

A. H. POLLEN & H. ISHERWOOD.
 BALL AND DISK VARIABLE SPEED MECHANISM.
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1,062,500.

Patented May 20, 1913.

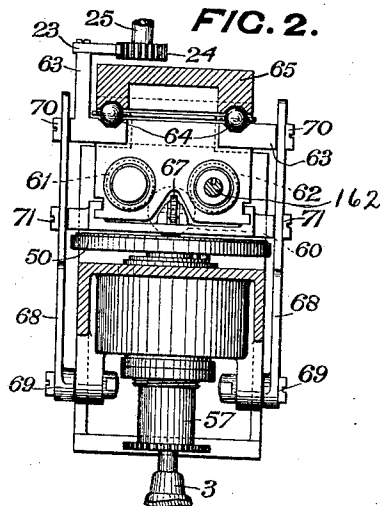
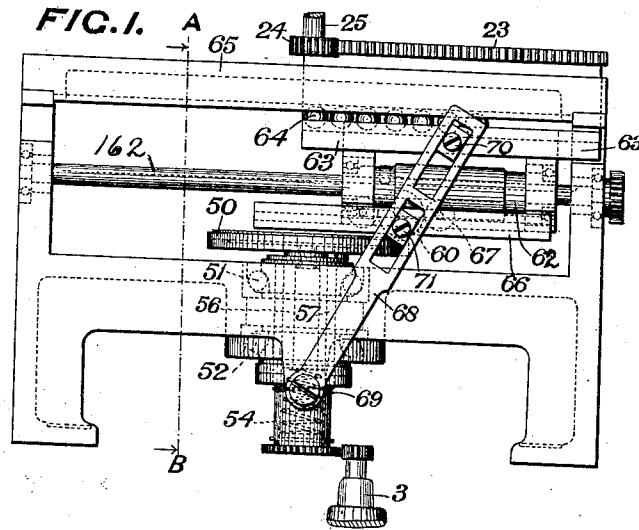
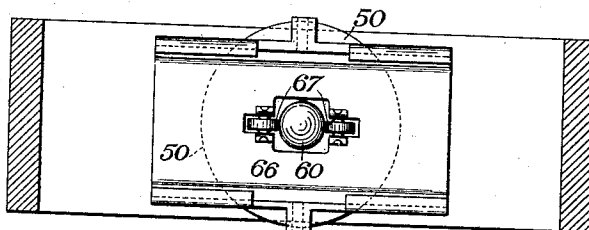


FIG. 3.



Witnesses

[Signature]
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Inventors

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UNITED STATES PATENT OFFICE.

ARTHUR H. POLLEN, OF LONDON, AND HAROLD ISHERWOOD, OF YORK, ENGLAND.

BALL-AND-DISK VARIABLE-SPEED MECHANISM.

1,062,500.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that we, ARTHUR HUNGERFORD POLLEN and HAROLD ISHERWOOD, subjects of the King of Great Britain, residing at 14 Buckingham street, Strand, London, W. C., England, and Bishophill House, York, England, respectively, have invented certain new and useful Improvements in Ball-and-Disk Variable-Speed Mechanism, of which the following is a specification.

This invention relates to an improved form of ball and disk variable speed gearing in which the speed can be changed from zero to a maximum speed in either direction and can be varied smoothly through the whole range.

The mechanism we employ consists of a horizontal disk which is caused to rotate at a constant rate about a vertical axis by any suitable means. Above the disk are arranged two horizontal rollers equidistant from a diameter of the disk, and geared to rotate in the same direction at the same speed. One of the rollers is keyed to the shaft to be driven at a variable speed, or if preferred the shaft on which that roller is mounted is geared to the driven shaft. The rollers are mounted in a frame adapted to slide horizontally on ball slides parallel to a diameter of the disk and in the direction of the axes of the rollers. A steel ball rests on the disk below and between the rollers, the pressure to insure frictional contact being derived from a spring acting on a ball thrust which forces the disk upward along its axis. The position of the ball on the disk is determined by the position of the aforesaid sliding frame, which when it moves through a given distance horizontally rolls the ball along a diameter of the disk through a distance approximately equal to half the travel of the sliding frame. In order, however, to insure that the ball shall remain in its correct position it is embraced by a fork or its equivalent adapted to move parallel to the motion of the sliding frame and driven thereby at the proper speed in relation to the speed of the frame. Such a motion may be obtained from a pivoted lever acting on the fork at a certain distance from the pivot and which is acted on by the frame at a greater distance from the pivot. It will be seen that when the ball is in the center of its travel and coincides with the center of the disk, no rotation will be given to the rollers; but if

the ball is displaced from such central position by a displacement of the sliding frame, the rollers will rotate with a speed directly proportional to the magnitude and sign of the displacement of the sliding frame from its central position.

In order that the invention may be clearly understood we proceed to describe the same with reference to the accompanying drawings in which—

Figure 1 shows a side elevation of a mechanism constructed according to this invention. Fig. 2 is a section on the line A—B, Fig. 1 looking in the direction of the arrows. Fig. 3 is a plan view of the ball controlling slide.

Referring to these figures 50 is a disk which is caused to rotate at a constant speed about a vertical axis by means of suitable driving mechanism such as the motor 3. The disk is carried on the cylindrical piece 56 sliding in the sleeve 57 which is mounted on ball bearings 51, 52 and is driven from the constant speed motor 3. The disk as a whole is forced upward by the spring 54 acting to press the cylindrical piece 56 upward within the sleeve 57. Above the disk 50 which is made of hard steel, is mounted a hard steel ball 60 which lies in contact with and between two rollers 61, 62 mounted in the frame 63. One of these rollers, in the present instance, the roller 62, is keyed to a shaft 162, and this shaft thus constitutes the driven shaft, although if preferred it may have a suitable gear connection with the driven shaft. The frame 63 is capable of sliding as a whole as shown in Fig. 2 on balls 64 mounted in a race cut in the piece 65 which forms part of the framework of the mechanism. The spring 54 presses the ball 60 upward against the rollers 61, 62 and maintains the frame 63 in contact with the balls 64. In general the disk 50 is driven at a constant speed and communicates a variable speed to the ball 60 which in turn communicates its speed of rotation to the rollers 61, 62 and thence to shaft 162 or to the shaft with which shaft 162 has a gear connection. In order to cause the displacement of the ball radially on the disk 50, the frame 63 carrying the rollers 61, 62 is shifted as shown in Fig. 2. In this way the position of the ball on the disk is determined by the position of the sliding frame 63 which when it moves through a given distance horizontally rolls the ball

along a diameter of the disk through a distance approximately equal to half the travel of the sliding frame. In order however to insure that the ball shall remain in its correct position it is embraced by a fork 66 carrying rollers 67 arranged to move parallel to the sliding frame and driven thereby at the proper speed by means of the levers 68 pivoted about the fixed centers 69 and provided with slots in which the pins 70 carried by the sliding frame 63 and the pins 71 carried by the fork 66 engage. In general a constant speed is communicated to the disk and a variable speed is taken out from the rollers, but in some cases this disposition is reversed and the rollers drive the disk. Any suitable means may be adopted for shifting the frame 63 which carries the rollers 61, 62, for producing the desired changes of speed. The means shown in the drawings consist of a rack 23 mounted on the frame 63 driven by the pinion 24 mounted on the shaft 25. The advantage of this construction is that owing to the changes in the ball's position being produced by a rolling action, the ball does not slip or fail to drive the rollers at the moment when its position is being changed. This was formerly a difficulty which introduced a noticeable inaccuracy in the earlier forms of disk and roller variable-speed gearing.

What we claim is:—

1. Variable-speed mechanism comprising a driving element, a driven element, a steel ball intermediate said elements and in frictional contact with one of them, a fork carrying said ball, a member connected rotatably to the other element and contacting with said ball, a frame wherein said member is carried, means to displace said frame so as to travel said ball radially relatively to the element with which it frictionally contacts, and means to produce the requisite degree of frictional contact between said ball and that element.

2. Variable-speed mechanism comprising, a driving element, a driven element, a steel ball intermediate said elements and in frictional contact with one of them, a fork carrying said ball, a pair of rollers mounted above said ball and contacting therewith, a frame carrying said pair of rollers, means to displace said frame so as to travel said ball along a diameter of the element with which it frictionally contacts, said fork constraining said ball to travel a distance equal

to half the distance traveled by said frame, and means to produce the requisite degree of frictional contact between said ball and that element.

3. Variable-speed mechanism comprising a horizontal driving disk, a driven shaft, a steel ball intermediate said disk and said shaft, said ball being in frictional contact with said disk, a fork carrying said ball, a pair of rollers mounted above said ball and contacting therewith, one of said rollers being keyed to said shaft, a frame carrying said pair of rollers, ball-slides supporting said frame, means to displace said frame longitudinally of said ball-slides so as to travel said ball along a diameter of said disk, said fork constraining said ball to travel a distance equal to half the distance traveled by said frame, and means to produce the requisite degree of frictional contact between said ball and said disk.

4. Variable-speed mechanism comprising a horizontal driving disk, a driven shaft, a steel ball intermediate said disk and said shaft, said ball being in frictional contact with said disk, a fork carrying said ball, a pair of rollers mounted above said ball and contacting therewith, one of said rollers being keyed to said shaft, a frame carrying said pair of rollers, ball-slides supporting said frame, means to displace said frame lengthwise of said ball-slides in a direction at right angles to the axes of said rollers so as to travel said ball along a diameter of said disk, means connecting said fork with said frame to cause the fork to move parallel to the direction of motion of the frame, said fork constraining said ball to travel a distance equal to half the distance traveled by said frame, and means to produce the requisite degree of frictional contact between said ball and said disk.

In testimony whereof we have hereunto set our hands in presence of two subscribing witnesses.

ARTHUR H. POLLEN.
HAROLD ISHERWOOD.

Witnesses as to the signature of Arthur H. Pollen:

F. H. POLLEN,
E. C. WALKER.

Witnesses as to the signature of Harold Isherwood:

B. R. ATTENBOROUGH,
S. MATTHEWS.