March 24, 1925. 1,530,799

F. WILLE ET AL

ROLLING MILL

Filed March 15, 1923

Fig. 1

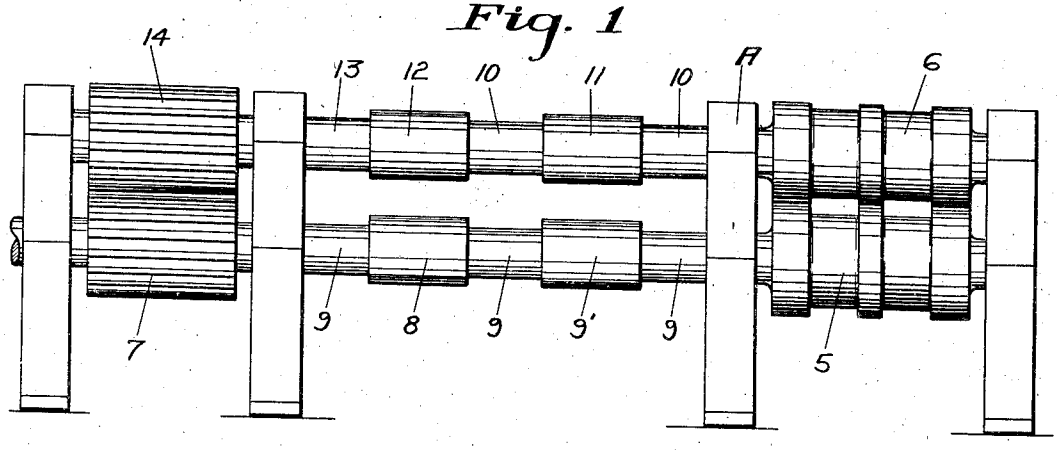


Fig. 2

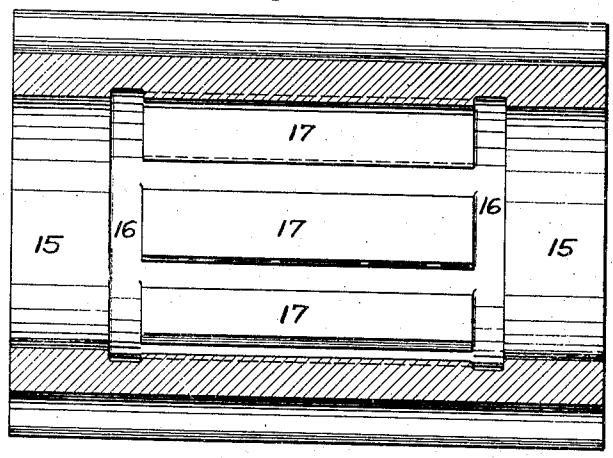


Fig. 3

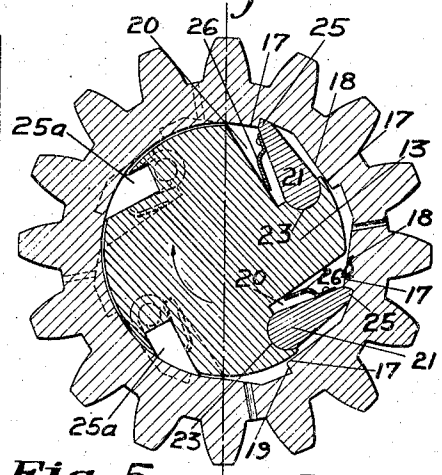


Fig. 5

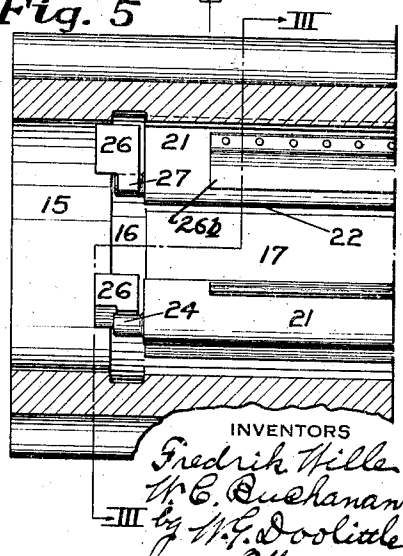


Fig. 4

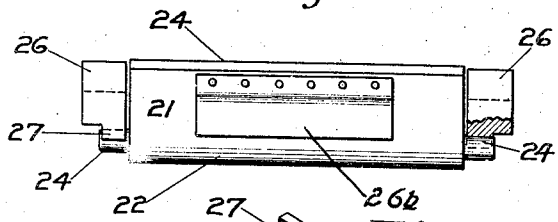
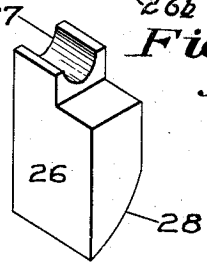


Fig. 6



INVENTORS
Fredrik Wille
W. C. Buchanan
by W. G. Doolittle
Attorney.

Patented Mar. 24, 1925. 1,530,799

UNITED STATES PATENT OFFICE.

FREDRIK WILLE AND WILLIAM C. BUCHANAN, OF WARREN, OHIO.

ROLLING MILL.

Application filed March 15, 1923. Serial No. 625,253.

To all whom it may concern:

Be it known that we, FREDRIK WILLE and WILLIAM C. BUCHANAN, citizens of the United States, residing at Warren, in the county of Trumbull and State of Ohio, have invented certain new and useful Improvements in Rolling Mills, of which the following is a specification.

This invention is for a rolling mill and relates particularly to means for transmitting power from a driving means to one of the rolls, the invention being especially applicable to mills for the production of hot or cold rolled strips.

In the production of rolled strips, it is desirable that the upper roll be driven frictionally, while the lower roll is driven positively. It is further desirable to have the upper roller just a little less in diameter than the lower one. When the upper roll, however, is driven solely by friction, the metal going into the roll will choke and buckle, such action being called "sticking", and producing "stickers", which causes cobbles or scrap. Such action is detrimental to the rolls, in that it is liable to burn or mark them, thereby necessitating a change of rolls, thus producing a delay and loss of time.

Consequently, although there are certain advantages in having the upper roll frictionally driven, especially in the production of cold rolled strips, yet, in view of the difficulties encountered when but one roll is driven, both rolls are now generally driven. There is also a certain disadvantage in having both rolls driven in that the rolls must be of the same size and the strips produced thereby are not straight, almost invariably having a certain amount of lateral curvature or camber, which, while it is not in most cases serious, is not desirable and does require the scrapping of some strips. The best surface finish on the product is not produced by having both rolls power driven.

It has been proposed, and adopted to some extent, to put a clutch in the driving connection for the upper roll, of a type having opposed flat surfaces on which are formed teeth, the one member being urged against the other by a spring. The teeth are so designed that the upper roll may move faster than its driving shaft through friction from the lower roll, the upper roll having a smaller diameter than the lower one.

As long as the upper roll moves faster than its driving shaft, the teeth on the two members slip over each other, causing one of the clutch members to slide back and forth continuously, producing a chatter and vibration throughout the roll, its bearings, and the driving connection. This vibration leaves a marking on the surface of the rolled product, called chatter marks.

With this type of clutch, as soon as the sticker is encountered, the speed of the upper roll will be slowed up to the speed of its driving shaft, and the driving shaft will positively drive the upper roll until the speed of the upper roll again increases.

The present invention proposes to provide a clutch in the driving connection for the upper roll, of such nature that endwise vibration will be entirely eliminated and more positive action is obtained, with the production of strips, either hot or cold rolled, which are straight and have the desired surface finish.

The invention may be readily understood by reference to the accompanying drawings, in which:

Fig. 1 is a somewhat diagrammatic view of a rolling mill having our invention embodied therein;

Fig. 2 is a longitudinal section through the upper gear for driving the upper roll;

Fig. 3 is a staggered transverse section in the plane of line III—III of Fig. 5;

Fig. 4 is a plan view of one of the pawls contained in the clutch;

Fig. 5 is a view similar to Fig. 2, but showing the interior mechanism in place; and

Fig. 6 is a perspective view of one of the keepers for retaining the pawls in place.

In the drawings, A designates a rolling mill, preferably one designed for the production of hot or cold rolled strips. The mill includes a housing in which is a lower roll 5 and an upper roll 6, the latter having a diameter slightly less than that of the former.

The lower roll is positively driven from a positively driven lower gear 7, through coupling 8, shaft 9, and coupling 9′.

The upper roller is connected with a shaft section 10 through coupling 11, and shaft 10 is connected through coupling 12 with a shaft 13 which carries the gear 14. The gear 14 is not the usual form of gear used in this type of machinery, but comprises a hollow shell having a central opening there-

in, providing end bearing surfaces 15, which provide bearings for the gear on shaft 13 that passes through the central opening.

Within the gear, and formed for the purpose of facilitating the machining of teeth, hereinafter described, are two annular channels 16. Extending between these two channels are a plurality of teeth 17 having inclined rear surfaces 18 and shouldered surfaces 19.

The part of the shaft 13 which is received in the gear in juxtaposition to the teeth, is provided with a series, preferably four, of longitudinally extending recesses 20. Received within each recess is a pawl 21 having a rounded back 22 which has a bearing at 23 in a similarly shaped recess in the shoulder formed on shaft 13 by the provision of the recesses 20 in the shaft. The pawls have end trunnions 24. The outer edge of each pawl is shaped to provide a tooth engaging portion 25 for engagement with the teeth 17.

Secured to the inner face of each pawl, is a leaf spring 26^b for urging the free edge of the pawl out into engagement with the teeth.

Formed in the shaft 13, near the ends of the recesses, are pockets 25^a which receive keepers 26 having a notched end 27 to receive the trunnions on the pawls. The outer ends 28 of the keepers are rounded to bear against bearing surfaces 15. These keepers merely serve to hold the pawls in proper position and prevent them from chattering.

In operation, the upper roll is normally driven frictionally faster than the lower roll and faster than gear 14, due to its smaller diameter. As long as this condition maintains, the pawls carried by the shaft ride over the inclined surfaces of the internal ratchet teeth. When, however, the upper roll is slowed down, due to a sticker, one or more of the ratchet teeth engage the pawls and positively drive the upper roll until it regains its normal speed of operation.

Since the ratchet teeth and pawls extend longitudinally of the axis of the rolls, no endwise motion or vibration or strain is placed on the rolls or the couplings, and the operation of the upper roll is smooth and even. This gives the desired finish to the rolled strips, particularly cold rolled strips. The clutch, being disposed in the gear, may run in the oil bath usually provided for driving gears in machinery of this character, so that wear of the parts is reduced to a minimum.

We claim as our invention:

1. The combination with a rolling mill having an upper and a lower roll, the upper roll being slightly less in diameter than the lower one, a driving shaft for the lower roll, a driving shaft for the upper roll, a gear fixed on the driving shaft of the lower roll, a gear meshing therewith loose on the shaft for the upper roll, longitudinally disposed teeth on the inside of said gear on the upper roll shaft, recesses in the portion of the shaft with the gear, and pawls in the recesses for engagement with said teeth, said teeth being so arranged that the shaft may rotate freely when it is rotating faster than the gear, but arranged so as to transmit power to the shaft when the speed of rotation of said upper roll shaft is slowed down.

2. The combination with a rolling mill having upper and lower rolls, driving shafts for the respective rolls, intermeshing gears on the shafts, the gear on the upper shaft having internal longitudinally extending teeth, and outwardly projecting pawls on the upper shaft within the upper gear engaging in the internal teeth of said outer member.

3. A slip clutch construction for rolling mills including an outer member having a toothed surface on the interior thereof, the outer member having annular channels therein at each end of the toothed area, a shaft passing through the outer member having recesses therein, pawls in the recesses for engagement with the teeth and keepers at each end of the pawls engaging in the said channels.

4. A clutch for use in rolling mills comprising an outer driven member having a central opening therethrough, a shaft passing through the outer member providing a bearing therefor, said shaft having longitudinally extending recesses therein, longitudinally extending pawls movably carried in said recesses, and teeth for cooperation with said pawls formed on the interior of the outer member.

5. A clutch for use in rolling mills comprising an outer driven member having a central opening therein, the interior end portions of said outer member providing bearing surfaces, a shaft passing through the outer member and providing a bearing for the bearing surfaces of the outer member, longitudinally extending teeth on the interior of the outer member between said bearing surfaces, longitudinally extending recesses in said shaft in juxtaposition to the teeth, longitudinally extending pawls mounted in said recess to swing out into engagement with said teeth, and springs for urging the pawls outwardly.

6. A clutch for use in rolling mills comprising an outer driven member having a central opening therein, the interior end portions of said outer member providing bearing surfaces, a shaft passing through the outer member and providing a bearing for the bearing surfaces of the outer member, longitudinally extending teeth on the interior of the outer member between said bearing surfaces, longitudinally extending recesses in said shaft in juxtaposition to

the teeth, longitudinally extending pawls mounted in said recess to swing out into engagement with said teeth, springs for urging the pawls outwardly, said pawls having trunnions at the ends thereof, and keepers mounted in the shaft providing a bearing for the trunnions, said keepers having a bearing against said bearing surfaces of the outer member.

In testimony whereof we affix our signatures.

FREDRIK WILLE.
WILLIAM C. BUCHANAN.