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MILL

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FIG. 1.

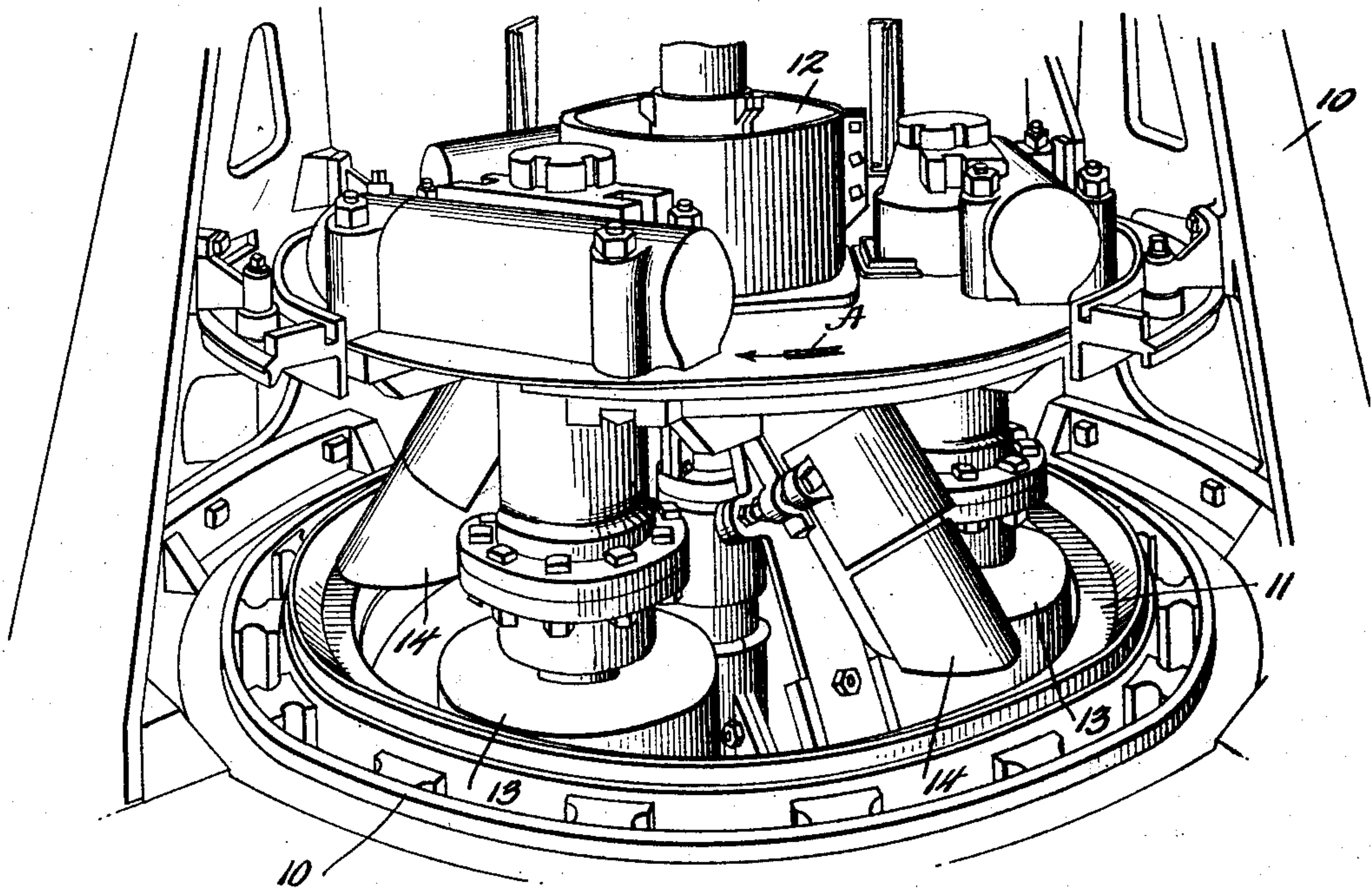
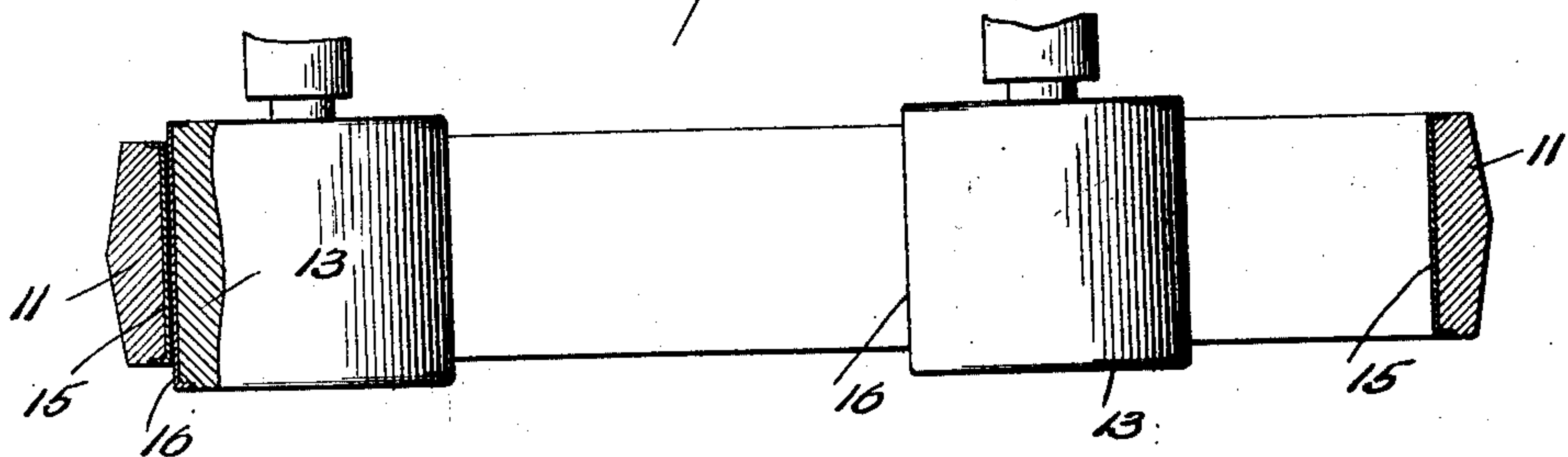


FIG. 2.



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## UNITED STATES PATENT OFFICE

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## MILL

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The present invention relates to mills and particularly to crushing or pulverizing mills.

Many types of mills for pulverizing lump and granular material have heretofore been designed and suggested and many are now on the market, such for instance as mills for grinding or pulverizing slag and mills for grinding cement clinker. Materials of this class are sometimes very hard and sharp, and the operation of crushing and reducing them to small size or to powder subjects the surfaces of the crushing elements to the continual attack of countless hard and sharp grains of the material being acted upon, with the result that the crushing surfaces are rapidly worn away. This attrition of the crushing surfaces or elements cannot proceed very far, of course, before such surfaces lose their original contour, becoming pitted as the softer portions of the metal, or those portions which are most subjected to wear, wear away at a faster rate than the harder portions, and eventually reach such a state of surface unevenness that uniformity of product can no longer be realized. Furthermore, there is a great reduction in the quantity of material which can be pulverized in a given time. It is then necessary to remove the worn crushing elements and to replace them with new ones, thus involving a considerable loss, not only because of the material and labor cost involved, but also because of the break in output due to the shut down. Particularly have the operators of cement clinker pulverizing mills been inconvenienced by the rapid wearing away of the crushing elements. Such mills are generally designed and intended for continuous day and night operation, a steady stream of hard, sharp cement clinker being continually fed into the machine. As the pulverizer constitutes an indispensable link in the cement making apparatus, being interposed between the kiln in which the cement is burned or clinkered, and the usual tube mill, the entire chain is thrown out of operation when the pulverizer is stopped for repairs.

Manufacturers and users of mills of this type have for many years endeavored to provide crushing elements having increased wear or abrasion resisting qualities, using or ex-

perimenting with all metals thought to be sufficiently hard and tough for the purpose. For instance, in a cement mill the crushing elements of which comprising respectively a stationary ring and three rollers which have rolling contact therewith, I have fabricated the ring and rollers of chilled iron and various alloys of steel, in the endeavor to find a metal which would stand up under the excessive abrasive action of the clinker. Past experiences have, however, demonstrated that the hardest and toughest materials heretofore believed to be suitable for the crushing elements of such a mill have not been sufficiently resistant to the abrasive or cutting action of the materials being pulverized and that, with any such known materials, the period of useful life of such elements is entirely too short, much shorter than that of the other moving parts of the mill.

I have now discovered that an alloy of cobalt and other metals of the chromium group, such for instance as that disclosed in Patent No. 1,057,423 issued to Elwood Haynes, and which alloy is well known throughout the machine tool industry, has remarkable ability to resist abrasion when fabricated into crushing elements of mills, such as pulverizing mills and the like, greatly increasing the length of useful life of such elements and promoting uniformity of product. Thus, while the period of usefulness of the crushing rings of the cement mills of the ring and roller type, with which I am most familiar has heretofore been quite short, I find that a crushing ring the active surface of which is fabricated of this alloy, has an almost indefinite life. The beneficial effects of this improvement are obvious, the grinding surface retaining its original contour thus insuring absolute uniformity of product and maximum output and much time and expense being saved due to the freedom from shut downs.

The crushing elements may be formed in various ways, mechanically, and the invention is not limited to any particular type of mill, it being obvious that crushing surfaces fabricated of the alloy specified may be utilized in mills which vary widely in specific



design and construction, that is, the invention will be found useful wherever means is provided for crushing or grinding materials of such hardness and sharpness as to possess marked abrasive qualities.

5 In the accompanying drawings one form of mill in which the novel crushing elements are incorporated is illustrated by way of example, Figure 1 being a perspective view of the mill and Figure 2 being an axial section  
10 through the stationary crushing ring, disclosing two of the crushing rollers.

This mill comprises a base 10 which supports the crushing ring 11, and a revoluble table indicated generally at 12, which carries  
15 three crushing rollers 13. The revoluble table 12 and ring 11 are concentric and, as the head is rapidly revolved, the rollers have rolling contact with the cylindrical inner crushing  
20 surface of the ring, as can be seen clearly from Figure 2. In the mill illustrated the table 12 is adapted to be revolved in the direction of the arrow A. It carries just in advance of each roller a feed chute 14 by means of which  
25 a stream of clinker is discharged. The table revolves so rapidly, however, that each particle or lump of clinker as it falls downwardly along the face of the stationary ring 11 is overtaken by that roller which immediately  
30 follows and is crushed between the roller and ring. That portion of the product which is reduced to the required fineness passes through a small mesh screen and falls into a hopper. Any particles too large to pass  
35 through the screen are reground, means being provided to collect such particles and again pass them between the grinding surfaces.

The action of the rollers in catching and  
40 crushing hard vitreous lumps of cement clinker results in rapid wear of the ring 11 in elongated patches or areas, in the event that the ring is fabricated of any metal which has heretofore been employed or suggested. To-  
45 ward the middle of the ring, as measured vertically, the wearing is particularly noticeable and continued use of the mill results ultimately in a hollowing out of the grinding surface between its upper and lower edges.  
50 This destruction of the cylindrical contour of the crushing ring of course results in reduced grinding efficiency and eventually the ring becomes so worn that it must be replaced.

55 My invention consists in fabricating the crushing ring and rollers in such a manner that the actual crushing surfaces are formed of the specified alloy and in Figure 2 of the drawings an alloy lining for the ring 11 is indicated at 15 and alloy coatings or casings for the rollers are indicated at 16. In a mill so  
60 constructed, that is, having the active crushing surfaces formed of this metal, the clinker or other hard material which may be fed

through the same is wholly crushed and without appreciable wear of the surfaces due to the intense abrading action which results. The alloy may be placed upon the crushing elements in any appropriate way. In the mill  
70 illustrated I prefer to weld the alloy to the metal surfaces of the ring and roller but it will be apparent that the lining of the ring may be formed as a hoop or cylinder and suitably secured in position and that likewise  
75 the casings 16 of the rollers may be separately formed when found most convenient. I have also found it satisfactory to use, in connection with the crushing ring lined with the alloy mentioned, crushing rollers which are  
80 so not covered, the greatest wear occurring in the ring and not in the rollers, but preferably I surface both crushing elements with a layer of the metal alloy mentioned. Of course, both the ring and rollers may be formed en-  
85 tirely of this alloy but I prefer not to do this because of the great cost of the same as compared with other metals which are available as backings for the crushing surfaces.

I am aware that an alloy of cobalt,  
90 chromium and other member, or members, of the chromium group has been used for various purposes in the mechanical arts such, for instance, as cutting implements, machine tools, table knives, cutlery and the like, for  
95 many years and that it has long been well known as possessing a high degree of hardness and toughness. So far as I am aware, however, the property of this alloy to resist abrasion in grinding or pulverizing clinker  
100 or other materials having hard and sharp crystals has never before been discovered. As previously pointed out, the alloy which I prefer to employ is fully disclosed in Patent No. 1,057,423 issued to Elwood Haynes, and  
105 comprises an alloy of cobalt with another member, or other members, of the chromium group. Preferably I do not employ the element molybdenum as set forth in said patent but utilize in combination with cobalt one  
110 or more of the remaining elements of the chromium group which are described, particularly tungsten.

While I have described my invention as incorporated in a mill, which is particularly  
115 designed for crushing or pulverizing cement clinker, in which mill I have found it to be of extraordinary utility, it is not limited in its application to any particular type of mill but may be applied wherever it is necessary  
120 to provide a crushing element having pronounced ability to resist abrasion. Such mills may, of course, vary in size and shape, in the type and design of the crushing elements, and in the manner in which the crush-  
125 ing operation is performed depending, of course, upon the material to be acted upon.

Having thus described the invention what is claimed as new and desired to be secured by Letters Patent is:



1. In a grinding or crushing mill, relatively movable members having crushing surfaces between which the material to be ground or crushed may be introduced, one of said members having a crushing surface comprising an alloy of cobalt and an additional member of the chromium group.

2. In a grinding or crushing mill, relatively movable members having crushing surfaces between which the material to be ground or crushed may be introduced, both of said members having crushing surfaces fabricated of an alloy of cobalt and an additional member of the chromium group.

3. In a grinding or crushing mill, relatively movable members having crushing surfaces between which the material to be ground or crushed may be introduced, one of said members comprising a metallic backing member having a welded-on crushing surface or lining of an alloy of cobalt and an additional member of the chromium group.

4. In a grinding or crushing mill, relatively movable members having crushing surfaces between which the material to be ground or crushed may be introduced, one of said members comprising a crushing ring and the other member a crushing roller arranged to move in a circular path within the ring, the crushing surface of the ring being formed of an alloy of cobalt and an additional member of the chromium group.

In testimony whereof I hereunto affix my signature.

ERNEST H. DIMLER.