

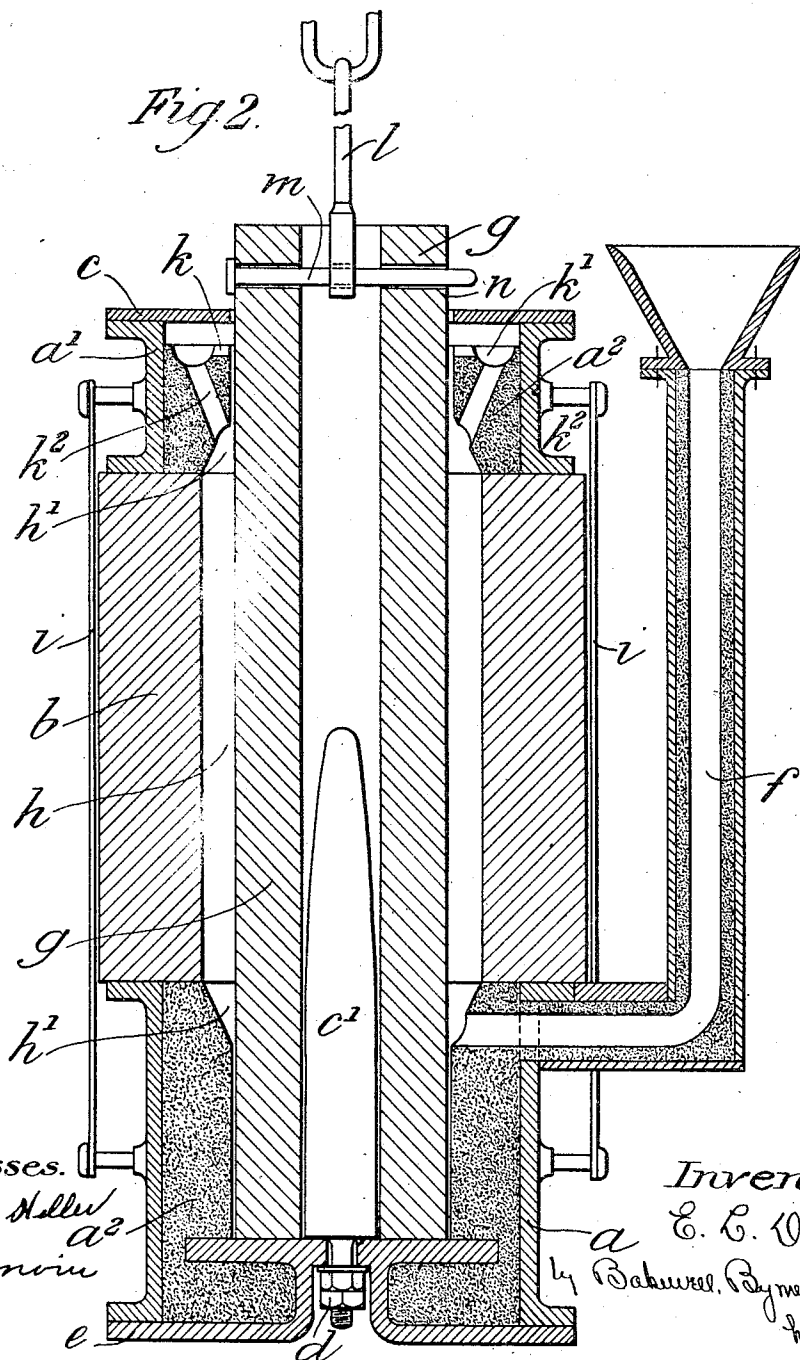
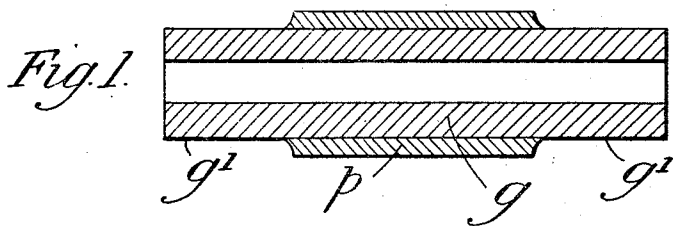
E. L. DAVIES.

MILL ROLL.

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1,057,713.

Patented Apr. 1, 1913.



Witnesses.

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UNITED STATES PATENT OFFICE.

EVAN LLEWELYN DAVIES, OF TREGENNA, ENGLAND.

MILL-ROLL.

1,057,713.

Specification of Letters Patent.

Patented Apr. 1, 1913.

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To all whom it may concern:

Be it known that I, EVAN LLEWELYN DAVIES, a subject of the King of Great Britain, residing at Tregenna, Vardre Road, Clydach S. O., in the county of Glamorgan, Wales, England, mining engineer, have invented certain new and useful Improvements in Mill-Rolls, of which the following is a specification.

This invention relates to mill rolls adapted for rolling down hot bars or plates of metal and also cold rolling mill sheets in the rough so as to give them a close smooth surface. In solid mills rolls used for such purposes breakages frequently occur by reason of stresses produced in the roll through unequal and rapid heating or cooling throughout its bulk. Thus, the surface of the roll in normal working may be rapidly heated through contact with the hot metal under treatment to a temperature of 400° C. or more, while the core of the roll remains practically cold. As the rolls are usually of cast iron and therefore have but little extensibility, the core is subjected to great tension and is frequently ruptured under the enormous stresses. In cooling after prolonged use, the surface of the roll loses its heat first and thereby becomes subject to contractile stresses, while the core retains its heat and does not therefore contract, so that in this case the surface of the roll comes into tension and rupture is liable to occur in consequence.

It has been found in practice that for rolls used for the purposes above indicated, chilled cast iron is the only material which possesses the requisite physical properties for doing the required work.

The present invention consists in an improved method of forming chilled cast iron rolls which, while retaining the good qualities of chilled cast iron rolls, will not be liable to rupture under the influences of stresses produced by unequal heating and cooling throughout their mass.

It has been previously proposed to construct chilled cast iron rolls by first filling or partially filling a suitable chilling mold with cast iron, and then, very shortly after the casting of the chilled cast iron, pouring into the same mold molten steel, which being heavier than the cast iron raises and forces out the body of molten cast iron within the mold, so that the steel fills the mold while in a molten condition and unites with the

cast iron that has been chilled. By another known method, a steel or iron tube after being heated is placed centrally within the mold and then molten steel and cast iron are simultaneously poured respectively into and around the tube. In such known methods a fusion of the cast iron and steel is relied upon to provide the adherence of the two classes of metal, but this fusion can never be perfect on account of the presence of oxids preventing absolute homogeneous contact. Consequently, rolls formed by such methods are not suitable for withstanding the excessive strains incurred in the hot and cold rolling of metals.

Now, according to this invention, a core of mild steel, solid or hollow, is preheated to a temperature somewhat higher than the melting point of copper (about 1100° C.) and, after having a flux applied to its exterior surface, is placed within the mold and centralized therein, whereupon the cast iron is underteamed into the space surrounding the core and externally bounded by the mold chills, the core and cast iron becoming welded together. The flux completely removes all traces of oxid, so that the two classes of metal unite in a manner to form a perfectly homogeneous weld. It has been found that the chilled cast iron cannot under these conditions be separated from the steel, the union of the two metals being absolutely perfect. Moreover, the pouring in of the molten metal into the mold is continued to produce a considerable overflow to insure coagulation from the chill surface inward toward the core with the object of further increasing the strength of the roll. The core preferably extends beyond the body of the roll in each direction; the projecting ends being suited to form the neck or journal and the wabbler by which the roll is connected to the other roll or rolls of the train.

The invention will be described with reference to the accompanying drawings, in which—

Figure 1 is a longitudinal section of a finished compound roll and Fig. 2 is a longitudinal section of a mold for carrying out the invention.

In constructing rolls according to my invention a suitable mold (Fig. 2) is prepared comprising a lower and an upper sand-box *a, a'* for holding the molding material *a*, and interposed between these sand-boxes is

the chill mold *b* as used for casting a simple cast iron roll. Suitable means are provided for centralizing the core within the mold, as, for example, by a top guide plate *c* and a vertical cone guide pin or rod *c'* suitably secured as by nuts and washers *d* at the lower end *e* of the mold and projecting centrally upward therefrom, and an underteeming gate *f* is provided. The mold boxes and chill when assembled may be suitably connected together as by clamps *i*.

The core of mild steel *g*, malleable iron, or equivalent material is preheated to a temperature somewhat higher than the melting point of copper (about 1100° C.) and a flux is applied to the core, either by immersing the heated core in a bath of molten flux, or after the core is preheated by removing the skin of oxid formed on its surface by means of rabbles or scrapers, and dusting the whole of its surface with the flux in powdered form, which latter is obtained by fusing the constituents that go to form the flux, casting into cakes and pulverizing them. The heated core thus covered with flux in the fluid state is lowered into position in the mold and the molten charge of cast iron which, in the known manner is constituted so as to obtain the requisite hardening on chilling, is underteemed either from a ladle or directly from the furnace (due precautions being taken to arrest the slag) into the space *h* surrounding the core and externally bounded by the chills *b*.

The molten metal must be poured into the mold in a continuous stream and should preferably be of a somewhat higher temperature than is usual in casting the ordinary simple cast iron rolls, the chills being correspondingly hotter. The molten metal should continue to be poured into the mold after the latter is full so as to produce a considerable overflow through channels *k* and blowholes *k*² into the overflow channel *k'*, with the object of: (1) insuring the removal from the mold of the flux and other impurities introduced with the core; (2) to maintain a fluid zone around the core so as to allow the temperature of the core to be raised substantially to that of the molten charge before the cast iron body has completely solidified, and thereby lessen the tendency of the core through expansion to bursting or straining the cast iron body; (3) to obviate the necessity of a top feed for the molten charge which affects the

homogeneous formation of the cast iron shell or body. A suitable flux for the purpose is a fusible silicate, preferably a mixture of Dinas sand and sodium carbonate, so proportioned that the resultant fused compound has alkaline properties; borax may be added, but its presence in the flux is not essential. The flux, when fused in a bath, is floated on molten copper which helps to maintain the flux in a very fluid condition.

When, after being allowed to cool slowly, the roll is taken from the mold, as for instance by means of the link *l* and pin *m* inserted through an aperture *n* formed in the core *g*, and is turned up and surfaced like an ordinary roll, it will be found that the cast iron and steel are homogeneously united. Any grade of white iron can be used to form the body of the rolls for cold rolling work, for example, basic pig containing two per cent. of phosphorus.

Figure 1 is a section of a roll having a hollow core in a finished state, *g* being the core, *g'* the neck portion thereof, and *p* the chilled metal sleeve. The material *a*² is molded so as to allow a sleeve of metal to be cast at *h'* around the portions of the core that constitute the neck *g'*, but these sleeves may be cut away or shaped in a lathe.

Having thus described the nature of my said invention and the best means I know of carrying the same into practical effect, I claim:—

The method of manufacture of mill rolls having a core of mild steel or the like and a body or shell of chilled cast iron homogeneously welded with the core, which consists in first heating the core to a temperature of about 1100° C., covering the outer surface of the same with a flux, placing the core in a mold the body of which is composed of mold chills, underteeming into the mold a molten charge of cast iron to surround the core and continuing the pouring of molten cast iron into the mold after the latter is full to the extent necessary for effecting a fusion of the outer surface of the core; substantially as described.

In testimony whereof, I have signed my name to this specification in the presence of two subscribing witnesses.

EVAN LLEWELYN DAVIES.

Witnesses:

A. L. WILLIAMS,
C. F. LEAKEY.