

W. A. REED.
BALANCING DEVICE.
APPLICATION FILED APR. 30, 1914.

Patented Jan. 9, 1917.
2 SHEETS—SHEET 1.

1,211,488.

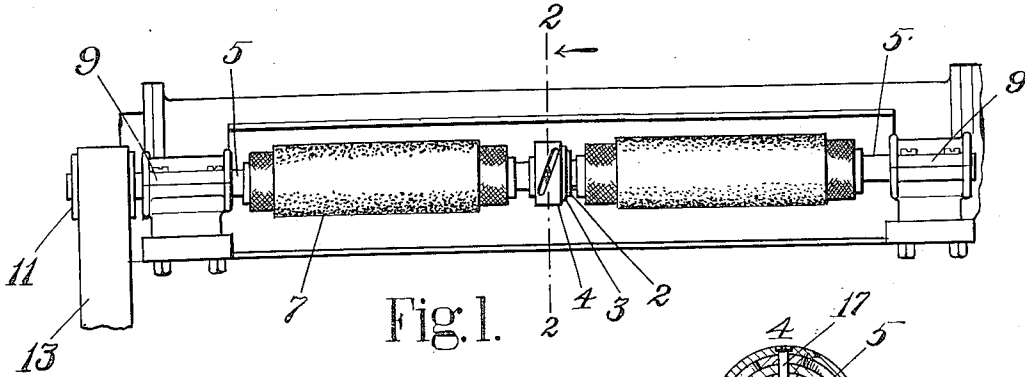


Fig. 1.

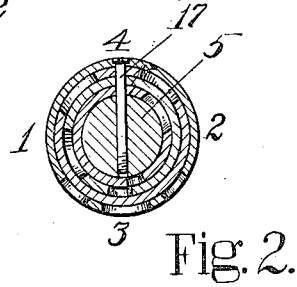


Fig. 2.

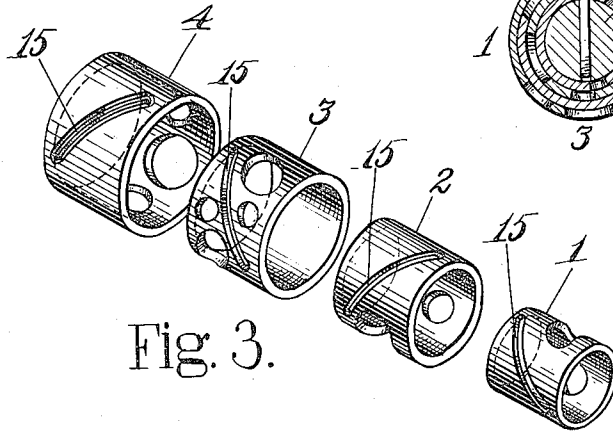


Fig. 3.

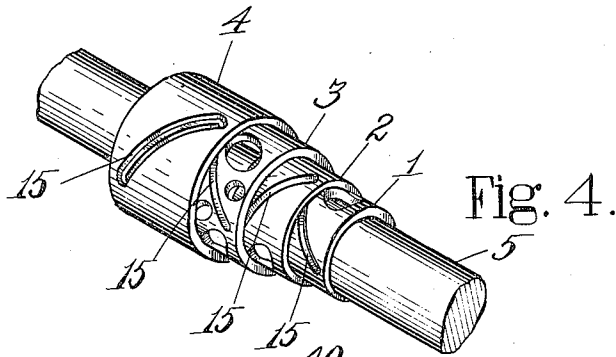


Fig. 4.

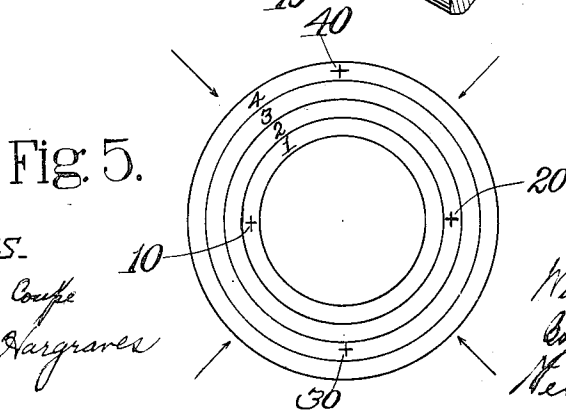


Fig. 5.

WITNESSES.

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2 SHEETS—SHEET 2.

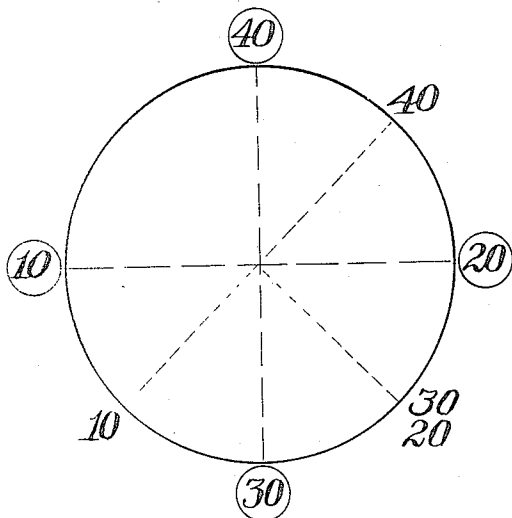


Fig. 6.

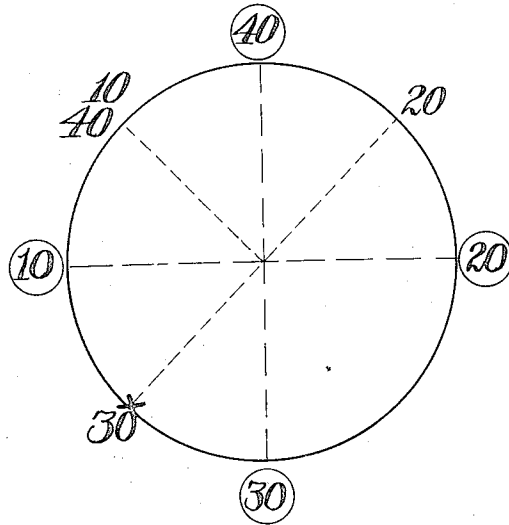


Fig. 7.

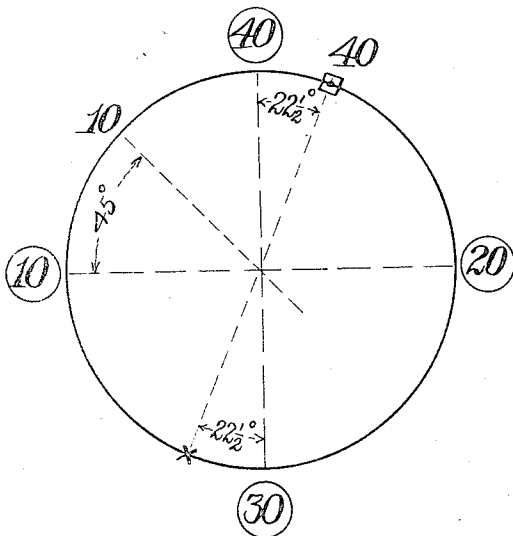


Fig. 8.

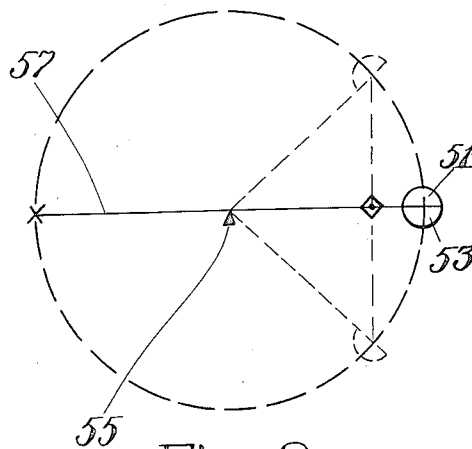


Fig. 9.

WITNESSES.

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UNITED STATES PATENT OFFICE.

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BALANCING DEVICE.

1,211,488.

Specification of Letters Patent.

Patented Jan. 9, 1917.

Application filed April 30, 1914. Serial No. 835,460.

To all whom it may concern:

Be it known that I, WILLIAM A. REED, a citizen of the United States, residing at Chelsea, in the county of Suffolk and State of Massachusetts, have invented certain Improvements in Balancing Devices, of which the following description, in connection with the accompanying drawings, is a specification, like reference characters on the drawings indicating like parts in the several figures.

This invention relates to balancing devices and is herein illustrated in connection with a device for balancing the shaft of a buffing machine while said shaft is rotating.

The shafts of machines used to buff the bottoms of boots and shoes are rotated at a velocity of from 3000 to 4500 revolutions per minute and it is consequently desirable that these shafts together with the buffing rolls which are mounted upon and rotate with them shall be balanced as perfectly as possible since if there is a preponderance of weight, even though a very small one, at one locality in the shaft or rolls, the centrifugal force generated by the high velocity at which the shaft and rolls are rotated wears the bearings unevenly so that a certain amount of play is developed; and this play is progressively increased as the wear becomes greater with the result that the chattering of the shaft produces an unbearable noise and the bottoms of the boots and shoes are unevenly buffed.

It has hitherto been the practice to balance the shafts and rolls very painstakingly by making use of the usual knife-edge ways; but even though a shaft and its rolls are balanced as perfectly as possible in this way it frequently happens that when the shaft is mounted in the frame of the machine and rotated at proper velocity more or less chattering occurs at once or presently develops.

A further difficulty arises, too, with respect to the rolls. These rolls are adapted to carry covers of sand paper in the form of sheets which are wrapped about the rolls and held in place in various ways. Where the ends of a sheet overlap (if the roll is a solid one) or where the ends are turned in (if the roll is a split one) there is a slight preponderance of weight. If now a roll is balanced for a light weight cover and afterward a heavy weight cover is used the over-

lapping or inturned ends, as the case may be, are heavier than the similar ends of the light weight cover with the result that the roll is no longer balanced. It is necessary then to change the angular position on the shaft of one roll, if this is possible, to counterbalance the increased weight, or to remove the rolls from the machine and rebalance them. Either procedure is wasteful of time and neither is certainly effective since, as with the shafts, a preponderance of weight in one locality which is too small to be detected when the rolls are not rotating will be so magnified when high velocity of rotation is imparted to the rolls as to produce the undesirable effects which have been referred to above.

The general object of the present invention is to provide means for balancing a rotary member while it is being rotated.

One feature of the invention comprises the combination with a rotary member of a weighted member mounted thereon and rotating therewith, said weighted member being loose on said rotary member whereby the rotation of said weighted member may be retarded or accelerated during the rotation of said rotary member to shift the angular position of said weighted member with respect to the axis of said rotary member.

These and other features of the invention, including certain details of construction and combinations of parts, will be described in connection with an illustrative device and pointed out in the appended claims.

Referring to the accompanying drawings,—Figure 1 is an elevation of a portion of a buffing machine in which the present invention is embodied; Fig. 2 is a cross section on the line 2—2 of Fig. 1; Fig. 3 is a perspective of a plurality of concentric weighted members which are adapted to be superposed one upon another; Fig. 4 is a perspective of the same members showing them in the course of being assembled upon the shaft which is to be balanced; Fig. 5 is a diagram illustrating by crosses the points at which the respective members are weighted; Figs. 6, 7 and 8 are diagrams illustrating the effect of adjusting the weighted members in different ways, and Fig. 9 is a diagram of a modification in which only two weighted members are made use of.

The shaft of a shoe buffing machine is indicated at 5 and the rolls at 7, said shaft being mounted in bearings 9 and carrying at its end a pulley 11 which is driven by means of a belt 13 from any suitable source of power. In machines of this type only a short length of shaft is exposed between the adjacent ends of the buffing rolls; and for this reason as well as to give greater accuracy and ease in the balancing operation, the balancing device illustrated in Figs. 1 to 8 inclusive is made in a plurality of parts herein shown as four concentric superposed rings or cylinders.

Referring more particularly to Fig. 3, each cylinder is provided with a slot 15, that of the largest cylinder being rabbeted to form a seat for the head of a guide, herein shown as a combined guide and clamping screw 17 which extends through the slots and is threaded into the shaft 5. The bore of the smallest cylinder 1 fits the shaft 5 closely so that, although it is loosely mounted in that it may be adjusted with respect to said shaft, it will be held in adjusted position by friction. The next largest cylinder 2 fits the cylinder 1 in the same manner in which the cylinder 1 fits the shaft 5; the cylinder 3 similarly fits the cylinder 2, and the cylinder 4 the cylinder 3.

The cylinders may be weighted in any convenient manner, and in the illustrated embodiment of the invention this weighting is accomplished by boring holes through the walls of said cylinders. The largest cylinder in the present case has three holes which are located in that portion of the cylinder opposite to the slot 15. This cylinder is consequently weighted at that portion which contains the slot.

The cylinder 3 has holes located near its slot and is therefore weighted at that portion opposite the slot. The cylinder 2 is weighted at a point approximately 90° to the right of the center of its slot, and the cylinder 1 at a point approximately 90° to the left of the center of its slot. It will be noted that both the cylinders 1 and 2 have holes which are approximately opposite to their respective slots, but these holes may be approximately equal in extent to the slots and may serve to counteract the lightness produced by said slots. When now the weighted cylinders or rings are slid one upon another and the smallest one upon the shaft 5 in the manner illustrated in Fig. 4 until the centers of their respective slots 15 coincide and the edges of the cylinders register one with another, the weighted portions will occupy positions approximately 90° apart as is indicated in the diagram of Fig. 5 wherein the locations of the weighted portions are marked by crosses numbered 10, 20, 30 and 40 to correspond to the members 1, 2, 3 and 4 which have been applied to the cylin-

ders. The guide screw 17 is then inserted and screwed into the shaft but not far enough to bind the cylinders until after they have been adjusted in a manner presently to be described.

The extent of the slots 15 measured circumferentially about the cylinders is approximately 90° so that each cylinder is capable of being adjusted to the extent of 45° on each side of its central position, this extent of movement being indicated in Fig. 5 by the straight arrows located 90° apart. It is thus possible to cause any given weighted portion to be effective in the same radial direction as that of the weighted portion on each side of it. Thus by moving the cylinder 4 clockwise and the cylinder 2 counter-clockwise to the limit of their respective paths their effective pull, when the shaft is rotating, will be in the same direction; and similarly by moving the cylinder 4 counter-clockwise and the cylinder 1 clockwise the effective pull of these two weighted members will coincide in direction.

The slots 15, in the embodiment of the invention which is being discussed, are oblique to the axis of the cylinders and cross one another approximately at right angles. In the operation of the device the guide screw 17 is first loosened and then power is applied to the shaft to rotate said shaft at the desired velocity. The weighted portions of the cylinder may be, if desired, made to balance one another exactly, but this is not essential. When the shaft is rotated a slight chattering will be produced if the balance is not approximately perfect; and the manipulator of the balancing device is guided by the increase or decrease of this noise.

The method used is one of trial and error, the manipulator holding a small flat piece of hard rubber or other suitable material against one end or the other of one or more of the cylinders and exerting a force in a direction parallel to the axis of the shaft. This moves one or more of the cylinders to the right or to the left and changes the angular location of said cylinder or cylinders and consequently of its or their weighted portions by reason of the engagement of the oblique slots 15 with the guide 17. A common procedure is first to push all the cylinders to the right. If the objectionable noise does not cease, and particularly if it increases, the cylinders are next pushed to the left. If neither of these adjustments is successful the cylinders are manipulated in threes or pairs or singly until the desired result is attained.

It has been found that when the weighted rings or cylinders are adjusted as described above during the rotation of the shaft, their adjusted position is maintained, a circumstance due probably both to their frictional fit and to the effect of centrifugal force; and

this adjusted position is maintained when the shaft is brought to rest. In order, then, to lock them in this adjusted position, the clamping screw 17 is tightened so as to insure that the adjustment will not be disturbed. With regard to the manipulation of any selected weighted ring, it should be noted that its angular adjustment results from the fact that when moved longitudinally in one direction its angular velocity is greater than that of the shaft while when moved in the other direction its angular velocity is less.

The diagrams of Figs. 6, 7 and 8 illustrate some of the possibilities of the device. As has been stated, the first manipulation is usually to move all four cylinders in one direction to the limit of their possible movement. In Fig. 6 the effect of moving them all to the right is illustrated. The original positions of the weighted portions are indicated by the numerals 20, 30 and 40 which are inclosed in circles, while their positions after the cylinders have been moved are indicated by the same numerals uninclosed. In this case the effect is to cause the weighted portions 10 and 40 to counter-balance each other while the weighted portions 20 and 30 act in conjunction along a line half way between their original positions. In Fig. 7 has been illustrated in a similar manner the effect of moving all the cylinders to the left. In Fig. 8 a problem and a possible manner of solution are illustrated. The original positions of the weighted portions, as well as the positions after adjustment, are indicated in the same manner as in Figs. 6 and 7. The cross indicates the angular position of a heavy portion of the shaft, and the small square the consequent angular position into which a counter-balancing weight should be moved.

It will be obvious that the weighted portion 40 may readily be moved into this position as is indicated. If, however, this is not sufficient, the weighted portion 10 may be moved clockwise 45°, as is indicated, whereupon the effective pull of the weighted portions 10 and 20 will strengthen that of the weighted portion 40.

The diagram of Fig. 9 is illustrative of an embodiment in which only two weighted rings or other members are provided. In such case the spiral slots, which correspond to the slots 15 of the embodiment shown in Figs. 1 to 8, will extend entirely around each ring so that the weighted portions of said rings may be caused to occupy any angular position about the shaft which is to be balanced.

In the diagram the weighted portions of the balancing rings are indicated by two hemispheres 51 and 53 which together form a complete sphere but may be separated when desired, and the weight indicated by

the whole sphere is made slightly greater than any preponderance of weight which may occur in the shaft or other member to be balanced. If now the cross indicates the location of a heavy portion of the shaft, the weight indicated by the sphere may be placed diametrically opposite to the heavy portion of the shaft, the location of which is indicated by the cross, and then the two halves of the weight may be separated. In the diagram this is indicated in dotted lines by the separated hemispheres.

At 55 is indicated the apex of an imaginary fulcrum for an imaginary lever indicated by the line 57. Considering now that the heavy portion of the shaft, the location of which is indicated by the cross, is fast to one end of this lever, it will be seen that progressive separation of the weights indicated by the hemispheres 51 and 53 will have the effect of shifting the whole weight, indicated by the whole sphere, to the left along this lever; and since the weight indicated by the sphere is greater than the weight located at the cross a balance will presently be secured.

Of course in the actual use of a balancing device composed of two members the method employed would be one of trial and error just as has been explained in connection with the device consisting of four members, since it would not be possible to determine beforehand the location of the heavy portion of the shaft which is indicated in the diagram by the cross. The purpose of the diagram is merely to present a theoretical explanation of the operation of a simple embodiment of the invention.

Although the invention has been set forth in connection with certain specific devices it should be understood that the invention is not limited in the scope of its application to the particular devices shown and described.

Having thus described my invention, I claim as new and desire to secure by Letters Patent of the United States:

1. The combination with a rotary member of a weighted member frictionally mounted thereon and rotating therewith whereby the rotation of said weighted member may be retarded during the rotation of said rotary member to shift its angular position and thereby its weighted portion circumferentially of the axis of said rotary member.

2. The combination with a rotary member of a weighted member adjustable circumferentially thereof and held in adjusted angular position by friction whereby when the shaft is rotated said shaft may be balanced by pressing upon said weighted member to cause it to slip on said rotating member.

3. The combination with a rotary shaft of a balancing member having a weighted portion mounted on said shaft, and means

connecting said shaft and member so constructed and arranged that movement of said member longitudinally of said shaft shifts said weighted portion angularly with respect to the axis of said shaft.

4. The combination with a rotary member of a weighted member mounted thereon, a guide on one of said members and the other member being provided with a cooperating guideway, said guideway extending in a direction oblique to the axis of said rotating member whereby movement of said weighted member longitudinally with respect to said rotary member will shift said member angularly with respect to the axis of said rotary member.

5. The combination with a rotary shaft of a guide connected therewith and a weighted member having a guideway to receive said guide, said guideway extending in a direction oblique to the axis of said shaft, whereby movement of said member longitudinally with respect to said shaft will shift the weighted portion of said member angularly with respect to the axis of said shaft, said guide being movable to lock said weighted member in adjusted position.

6. The combination with a rotary shaft of a guide carried thereby, and a plurality of superposed weighted members mounted on said shaft and provided with guideways to receive said guide.

7. The combination with a rotary shaft of a guide carried thereby, and a plurality of superposed weighted members mounted on said shaft and provided with guideways to receive said guide, said guideways extending in directions oblique to each other.

8. The combination with a rotary shaft of a guide carried thereby, a plurality of superposed members having weighted portions mounted thereon, said members being held from movement with respect to the shaft and with respect to each other by friction and having guideways to receive said guide, and means for locking said members in adjusted position.

9. The combination with a rotary shaft of a weighted member mounted thereon and

connecting means between said shaft and member constructed and arranged to cause said member to rotate at a speed different from that of the shaft when pressure is applied to said member in a direction at an angle to its path of rotation.

10. The combination with a rotary shaft of a weighted member mounted thereon and connecting means between said shaft and member constructed and arranged to cause said member to rotate faster than said shaft when moved longitudinally of said shaft in one direction and to cause said member to rotate slower than said shaft when moved in the opposite direction.

11. The combination with a rotary shaft of a guide carried thereby and a plurality of nested weighted members mounted on said shaft and provided with guideways to receive said guide.

12. The combination with a rotary shaft, of a guide carried thereby, and a plurality of nested weighted cylinders mounted on said shaft and provided with guideways to receive said guide, said guideways extending in directions oblique to each other.

13. The combination with a rotary member, of a weighted balancing member frictionally mounted thereon and normally rotating therewith but capable of slipping with respect to said shaft when pressure is applied to said weighted member whereby the rotary member may be balanced while it is rotating.

14. The combination with a rotary member, of a weighted balancing member mounted thereon, the mounting being such that normally the angular relation of the two members remains unchanged while at the same time said relation may be changed at will during the rotation of said members.

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

WILLIAM A. REED.

Witnesses:

CHESTER E. ROGERS,
LILLIAN B. DUPEE.