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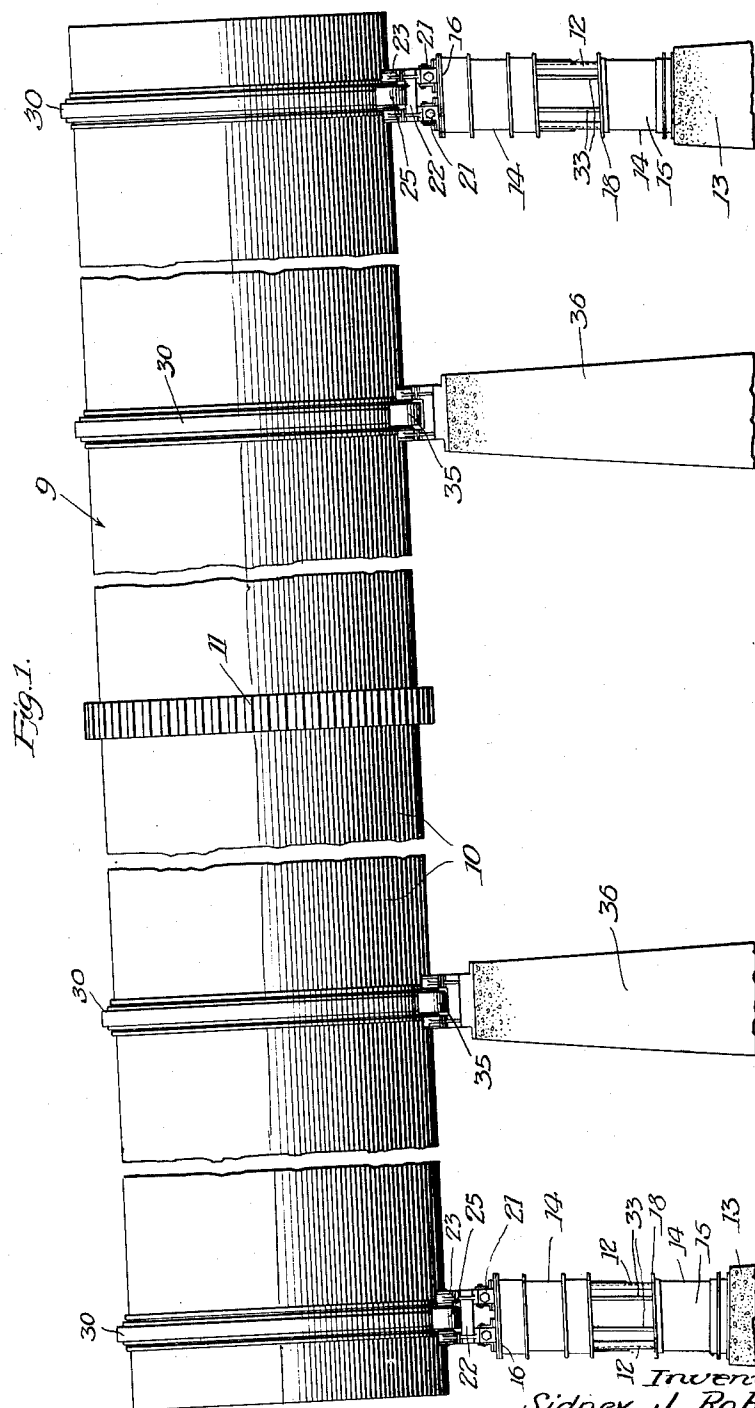
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2,072,219

FLEXIBLE SUPPORT FOR ROTARY KILNS

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2 Sheets-Sheet 1



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Fig. 2.

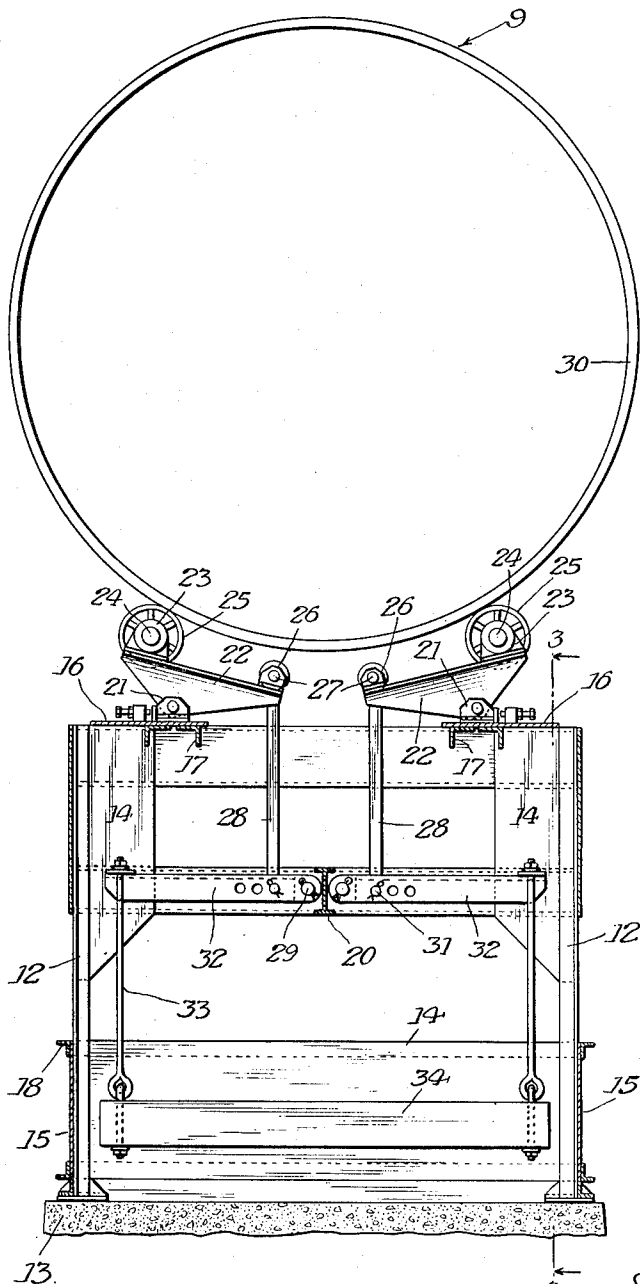
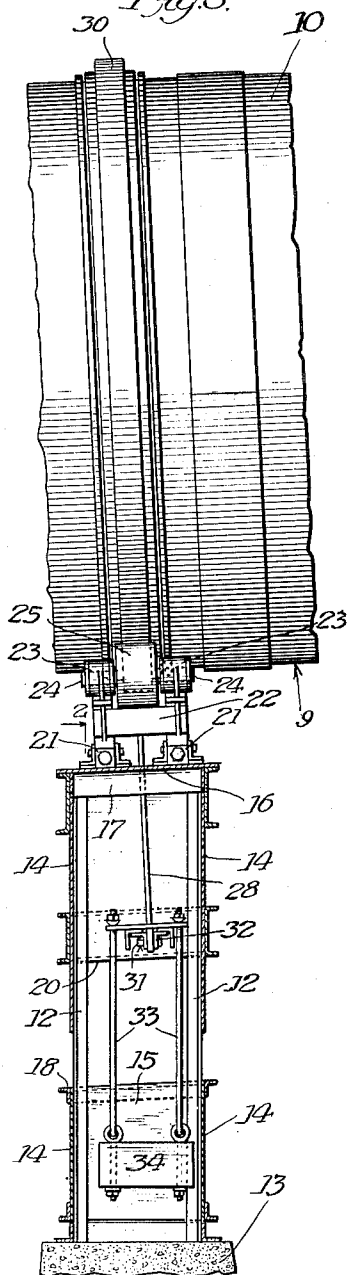


Fig. 3.



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UNITED STATES PATENT OFFICE

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FLEXIBLE SUPPORT FOR ROTARY KILNS

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7 Claims. (Cl. 303—203)

The invention relates to rotary kilns of the type used in the manufacture of cement and has reference particularly to improvements in the means for supporting said kilns.

5 Since the early days of the cement industry the length and weight of rotary kilns has increased until today many of the more modern kilns are twelve feet in diameter and four hundred feet in length. As the length and weight increased a point was reached at which the loads on the rollers and the moments on the kiln shell were too great for two supports and consequently multiple supports were introduced. Generally four supports are deemed sufficient for all except very long kilns.

15 The principal object of the invention is to provide means for flexibly or yieldingly supporting the shell of a kiln so that the stress on the shell will be maintained within the desired limits.

20 A further object of the invention is to provide supporting means for kilns which will consist of at least two fixed supports and one or more flexible supports. In a system consisting of flexible supports combined with fixed supports the changes in load in the kiln only increase or decrease the bending moments at the fixed supports and the design can be constructed so that the maximum possible load will not produce over-stress in the shell.

30 In the drawings which illustrate an embodiment of the invention—

Figure 1 is an elevational view of a cement kiln showing the same mounted for rotation by an arrangement of yielding and unyielding supporting rollers according to the invention;

35 Figure 2 is a transverse sectional view showing a conventional type of rotary kiln flexibly supported by the improved means of the invention; and

40 Figure 3 is a fragmentary elevational view of the kiln illustrating the manner of supporting the same by the structure of Figure 1.

The drawings, Figure 1, show in elevation, sections of a rotary kiln 9 constructed of steel plates 10 having the circular gear 11 by which the kiln is rotated, and which is lined with fire brick as is usual in the construction of kilns for manufacturing cement. The kilns are supported so that their discharge end is slightly lower than the feed end which gives to the kiln an inclination such as shown in Figures 1 and 3. In operation the kiln is fired at the low or discharge end, which therefore is at the highest temperature, the products of combustion travelling through the kiln and being taken off at the opposite or feed end of the kiln and delivered to the atmosphere through the usual stacks.

For greatest efficiency and economy in the operation of rotary kilns it is deemed necessary that 60 they have considerable length and for properly

supporting a long kiln multiple supports must be used, the kilns being supported at their ends and at a plurality of points intermediate the ends. Said supports have heretofore been stationary and the greatest accuracy is required in their installation as perfect alignment is necessary to reduce the stresses which would otherwise develop in the shell of the kiln. Even when initially in proper alignment the shells are subject to warping and distortion from thermal expansion. The invention provides flexible or yielding supporting means whereby the shell of the kiln can be supported at one or more points to permit the shell to seek a position where the stresses will be automatically reduced to a minimum. The particular aim of the invention is to provide a system for supporting means for a kiln of excessive length which will comprise at least two fixed supports and one or more flexible or yielding supports. The flexible supports are preferably located under the outside tires with at least two sets of rollers on fixed bases between the outer tires, although the invention is not to be limited in this manner as it is entirely practical to use rigid supports for the said outer tires and to use one or more flexible supports between the rigidly supported tires. The weights and reactions of a kiln can be closely calculated and by the use of at least two fixed or rigid supports and one or more supporting means constructed to permit yielding movement, the stresses in the kiln can be kept within the desired limits.

Referring particularly to Figures 2 and 3, the embodiment of the invention for yieldingly supporting a rotary kiln consists of framework providing an enclosure and including corner members 12 suitably anchored at their lower end to the cement foundation 13, upper and lower side plates 14, end plates 15 and the top members 16, which, as shown in Figure 1, extend transversely of the framework at the respective ends thereof, being joined to said framework by the cross pieces 17. In addition to the structure above described the enclosure is suitably braced and strengthened by angle pieces 18, while the upper side plates are joined by an I beam 20 extending transversely of the framework at its approximate center. Each top plate 16 has suitably secured thereto a pair of mountings 21 which pivotally support a cradle 22. The cradles are formed with a flat upper surface to one end of which is secured bearings 23 for journalling the shaft 24 to which is fixed the roller 25. On the opposite end of the cradles are members 26 providing bearings for shaft 27 having connection with the upper end of strap 28. It will be clear from the drawings that two rollers are provided for supporting the shell of the kiln and that each roller is journalled and mounted for vertical bodily movement by a cradle which is constructed and 60

pivotally supported on the framework as described.

The rollers are adapted to engage a circular tire 30 secured in any suitable manner to the shell of the kiln. A tire such as shown in Figure 2 is provided on the kiln at those points where the same is to be supported by the rollers 25 with the result that the kiln is mounted for rotation, which is necessary during the operation of the kiln in order to properly form the cement and cause the same to travel from the feed end to the discharge end of the kiln. For flexibly or yieldingly supporting the kiln the straps 28 are pivoted at 31 to arms 32 which in turn extend laterally from the respective sides of the beam 20, the said arms being pivoted to the beam at 29. The outer end of each arm has a pair of rods 33 secured thereto in spaced relation as shown in Figure 2, the rods at the lower end being loosely secured to a counter-weight 34.

Each end of the counter-weight is therefore carried by a pair of rods 33 which connect through a system of levers with the rollers 25. The leverage of the arms 32 is such as to produce a considerable uplift and supporting force for the kiln through a relatively small counter-weight. The lever ratio of course can be varied to suit conditions and can be proportioned to secure any desired uplift and the distribution of the kiln weight on the supports can be made uniform and according to calculation. The flexible supporting means of the invention can be applied to kilns now in use, especially where it is desired to lengthen them, since it is contemplated that the kilns are to be supported at two points by rigid supports consisting of rollers 35 on concrete foundations 36 as in Figure 1, with the remaining supports being flexible or yielding, which result is best secured by the structure shown in the drawings. This will best tend to retain the axis of the kiln in a fixed position and only changes the stress in the shell plates by the amount that results from the changes in the total weight of the structure and contents. When more than two rigid supports are employed lack of alignment produces severe overloads on the tires and supporting rolls. There is some elasticity in the kiln shell but the extra loads on the bearing rollers necessary to deflect the shell to a straight line are the cause of excessive wear of the tires and breakage of the supports.

The invention is not to be limited to or by details of construction of the particular embodiment thereof illustrated by the drawings, as various other forms of the device will of course be apparent to those skilled in the art without departing from the spirit of the invention or the scope of the claims.

What is claimed is:

1. A rotary kiln including a cylindrical shell having a plurality of tires thereon, a pair of rollers in engagement with each tire supporting the tire and therefore the kiln for rotation, members mounting certain pairs of rollers for bodily vertical movement, a counter-weight, and means connecting the ends of the counter-weight with said members respectively, whereby said rollers are urged upwardly to yieldingly support the weight of the kiln thereon and permit movement of said supported section of the kiln in a vertical direction.

2. A rotary kiln including a cylindrical shell having a plurality of tires thereon, a pair of rollers in engagement with each tire supporting the tire and therefore the kiln for rotation, members pivoted to a support and mounting certain pairs of rollers for bodily vertical movement, a counter-weight, and means connecting with said members and with the counter-weight for urging the rollers upwardly to thereby yieldingly support the weight of the kiln thereon and permit movement of said supported section of the kiln in a vertical direction.

3. A rotary kiln including a cylindrical shell having a plurality of tires thereon, a pair of rollers in engagement with each tire supporting the tire and therefore the kiln for rotation, members pivoted to a support and mounting certain pairs of rollers for bodily vertical movement, a counter-weight, connections from each member to the respective ends of the counter-weight, whereby the rollers are urged upwardly and yieldingly support the weight of the kiln thereon, said connections having a leverage ratio permitting use of a counter-weight of relatively light weight compared to that of the kiln.

4. A rotary kiln including a cylindrical shell having a plurality of tires thereon, a pair of rollers in engagement with each tire supporting the tire and therefore the kiln for rotation, certain pairs of rollers providing a fixed support for the kiln and other pairs of rollers being mounted for bodily vertical movement to yieldingly support the weight of the kiln thereon whereby the yieldingly supported section of the kiln may have movement in a vertical direction.

5. A rotary kiln including a cylindrical shell having a plurality of tires thereon, a pair of rollers in engagement with each tire supporting the tire and therefore the kiln for rotation, certain pairs of rollers providing a fixed support for the kiln, other pairs of rollers being mounted for bodily vertical movement, and means counter-balancing each pair of rollers so mounted for bodily movement, whereby the kiln shell at certain points is rigidly supported and at other points is yieldingly supported, said yieldingly supported section of the kiln having movement in a vertical direction.

6. A rotary kiln including a cylindrical shell, annular tires fixed to said shell and located on the respective ends and intermediate said ends, a pair of rollers in engagement with each tire supporting the tire and therefore the kiln for rotation, said rollers in engagement with the tires on the ends of the kiln being fixedly supported, means mounting the rollers having engagement with the intermediate tires for bodily vertical movement, and other means connecting with the rollers of each intermediate pair for counter-balancing the weight of the kiln shell supported by each pair of intermediate rollers, whereby the section of the kiln supported by said counter-balanced rollers may have movement in a vertical direction.

7. A rotary kiln including a cylindrical shell having unyielding supporting rollers at certain points in its length and yielding supporting rollers at other points, said yielding supporting rollers permitting movement of their supported section of the kiln in a vertical direction.

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