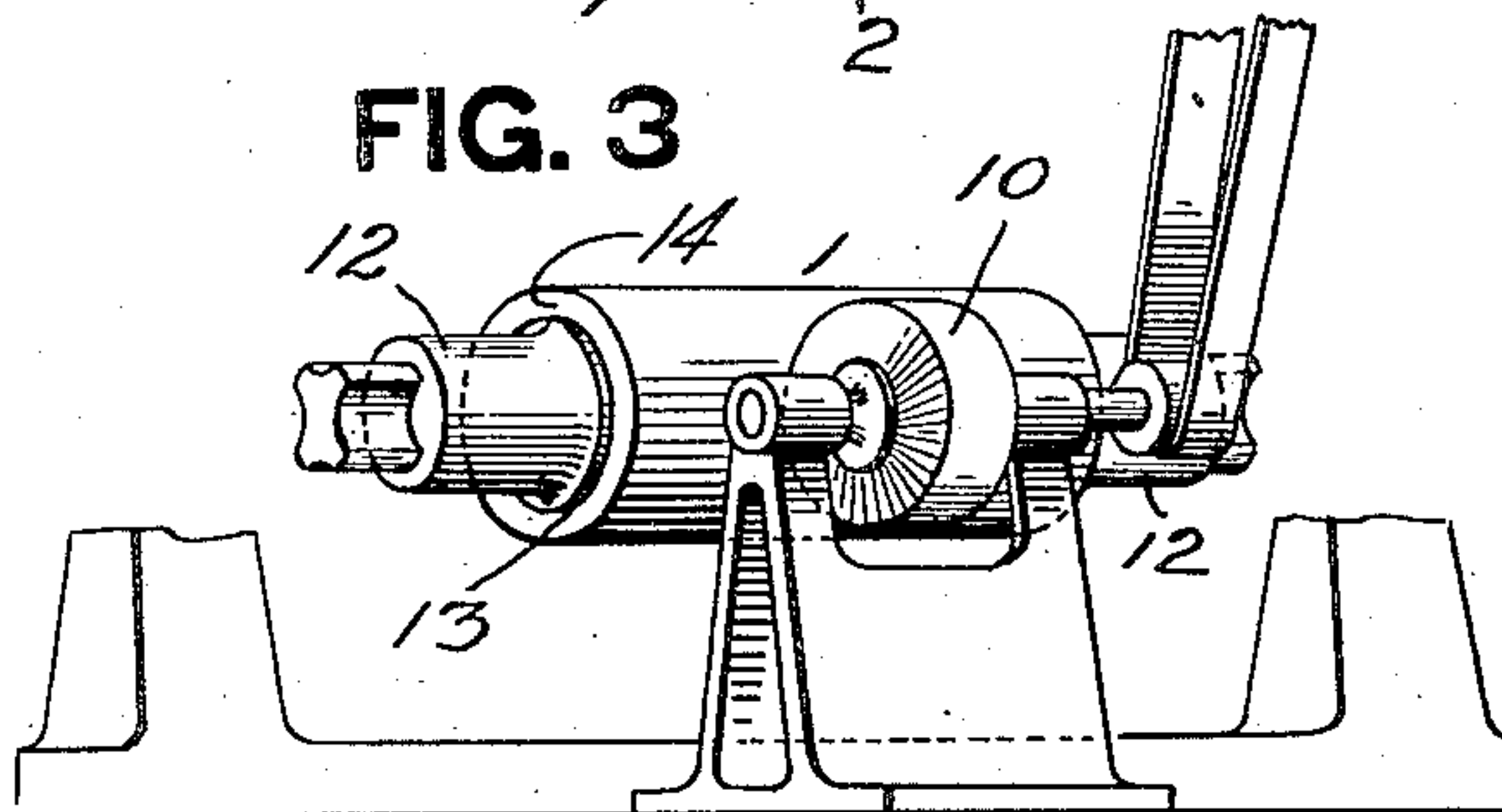
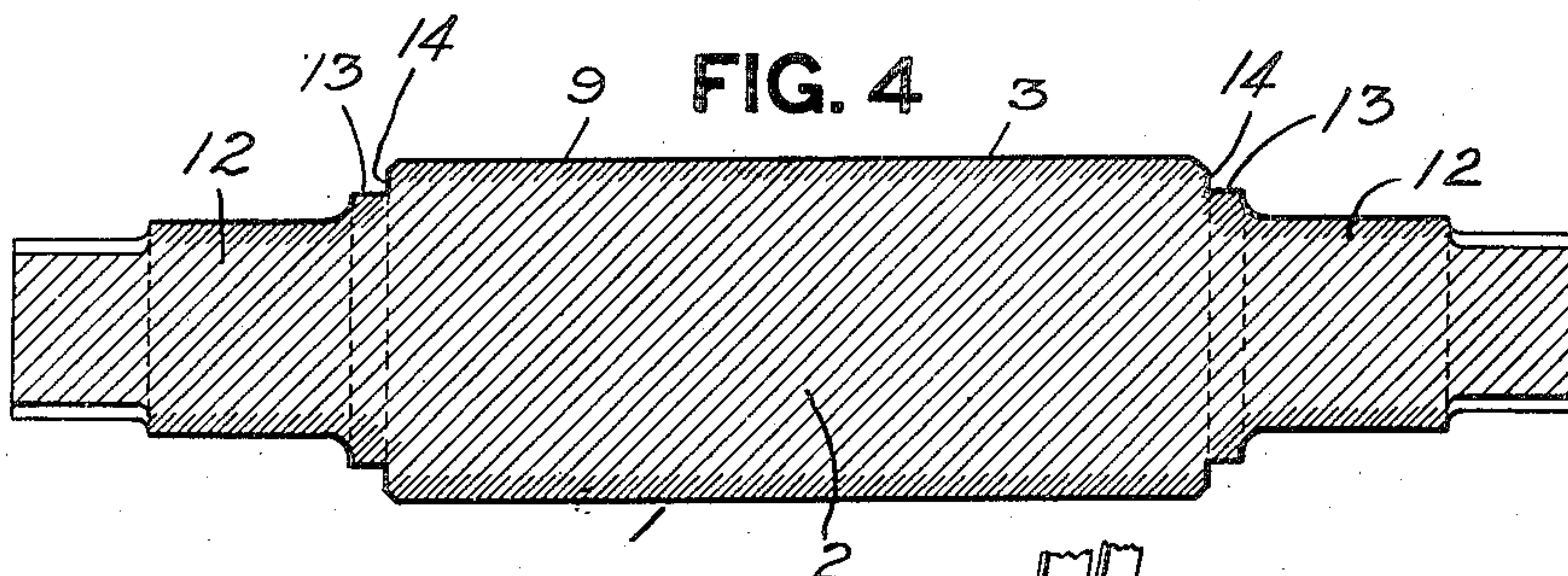
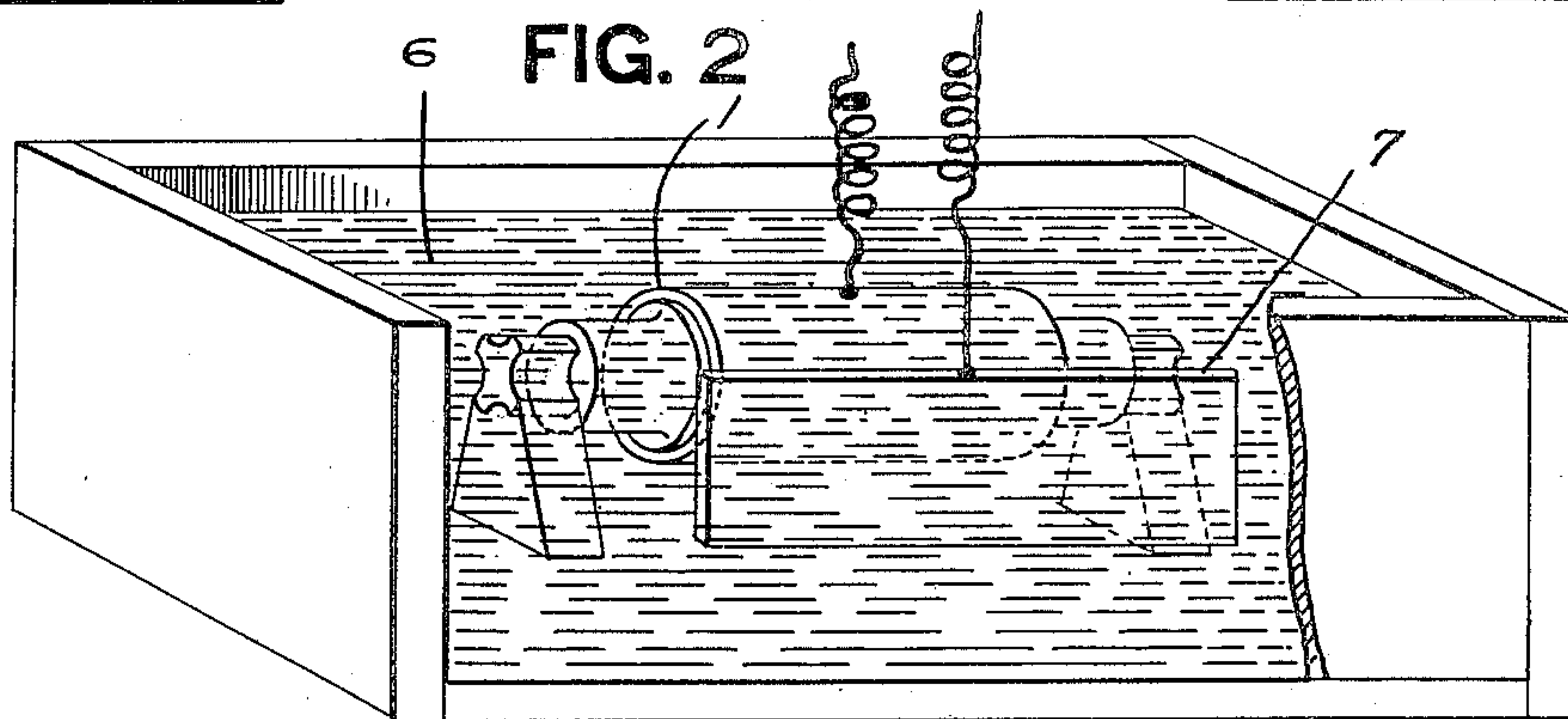
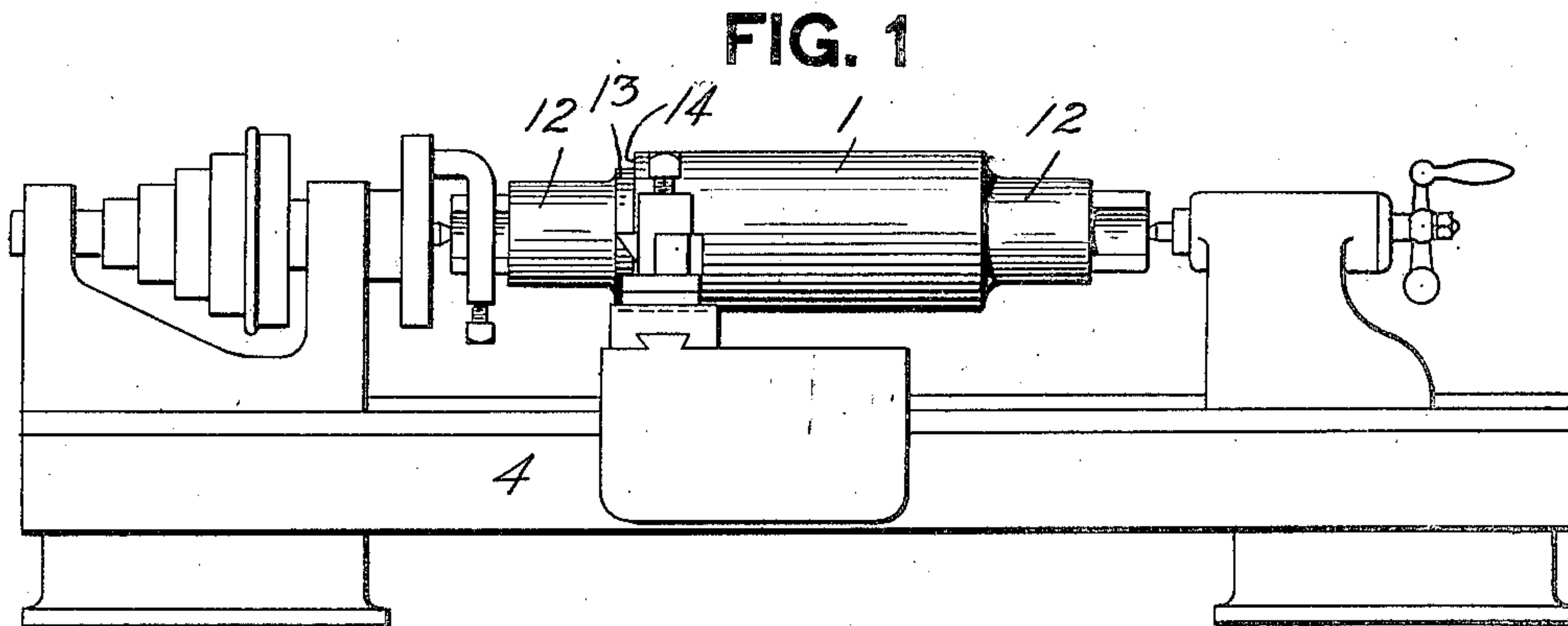


No. 827,689.

PATENTED JULY 31, 1906.

E. J. FRANCIS.  
ROLL, JOURNAL BEARING AND THE LIKE.  
APPLICATION FILED JAN. 23, 1905.



WITNESSES.

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# UNITED STATES PATENT OFFICE.

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## ROLL, JOURNAL-BEARING, AND THE LIKE.

No. 827,689.

Specification of Letters Patent.

Patented July 31, 1906.

Original application filed October 7, 1904, Serial No. 227,597. Divided and this application filed January 23, 1905. Serial No. 242,379.

*To all whom it may concern:*

Be it known that I, EVAN J. FRANCIS, a resident of New Kensington, in the county of Westmoreland and State of Pennsylvania, have invented a new and useful Improvement in Rolls, Journal-Bearings, and the Like; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to metal-reducing and similar rolls, dies, journals, bearings, and the like.

The object of the invention is to provide an article of the character described whose life is much longer than that of similar articles now in use.

The invention consists, generally stated, in providing the articles with a smooth hard wearing-face, preferably formed by a coating of nickel or similar metal.

This application is a division of my application filed October 7, 1904, Serial No. 227,597, which claims the process herein disclosed.

My invention is designed especially for finishing rolls used in sheet and other mills, and as the invention is illustrated as well by such rolls as by other articles I will describe the same in connection therewith. It will be understood, however, that no limitation is to be imposed on the claims by reason of such illustration and description.

Rolls for reducing metal are formed by casting in chill-molds, so as to give a hard working face to the roll, the center or body of the roll being of soft gray iron. All such rolls, and especially those for reducing sheet metal, are subjected to alternate contractions and expansions which cause the chilled surface to become cracked. These cracks are so minute that they are hardly visible; but in use they cause the scale on the metal being reduced to adhere to the rolls. The scale works or cuts into the surface of the rolls, and this soon results in roughening the rolls to such an extent that it is necessary to turn down the faces thereof to secure a smooth surface. This, however, removes a portion of the chill or hardened surface, and the dressed roll has not as hard a surface as it should have and will again quickly roughen. After a few dressings the entire chilled exterior is removed and the roll will then have to be thrown away as useless. The life of a

chilled roll, especially in sheet-mills, is very short, and the expense of renewing the same is a very important item in the cost of manufacture.

The object of my invention is to provide such chilled rolls, as well as all other forms of rolls, dies, journals, bearings, car-wheels, tires, &c., with a hard smooth working or wearing surface, so that the foregoing difficulties are overcome and the life of the roll or other article lengthened. Such hard smooth wearing-face greatly reduces friction and wear, so that scale and other foreign substances will not adhere thereto. As a consequence the working or wearing face will not roughen anywhere nearly as rapidly as with existing forms of such articles.

To this end the invention consists in coating the working or wearing face or faces of the roll, die, journal, bearing, or other article with nickel or a metal of the nickel group or combinations thereof, said coating being applied preferably by electroplating and then burnishing the coated article. The electroplating fills up all surface cracks or depressions, thus giving the smooth and hard surface to the roll or other article. Such wearing-surfaces can be applied not only to new rolls but also to worn rolls by first turning down the roughened faces of the latter to smoothen the same and then coating the same with the nickel or other metal.

The invention also consists in a roll having the ends of its body turned down to a greater depth than the depth of the chilled surface—that is, down to the gray iron, so as to leave the chilled portion free to expand and contract independently of the soft gray iron body.

In the accompanying drawings the invention is illustrated as a process applied to the treatment of worn chilled rolls, and Figure 1 is a diagrammatic view showing the dressing of the roll-face. Fig. 2 is a diagrammatic view illustrating the electroplating thereof. Fig. 3 is a diagrammatic view illustrating the burnishing thereof; and Fig. 4 is a longitudinal section through a chilled roll, indicating the different characters of metal therein.

My invention is applicable to new rolls or other articles, as well as those which have become worn; but in the drawings I have illustrated the same for the treatment of worn rolls. The treatment of new rolls or other



articles will be the same except that the first step of dressing down the surface thereof will be omitted.

The rolls 1 or other article to be treated will be formed by casting or other manner and may be cast in a chill-mold in the usual way, so as to give to the same the soft gray iron body or interior 2 and the hard exterior surface 3. This casting will be done in the usual way. After the roll or other article has been used to some extent the surface thereof becomes worn and roughened, and if the article is a roll or die for working hot metal the surface will also become fire-cracked, due to the alternate expansions and contractions thereof. These fire-cracks cause the scale to adhere to the surface of the roll or die, and the scale rapidly works or cuts into the surface of the roll or die and roughens the same. When the article becomes roughened or worn from any cause, it will be resurfaced in any suitable way. If the article is a roll, it is placed in a suitable lathe—such as shown at 4, Fig. 1—and by means of a suitable tool the surface is dressed down to smooth the same. The article will then be electroplated. In case the article is new the step of redressing the surface just described will be omitted. Such new article or the dressed-down worn article will then be placed in a suitable bath 6, composed of a solution of nickel or other metal of the nickel group or combination of the same and will have connected thereto one pole of an electric circuit, while the other pole is connected to a plate 7 in said bath, thus causing the nickel or similar metal to be deposited on the surface of the article in the well-understood manner of electroplating.

The electroplated surface 9 on the roll or other article is then treated by means of a suitable burnishing wheel or tool—such as shown at 10, Fig. 3—whereby the surface is rendered very smooth. The roll or other article is then ready for further use.

The electroplating of the surface of the roll or other article with nickel fills up all cracks or other inequalities or depressions in the surface of the article and also produces a harder exterior surface, this being due in part to the action of the electric current used in electroplating and in part to the alloy which is formed by the nickel and the iron. The result is that the working or wearing face of the roll or other article is exceedingly hard and smooth. The smoothness thereof reduces friction and prevents the scale from adhering thereto, and the hardness greatly reduces wear. As a consequence such electroplated face does not wear or roughen anywhere near as fast as ordinary iron working faces. The consequence is that the life of the roll or other article is very much longer than that of similar articles at present in use. If after a time the electroplated face becomes rough or

worn it can be dressed down in the manner illustrated in Fig. 1, and the roll or other article then again electroplated with nickel and burnished in the manner described.

The nickel-plating will preferably be extended to the necks 12 of the rolls, so as to give hard smooth surfaces thereto, thus greatly reducing friction and wear. Journals and journal-bearings of all kinds can be treated in the same manner with like beneficial results.

The outer chilled and hardened surface of a metal-working roll has a different coefficient of expansion than the soft gray iron interior thereof. In casting such rolls the chill frequently extends down the ends thereof into the fillet, thus forming hard walls at the ends of the roll which prevent the independent contraction and expansion of the outer hardened surface and the inner soft gray iron. To avoid this, I turn down the ends of the body of the roll, as indicated at 13. This turning is continued until the end of the roll-body is cut down below the chilled surface, or, in other words, down into the soft gray iron interior. As a consequence there is nothing at the ends of the roll-body to prevent the free independent contraction and expansion of the hardened exterior and the soft gray iron interior.

The result of the treatment above described produces a roll such as indicated in Fig. 4, the same having a soft gray iron interior and hardened or chill exterior, and the working face and necks having a nickel-plated surface coating. At the ends is the reduced portion 13, leaving substantially straight end walls 14, extending down below the hard exterior surface.

A roll thus treated can be used many times longer than ordinary chill-rolls before the surface becomes roughened, and even when it does roughen it can be redressed and retreated more frequently than the old forms of iron roll. As a consequence the cost of rolls is very materially decreased.

My invention may be applied to the working surfaces of unchilled iron or steel rolls and also to the working surfaces of forging-dies and the wearing-faces of journals, bearings, treads of car-wheels, car and locomotive tires, &c. The manner of treating such articles will be obvious from the illustration and description of the treatment of the rolls.

While in the claims I refer especially to nickel as the coating metal, I wish it understood that by this term I include not only nickel but any metal of the nickel group, such as manganese, cobalt, chromium, tungsten, or combinations of any two or more thereof.

What I claim is—

1. An article of the character specified, having its working or wearing face or faces coated with nickel.

2. An article of the character specified



having its working or wearing face or faces provided with a nickel coating electroplated thereon.

3. An article of the character specified  
5 having a soft body, and a hardened chilled surface coated with nickel.

4. A cast roll having a soft gray iron interior and a chilled and hardened exterior, said roll being cut down at the ends of its

body to a greater depth than the depth of the chilled iron and exposing the gray-iron interior.

In testimony whereof I, the said EVAN J. FRANCIS, have hereunto set my hand.

EVAN J. FRANCIS.

Witnesses:

ROBERT C. TOTTEN.

G. C. RAYMOND.