Oct. 7, 1930.

E. B. HUDSON

1,777,921

MOUNTING OF FURNACE ROLLS

Filed Oct. 13, 1928

2 Sheets-Sheet 1

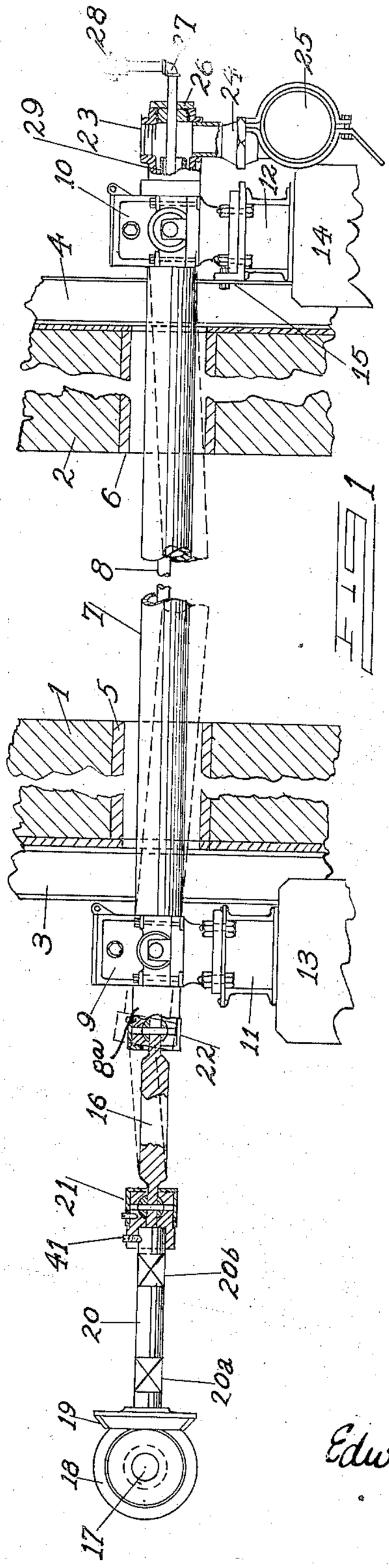

FIG 1

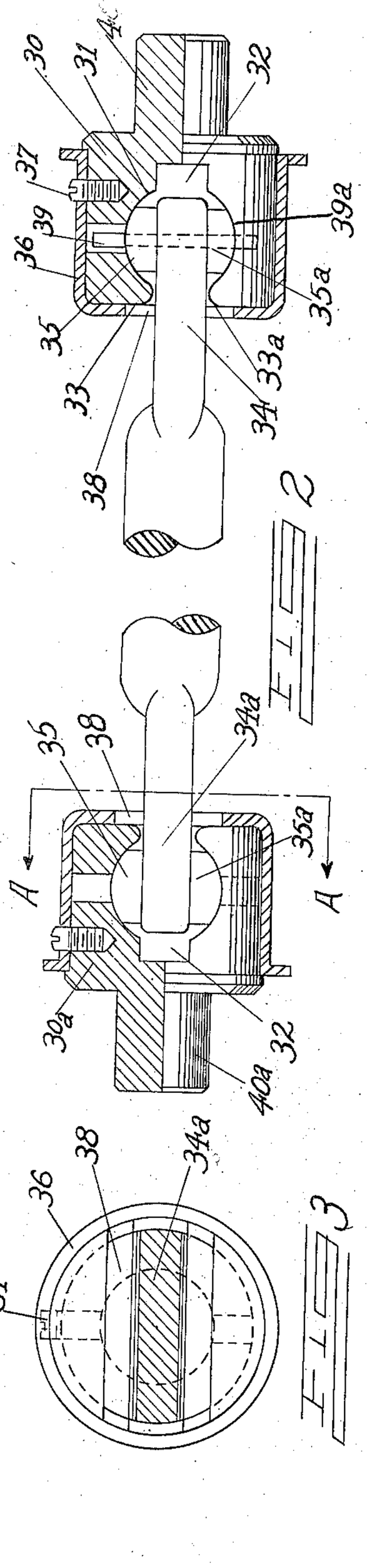

FIG 2

FIG 3

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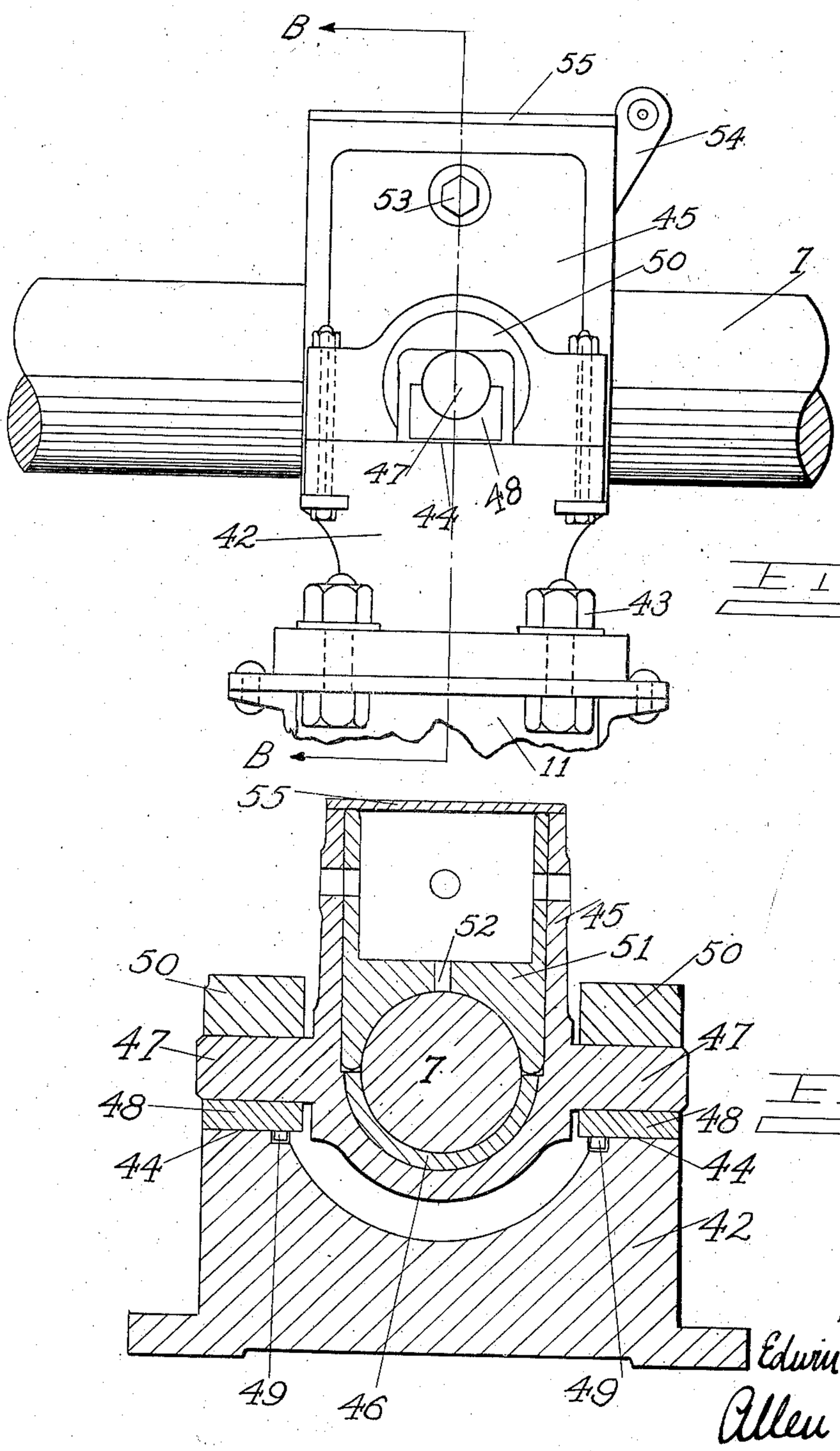

FIG 4

FIG 5

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UNITED STATES PATENT OFFICE

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MOUNTING OF FURNACE ROLLS

Application filed October 13, 1928. Serial No. 312,376.

My invention applies primarily to a new furnace procedure for sheets and slabs which is described and claimed in a co-pending application of Marion S. Amburgy, Serial No. 296,166, filed July 30, 1928. As set forth therein, it has been found that when a mechanism for conducting iron or steel sheets through a continuous heat treating furnace comprises a series of rolls which are maintained cold as distinguished on the one hand from merely cool enough to prevent their softening, and on the other hand from uncooled conveying devices of alloy material, a new result is produced. Instead of picking up scales of oxide from the sheets and depositing the collected material upon other sheets, producing pits and surface imperfections, the rolls after a short period of use become highly polished, and sheets unusually free from imperfections and with better surfaces than hitherto obtainable are delivered. Further, the difficulties due to the deterioration of alloy conveying devices, uncooled rolls and the like, are eliminated; and there is no sticking.

My invention relates to a construction and mounting including a drive for such rolls which facilitates their use. Since the rolls must be maintained cold, they are of hollow construction with comparatively thin walls, and are more subject to deformation from a number of causes than other rolls would be. Thus if bumped by a heavy slab, they may be bent; if for any reason the fluid cooling mechanism becomes inoperative, or is shut off before the furnace has sufficiently cooled at the end of a run, the roll may become overheated and sag under its own weight. For these and other reasons ordinary bearings comprising journals and stuffing boxes do not give the utmost satisfaction. Also for these reasons, means must preferably be devised for permitting the easy and quick interchange and removal of rolls even while the furnace is operating. Further since these rolls are preferably driven, means must be provided for this end which will permit the driving of the rolls without binding in the bearings even when warped, and which will not interfere with the quick removal of rolls. Mechanism for these purposes must be provided which will not materially increase the cost of installation, since in long furnaces there are many rolls.

It is an object of my invention to provide a mounting comprising a bearing structure which will permit the rotation of warped rolls, and a driving mechanism which will function in spite of such warping.

It is a further object of my invention to provide a mounting which will permit the ready removal of rolls when damaged, which, to this end is independent of the openings in the furnace walls, and which includes an easily detachable drive.

It is still a further object of my invention to provide a construction which may be multiplied by the number of rolls in a furnace without making the cost thereof prohibitive.

These and other objects of my invention, which will be referred to hereinafter or will be apparent to one reading this specification, I accomplish by that certain construction and arrangement of parts of which I shall now describe a preferred embodiment, reference being made to the drawings forming a part hereof.

In the drawings:—

Figure 1 is a general elevation, with some sectional parts, of a water-cooled roll installed in a furnace and showing my mounting including bearings and drive.

Figure 2 shows the connecting spindle and universals.

Figure 3 is an end view of a universal, cutting the spindle transversely along the lines *a*—*a* in Figure 2.

Figure 4 is an elevation of one of my bearings.

Figure 5 is a section therethrough along the lines *b*—*b* in Figure 4.

The view of Figure 1 shows a horizontal furnace in vertical section. The furnace has walls 1 and 2 which may be of suitable refractory brick or the like, and may be supported and braced by I beams 3 and 4. Metallic sheets or other shapes are to be heat treated by passing them through this furnace upon a table of water cooled, cold rolls, aligned horizontally, and spaced at suitable

intervals. The spacing may vary with the articles to be treated and in accordance with whether the rolls themselves are to convey the articles through the furnace. Thus the rolls need not be so close together for long strip or connected sheets as for separate sheets, nor for large sheets as for small. Openings in the furnace wall, which are preferably lined as at 5 and 6, permit the passage of the rolls therethrough.

The rolls comprise a roll body 7 which is hollow. Through its center, and interspaced from its walls is a second smaller pipe 8. The arrangement is such that this smaller or feed pipe extends beyond one end of the roll, and through the roll nearly to its other end, which is closed. Cold water enters through the pipe 8, is carried to the far end of the roll, and returns outside of the pipe 8 to the entrance end where it is discharged. This produces a counterflow of the cooling fluid which ensures an even temperature across the roll, and makes it possible to maintain the roll cold. The roll is a plane cylinder in shape so that there is no tendency to form steam pockets.

The roll is supported by bearings at either end, and in order that the holes in the furnace wall may be as small as possible, even allowing for a possible warping of the rolls, I prefer to locate them as close to the furnace walls as possible. Accordingly, I may mount the bearings 9 and 10 upon members 11 and 12 attached to foundations 13 and 14, and/or bolted to the I beam braces 3 and 4 as shown at 15. These bearings, being preferably of the same type, with interchangeable parts, I shall hereinafter more fully describe.

The roll is driven through a spindle 16 from a source of power which in its immediate aspect may comprise a line shaft 17, bevel gears 18 and 19, and a drive shaft 20. The drive shaft will be supported by suitable bearings which I have indicated symbolically at 20^a and 20^b. The spindle 16 connects the drive shaft 20 and the roll through universals 21 and 22 hereinafter more fully to be described. At the other end of the roll, a header 23, which is preferably a cross, encloses loosely the end of the roll so as to receive the discharge of water therefrom. It is connected by means of a union 24 to a drain pipe 25. The supply pipe 8 extends through a plug 26 in the end of the cross, and is fitted with an elbow 27 and a union 28. A restrictive member 29 may lie within the end of the roll and about the pipe 8 to build up a back pressure and prevent the formation of steam pockets. The roll is not larger at its driven end, which I have designated as 8^a in Figure 1, than elsewhere. It may be made of lesser diameter here if desired. It is my object to provide such a universal coupling 22 as will not increase that diameter. Thus, I may withdraw the roll 7 for repairs or replacement by a simple operation comprising only disconnecting universal 22. and unions 24 and 28, and pulling the roll out through the water feed end (to the right in Figure 1). A new roll may quickly be inserted and made operative by a reversal of these steps, even while the furnace is in use, and without interrupting the travel of material therethrough more than long enough to disconnect the universal.

To this end, the type of universal coupling which I provide, is illustrated in detail in Figures 2 and 3, and will now be described. The cylindrical body 30 is preferably not larger in diameter than the roll itself so that it may be withdrawn therewith through the bearing 9. It is bored transversely as at 31 and is slotted also as at 32 along the axis of the bore. The outer ends of the slot may be rounded off as at 33 and 33^a to permit the play of the flat end of the spindle therein. The spindle 16, itself, has flattened ends 34 and 34^a which are adapted to enter the slots 32 and 32^a. These ends are bushed with hemispherical blocks 35 and 35^a, which may be held to them by screw pins, countersunk bolts or the like as will be readily understood. I prefer, however, to employ a pin 39 passing through the spindle and blocks, and fitting so loosely in a hole 39^a in the body 30 as not to interfere with the necessary play in the universal. It will be clear that if the bushed end of the spindle is held centrally of the bore 31, an effective ball and socket joint is formed. The flattened end of the spindle, however, riding through the opening of the slot 32 will cause the body 30 to rotate with it. Thus a universal joint is provided. The means for holding the bushed spindle end centrally of the bore is a cap 36 which may be held in place by a set screw 37. It is slotted as at 38 to accommodate the flattened end of the spindle. To demount the universal it is usually only necessary to remove the set screw, slide back the cap, remove pin 39 from hole 39^a and slip the bushed spindle end out through the end or side of the bore 31. But if the adjustment of the drive is such as not to permit this, the bushing blocks may be unfastened from the spindle end, and the universal separated along its axis. The hole 39^a gives access, when the cap is removed, to the place pins or other means for fastening the bushing blocks to the spindle end.

In a disposition of the apparatus as shown in the drawings, I prefer to make the universal body designated as 30 in Figure 2 a part of the roll 7 at its closed end. I therefore provide the body 30 with a reduced neck 40 which may be placed inside the end of the tubular member forming the roll and welded therein, thus subserving this purpose, and rendering unnecessary any other means for

closing the end of the roll. The body 30ª of the universal on the other end of the spindle (see Figure 2) may have a similar neck 40ª so that it may be attached to the drive shaft 20 with a collar. Or instead the body may be elongated, bored to receive the shaft and fitted with a set screw as shown in Figure 1 at 41. Other means may be taken to attach the universal bodies to drive shaft and roll if desired.

The bearings are shown in detail in Figures 4 and 5. They comprise a base block 42 adapted to be attached by bolts 43 to the foundation member 11. The block is hollowed out centrally as shown to clear the yoke, and on either side its upper surface is machined as at 44. A yoke 45, having a bushing 46, is fitted with trunnions 47. These trunnions ride in saddles 48 which have machined under surfaces, and fit against the surfaces 44, where they are kept from outward displacement by ribs 49 which lie in corresponding grooves in the base block. A keeper 50 with a central opening to clear saddle and trunnion is bolted to the base block. A grease box 51 has a lower surface to correspond with the roll 7 or shaft which the bearing accommodates and is hollow within to hold lubricant, which may reach the roll or shaft surface through a hole 52. The grease box lies within the yoke where it may be held by bolts 53; and it may be fitted also with ears 54 for hinging in place a cover 55.

It will be seen that the machined surface 44 of the base block top is longer than the saddles 48, and that the opening in the keeper is also longer in a horizontal direction than the saddles. Thus these are free to slide horizontally so as to take care of any horizontal bearing displacement, while the rocking of the yoke on the trunnions will take care of any vertical bearing displacement. Even through the roll be bent by a blow or by some other cause into the shape of the dotted lines in Figure 1, my bearings will still permit its free rotation and compensate for the misalignment. It will be understood that the connections between roll 7 and drive shaft 20, including the spindle and universals, are to be left with sufficient play.

Various modifications in my construction are clearly within the power of one skilled in the art to make to adapt it to varying conditions; and they may be made without departing from the spirit of my invention.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent, is:—

1. In combination, a furnace, a hollow water cooled roll of constant diameter extending transversely through said furnace and through holes in the walls thereof, self-aligning bearings on the projecting ends of said roll adjacent said holes, and means for rotating said roll.

2. In combination, a furnace, a hollow water cooled roll of constant diameter extending transversely through said furnace and through holes in the walls thereof, self-aligning bearings on the projecting ends of said roll adjacent said holes, and means for rotating said roll, said bearings adapted for endwise withdrawal of said roll.

3. In combination, a furnace, a hollow water cooled roll of constant diameter extending transversely through said furnace and through holes in the walls thereof, self-aligning bearings on the projecting ends of said roll adjacent said holes, and means for rotating said roll, said bearings adapted for endwise withdrawal of said roll, said means for rotating said roll comprising a spindle, a universal on either end thereof connecting it respectively with said roll and a source of power, at least one of said universals being readily separable.

4. In combination, a furnace, a hollow water cooled roll of constant diameter extending transversely through said furnace and projecting at either side through holes in the walls thereof, said roll closed at one end by a driving member, separable driving means adapted for universal connection with said driving member, bearings on either end of said roll externally adjacent said holes, said bearings adapted for endwise withdrawal of said roll, said driving member being not greater in diameter than said roll whereby it may be withdrawn therewith through said bearings.

5. In combination, a furnace, a hollow water cooled roll of constant diameter extending transversely through said furnace and projecting at either side through holes in the walls thereof, said roll closed at one end by a driving member, separable driving means adapted for universal connection with said driving member, bearings on either end of said roll externally adjacent said holes, said bearings adapted for endwise withdrawal of said roll, said driving member being not greater in diameter than said roll whereby it may be withdrawn therewith through said bearings, a feed pipe extending interiorly of said roll to a point adjacent the closed end thereof and projecting from the other end, a header enclosing the open end of said roll, unions for said header and said feed pipe, whereby said roll, feed pipe, header and driving member may be withdrawn as a unit.

6. In combination, a furnace, a hollow water cooled roll of constant diameter extending transversely through said furnace and projecting at either side through holes in the walls thereof, said roll closed at one end by a driving member, separable driving means adapted for universal connection with said driving member, bearings on

either end of said roll externally adjacent said holes, said bearings adapted for endwise withdrawal of said roll, said driving member being not greater in diameter than said roll whereby it may be withdrawn therewith through said bearings, a feed pipe extending interiorly of said roll to a point adjacent the closed end thereof and projecting from the other end, a header enclosing the open end of said roll, unions for said header and said feed pipe, whereby said roll, feed pipe, header and driving member may be withdrawn as a unit, a restriction about said feed pipe adjacent the open end of said roll whereby a head of fluid may be maintained in said roll.

7. In combination, a furnace, a hollow water cooled roll of constant diameter extending transversely through said furnace and projecting at either side through holes in the walls thereof, said roll closed at one end by a driving member, separable driving means adapted for universal connection with said driving member, bearings on either end of said roll externally adjacent said holes, said bearings adapted for endwise withdrawal of said roll, said driving member being not greater in diameter than said roll whereby it may be withdrawn therewith through said bearings, a feed pipe extending interiorly of said roll to a point adjacent the closed end thereof and projecting from the other end, a header enclosing the open end of said roll, unions for said header and said feed pipe, whereby said roll, feed pipe, header and driving member may be withdrawn as a unit, said bearings comprising a sleeve bushing in a yoke, trunnions on said yoke, a base member with oscillating saddles supporting said trunnions, whereby said bearings may compensate for warping of the roll.

8. In combination, a furnace, a hollow water cooled roll of constant diameter extending transversely through said furnace and projecting at either side through holes in the walls thereof, said roll closed at one end by a driving member, separable driving means adapted for universal connection with said driving member, bearings on either end of said roll externally adjacent said holes, said bearings adapted for endwise withdrawal of said roll, said driving member being not greater in diameter than said roll whereby it may be withdrawn therewith through said bearings, a feed pipe extending interiorly of said roll to a point adjacent the closed end thereof and projecting from the other end, a header enclosing the open end of said roll, unions for said header and said feed pipe, whereby said roll, feed pipe, header and driving member may be withdrawn as a unit, said bearings comprising a sleeve bushing in a yoke, trunnions on said yoke, a base member with oscillating saddles supporting said trunnions, whereby said bearings may compensate for warping of the roll, said driving means comprising a spindle adapted for universal connection with said driving member and with a source of power, said universal connection being severable.

9. In combination, a furnace, a hollow water cooled roll of constant diameter extending transversely through said furnace and projecting at either side through holes in the walls thereof, said roll closed at one end by a driving member, separable driving means adapted for universal connection with said driving member, bearings on either end of said roll externally adjacent said holes, said bearings adapted for endwise withdrawal of said roll, said driving member being not greater in diameter than said roll whereby it may be withdrawn therewith through said bearings, a feed pipe extending interiorly of said roll to a point adjacent the closed end thereof and projecting from the other end, a header enclosing the open end of said roll, unions for said header and said feed pipe, whereby said roll, feed pipe, header and driving member may be withdrawn as a unit, said bearings comprising a sleeve bushing in a yoke, trunnions on said yoke, a base member with oscillating saddles supporting said trunnions, whereby said bearings may compensate for warping of the roll, said driving means comprising a bore and slot in said driving member, a spindle with flatened end adapted to enter said slot and bore, a ball and socket bushing on the flattened end of said spindle, and a cap for holding said spindle end and bushing in said driving member, and a universal connection for the other end of said spindle to a source of power.

10. In combination, a furnace, a hollow water cooled roll of constant diameter extending transversely through said furnace and through holes in the walls thereof, self aligning bearings on the projecting ends of said roll externally adjacent said holes, said bearings comprising a base member, blocks supported thereon, and having horizontal play, a yoke having trunnions, said trunnions mounted in said blocks, a lower bearing member in the base of said yoke, an upper bearing member riding in said yoke and having a portion to contact said roll, a hollow internal portion to serve as a reservoir for lubricants, and a communicating passage between said two portions, and means for transmitting power to said roll, said means being of such size as to be withdrawable with said roll through said bearings.

EDWIN B. HUDSON.