

F. SCHAFER.  
 VARIABLE SPEED APPARATUS.  
 APPLICATION FILED APR. 6, 1910.

978,065.

Patented Dec. 6, 1910.

4 SHEETS—SHEET 1.

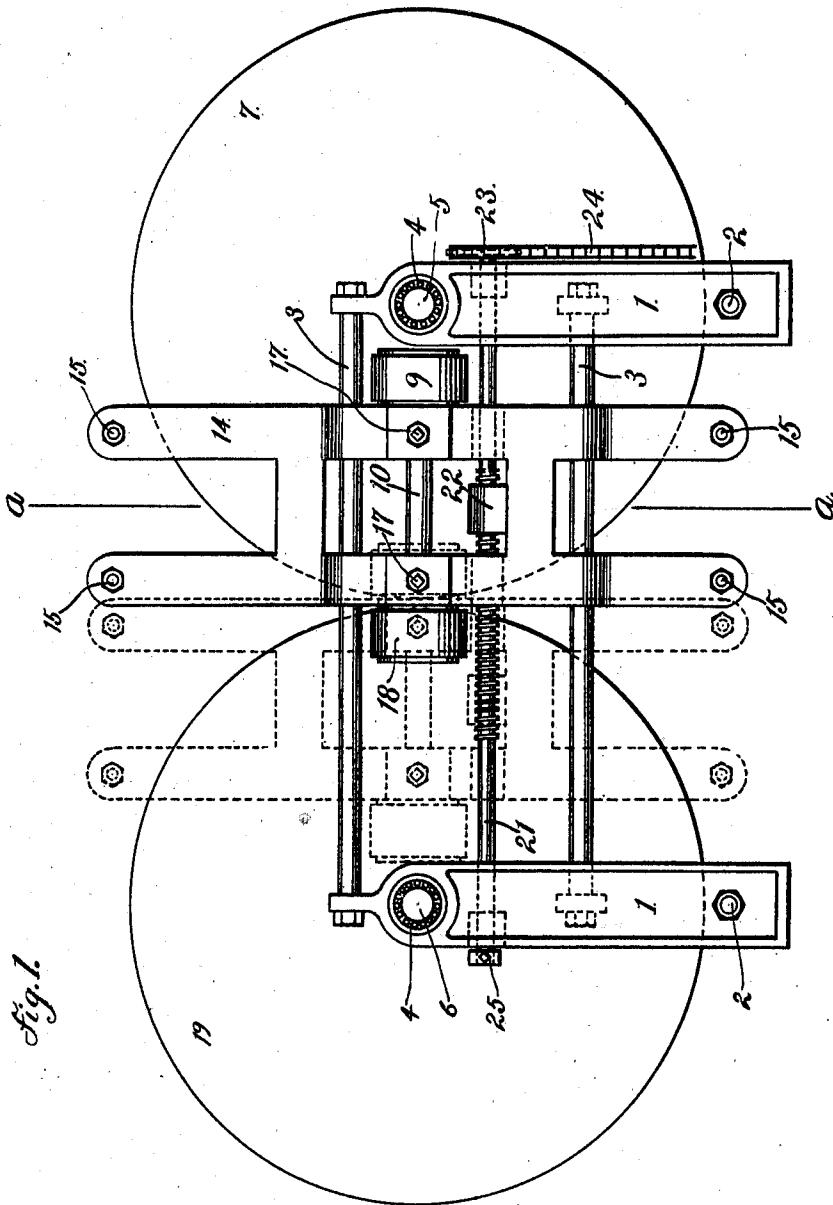


fig. 1.

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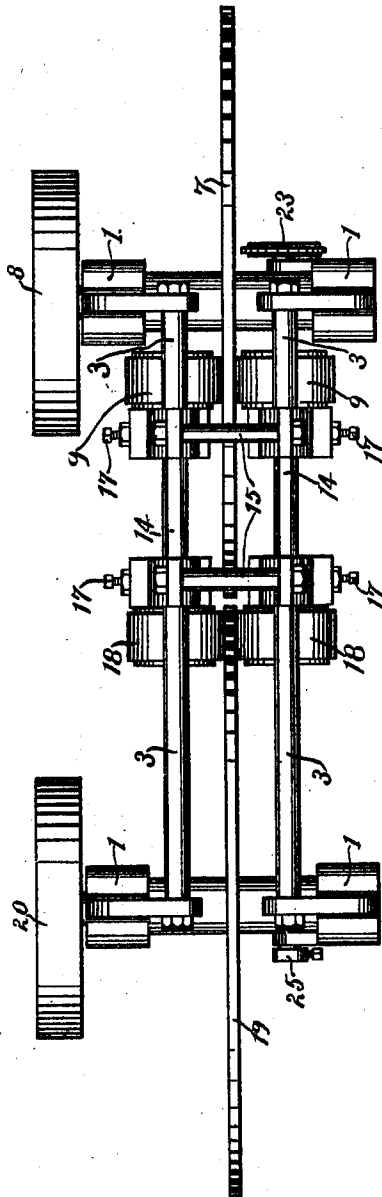
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4 SHEETS-SHEET 2.

*Fig. 2.*



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4 SHEETS—SHEET 3.

Fig. 3.

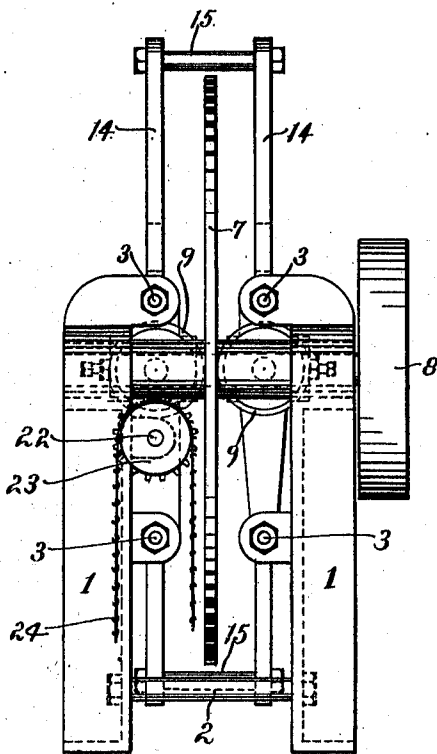
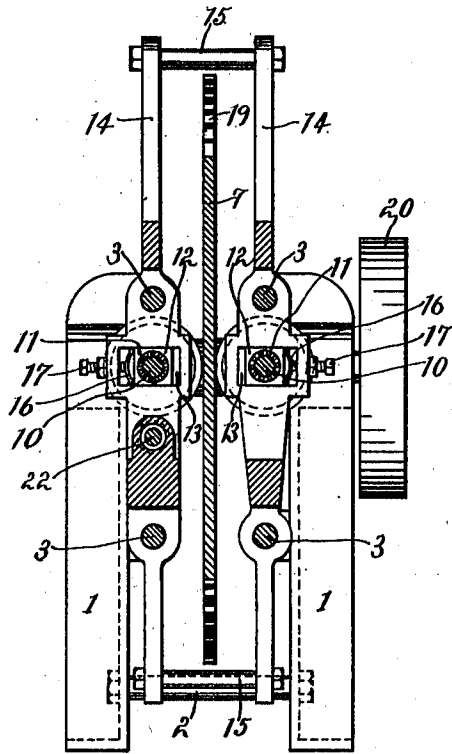


Fig. 4.



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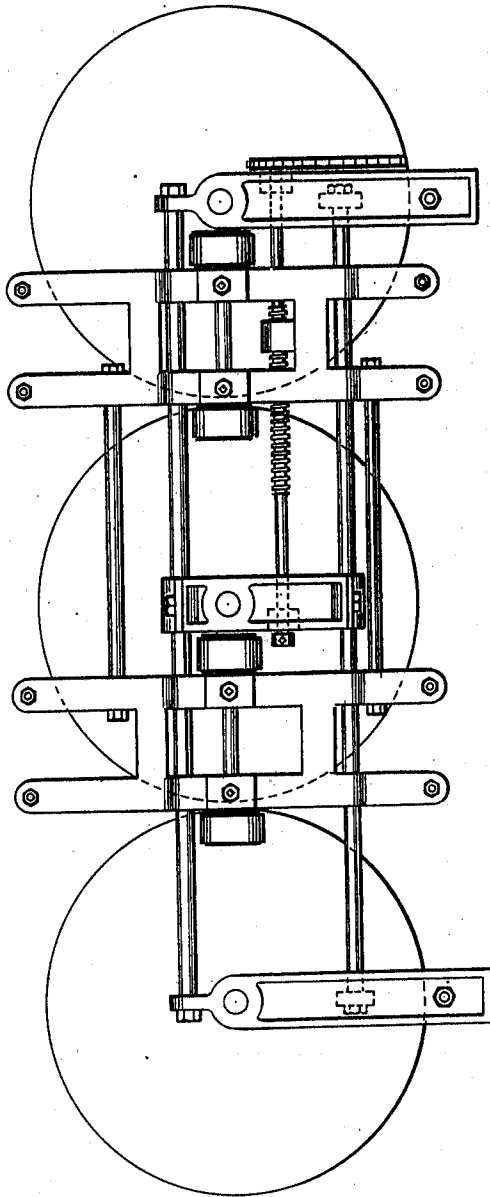
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4 SHEETS—SHEET 4.

*Fig. 5.*



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# UNITED STATES PATENT OFFICE.

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## VARIABLE-SPEED APPARATUS.

978,065.

Specification of Letters Patent.

Patented Dec. 6, 1910.

Application filed April 6, 1910. Serial No. 553,878.

*To all whom it may concern:*

Be it known that I, FRANK SCHAFER, a citizen of the United States, residing in the city and county of Philadelphia, State of Pennsylvania, have invented a certain new and useful Improvement in Variable-Speed Apparatus, of which the following is a full, clear, and exact description.

My invention relates to apparatus which receives motion from a primary motor or a line shafting running at a constant speed and gradually increasing or decreasing the speed of the driven machine at the will of the operator without changing the speed of the primary motor.

It is also applicable to be used for changing the speed of feed of lathe carriages, milling machines, boring mills, drill presses, etc.

It is also applicable to be used for driving the drills or other cutting tools direct.

It consists of a driving disk against the sides of which contact friction rollers which are rotated thereby and in turn rotate a driven disk and by causing the rollers to move radially across the sides of the disk, thus increasing or decreasing the speed of the driven disk. The rollers being placed opposite each other on the sides of the disk thus balance the pressure and also double the frictional driving power.

It also consists of means whereby a number of disks can be used thus giving a great ratio of speed between the first and last disk.

In the accompanying drawings Figure 1 is a side elevation of the apparatus. Fig. 2 is a plan view of Fig. 1. Fig. 3 is an end view of Fig. 1 looking toward the left. Fig. 4 is a view on lines *a-a* of Fig. 1. Fig. 5 is a side elevation showing the manner in which a train of friction disks may be employed.

Similar letters of reference indicate corresponding parts in the several figures.

1 designates frames or stands which support the various parts of the apparatus, 2 designates shouldered bolts which connect the frames together, 3 designates long shafts which run longitudinally of the apparatus and are shouldered and bolted to the said frames and on which slide the frame carrying the friction rollers as will be hereinafter explained.

4 designates roller bearings in the frame 1 in which rotate the shafts 5 and 6. To shaft 5 is secured a cast iron disk 7 (any suitable

material will do) and the purpose of which will be hereinafter explained. Also secured to shaft 5 is a pulley 8 partly around which passes a belt (not shown) and which imparts motion from any suitable source (the shaft 5 can be coupled direct to any primary motor.)

9 designates friction rollers pressing against the sides of the disks 7 and which are secured to shafts 10 which rotate in roller bearings 11 set in the movable blocks 12 moving in ways 13 of the sliding frames 14 which are connected by the bolts 15, the frames 14 sliding on the shafts 3. The movable blocks are pressed toward one another by the springs 16 the pressure of which is adjusted by the set screws 17 passing through the side of the frame 14 and which are locked by suitable nuts. (See Fig. 4).

18 designates friction rollers secured to shafts 10 and which press on the sides of the disk 19 secured to the shaft 6 rotating in roller bearings 4 in the frames 1.

20 designates a pulley secured to shaft 6 and which is used to drive any desired machine by a belt in the usual manner.

21 designates a screw which passes through suitable holes in one of the frames 14 and engages the nut 22 which is part of the said frame or may be secured thereto. This screw rotates in suitable bearings extending inward from the frames 1 and to which is secured the sprocket 23 around which passes a chain 24. On rotating the screw 21 it moves the frame 14 radially across the sides of the disks 7 and 19. The collar 25 and sprocket 23 prevent any endwise movement of the screw 21.

The mode of operation is as follows: The pulley 8 is rotated in any direction by a belt in the usual manner which rotates the shaft 5 running in the roller bearings 4 in the frames 1. This also rotates the large disk 7 against the sides of which and directly opposite each other press the friction rollers 9 which are rapidly rotated thereby. This rotates the shafts 10 to which are secured the friction rollers 18 which are also directly opposite each other and press against the sides of the disk 19 and cause the latter to rotate. (See Figs. 1 and 2.) The shafts 10 rotate in roller bearings set in movable blocks in openings or ways 13 of the frames 14 and are caused to press the friction rollers 9 and 18 against the sides of the disks 7 and 19 by means of the set screws 17 which are locked

by a suitable nut. The spring 16 is inserted between the blocks 12 and set screws 17 so that the friction rollers will at all times be kept in contact against the sides of the disks in case of any unevenness or irregularity in the friction rollers or disks. The set screws 17 also permit the adjustment of the pressure or wear of the friction rollers. (See Fig. 4.) The frame 14 slides on the shafts 3 and is caused to move across the sides of the disks 7 and 19 by means of the screw 21 engaging the nut 22. It is plainly apparent that rotating the screw 21 in one direction will move the frame 14 radially from one disk toward the other and reversing it will bring it back again, the sprocket 23 and collar 25 preventing any endwise movement of the screw 21.

Referring to Fig. 1 it will be noted that when the frame 14 is in the position shown and the disk 7 is the driving disk the disk 19 is rotated at a slow speed. If the screw 21 is rotated in the proper direction it will move the frame 14 radially across the face of the disks 7 and 19 carrying the friction roller 9 with it and bringing it nearer to the larger diameter of the disk 7 which will cause the friction roller 9 to rotate faster. This also rotates the friction roller 18 and carries it nearer the smaller diameter of the disk 19 which greatly increases the speed of the latter disk and which is greatest when the frame 14 occupies the position as shown in the dotted lines. Reversing the rotation of the screw 21 moves the frame 14 in the opposite direction and materially decreases the speed of rotation of the disk 19. (See Fig. 1.)

In the drawings I have shown the apparatus as intended to drive another machine when the power is applied by a belt on the pulley 8 in which case a belt passes partly around the pulley 20 to drive the desired machine. The pulley 20 is secured to the same shaft to which the disk 19 is secured. The sprocket 23 and chain 24 is used to rotate the screw 21 when the apparatus is out of reach of the operator in which case a suitable sprocket turned by a handle is used and partly around which the chain 24 passes. If within reach of the operator a handle placed on the screw 21 is sufficient.

Referring to Fig. 4 it is seen that the pressure of one set of friction rollers is balanced by that of the other thus avoiding any side thrust of the disks 7 and 19 and also doubling the frictional driving power. By means of the screws 17 a greater or lesser pressure can be used on the friction rollers and the springs 16 take up any irregularities or unevenness of the friction rollers or the disks. If desired a train of disks and friction rollers can be used as shown in Fig. 5 in which it can be seen that the sliding frames are connected by suitable bolts and that one screw moves both frames simulta-

neously. The ratio of speed as shown in Fig. 1 is about 5 to 1 and in Fig. 5 it is 25 to 1 and this ratio can be increased in like proportion by increasing the number of disks.

In applying the principles of this invention as a feed for drill-presses, lathes, etc., the driving disk is secured directly to any desired shaft and the receiving disk to the shaft operating the feed and the friction rollers in any suitable frame can be caused to move as explained or by a lever or any suitable means. The roller bearings while desirable are not essential as the apparatus will work as well in ordinary bearings. It will also be noted that the friction rollers balance each other thus avoiding any side thrust or pressure of the disks 7 and 19. (See Fig. 4).

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

1. In a device of the character stated, a driving disk, a driven disk in the same plane, two pairs of guide rods arranged in opposite pairs at opposite sides and in parallel planes to the disks, frames guided to slide on said rods and connected together, pairs of separately yielding bearings in said frames, shafts journaled in said bearings and parallel to the planes of the driving and driven disk, two pairs of friction disks, each pair secured upon one of said shafts and engaging the faces of the driving and driven disk, and means connected to the frames for longitudinally adjusting the same.

2. In a device of the character stated, a driving disk, a driven disk in the same plane, two pairs of guide rods arranged in opposite pairs at opposite sides and in parallel planes to the disks, frames guided to slide on said rods and connected together, pairs of separately yielding bearings in said frames, shafts journaled in said bearings and parallel to the planes of the driving and driven disk, two pairs of friction disks each pair secured upon one of said shafts and engaging the faces of the driving and driven disk, and a screw engaging a frame to move the same radially in relation to the driving and driven disk.

3. In a device of the character stated, a driving disk, a driven disk in the same plane, two pairs of guide rods arranged upon opposite sides of said disks and in parallel planes thereto, a frame upon each side of said disks, each frame being guided to slide on a pair of said rods, means for connecting said frames together, a pair of friction disks carried by each of said frames, each pair being carried by a frame intermediate of the rods supporting said frame and each pair engaging the faces of the driving and driven disk, and yielding means carried by said frame for supporting said disks.

4. In a device of the character stated, a

driving disk, a driven disk in the same plane, two pairs of guide rods arranged in opposite pairs at opposite sides and in parallel planes to the disks, frames guided to slide on said rods and connected together, pairs of separately yielding bearings in said frames, shafts journaled in said bearings and parallel to the planes of the driving and driven disk, two pairs of friction disks, each pair secured upon one of said shafts and engaging the faces of the driving and driven disk, and means for longitudinally adjusting the frames and for holding the same in any adjusted position. 10

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