comprising a coil of a plurality of turns in series to carry alternating current and with parts of its turns assembled in a U-shaped structure and having other parts of the turns contrived to be opened for the application of the U-shaped structure over rolls in a plurality and closed for heating them and opened for the removal of the U-shaped structure from said rolls, whereby the rolls themselves when surrounded by the coil are made each to form a core therefor and so are subjected to alternating magnetization, to electric eddy currents and to hysteresis, and thereby caused to become heated.

6. An apparatus for heating rolling mill rolls, comprising a coil of a plurality of turns in series to carry alternating current and with parts of its turns assembled in a U-shaped structure and having in each turn a movable portion movable into and out of connection with another portion and means for connecting said portions allowing the turns of the coil to be opened for the application of the U-shaped structure over rolls in a plurality and closed for heating them and opened for the removal of the U-shaped structures from said rolls whereby the rolls themselves when surrounded by the coil are each made to form a core therefor and so are subjected to alternating magnetization, to electric eddy currents and to hysteresis, and thereby caused to become heated.

7. An apparatus for heating rolling mill rolls, comprising a coil of a plurality of turns in series to carry alternating current and with parts of its turns assembled in a U-shaped structure and having in each turn a movable portion movable at one end into and out of connection with another portion and means for connecting said end of the movable portion to the other portion mentioned, allowing the turns of the coil to be opened for the application of the U-shaped structure over rolls in a plurality and closed for heating them and opened for the removal of the U-shaped structure from said rolls whereby the rolls themselves when surrounded by the coil are made each to form a core therefor and so are subjected to alternating magnetization, to electric eddy currents and to hysteresis, and thereby caused to become heated.

8. An apparatus for heating rolling mill rolls, comprising a coil of a plurality of turns in series to carry alternating current and with parts of its turns assembled in a U-shaped structure and having in each turn a flexible portion in connection at one end with one end of another part and its other end movable into and out of connection with the other end of an adjacent part and means for connecting the connectible and disconnectible ends of said flexible portions and other parts allowing the turns of the coil to be opened for the application of the U-shaped structure over rolls in a plurality and closed for heating them and opened for the removal of the U-shaped structure from said rolls, whereby the rolls themselves when surrounded by the coil are made each to form a core therefor and so are subjected to alternating magnetization, to electric eddy currents and to hysteresis, and thereby caused to become heated.

In testimony, that I claim the foregoing as my invention, I have signed my name this thirteenth day of November, 1928.

KENNETH YOUNGHUSBAND.