Oct. 29, 1940. M. T. WESTON 2,219,856

MICROVARIABLE PAPER MACHINE DRIVE

Filed Aug. 19, 1936 3 Sheets-Sheet 1

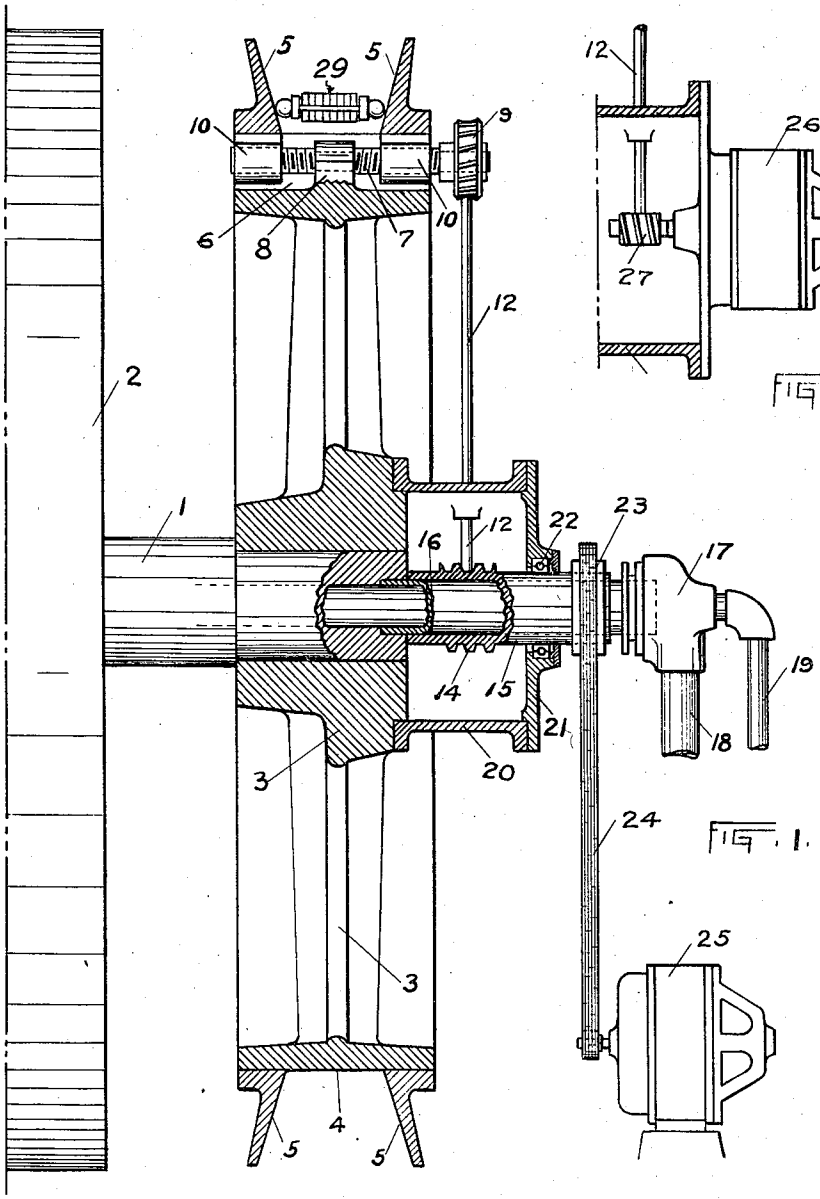


FIG. 1.

FIG. 2.

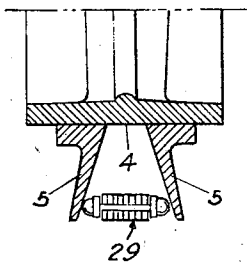


FIG. 3.

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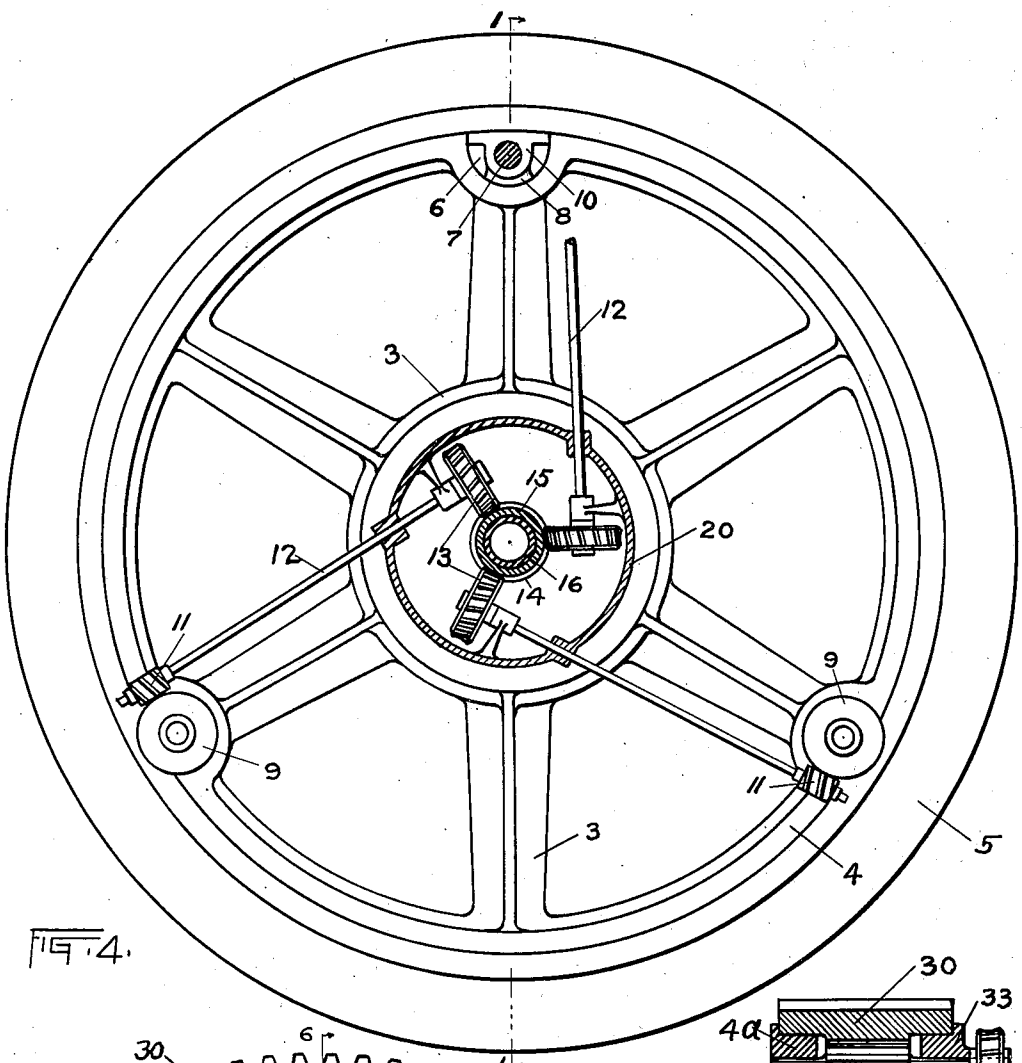


FIG. 4.

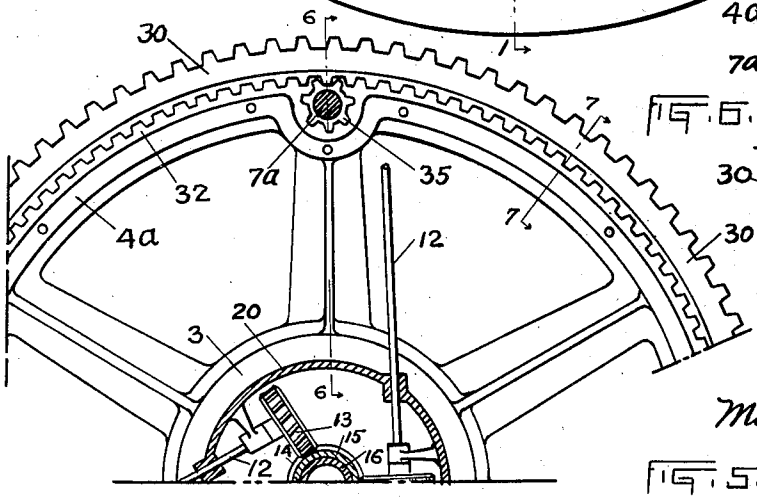


FIG. 5.

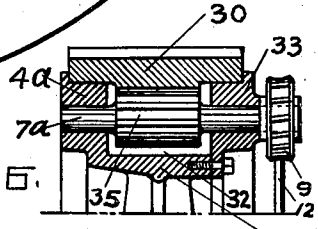


FIG. 6.

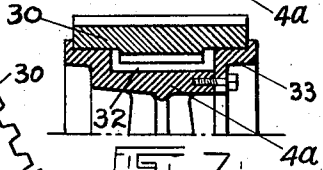


FIG. 7.

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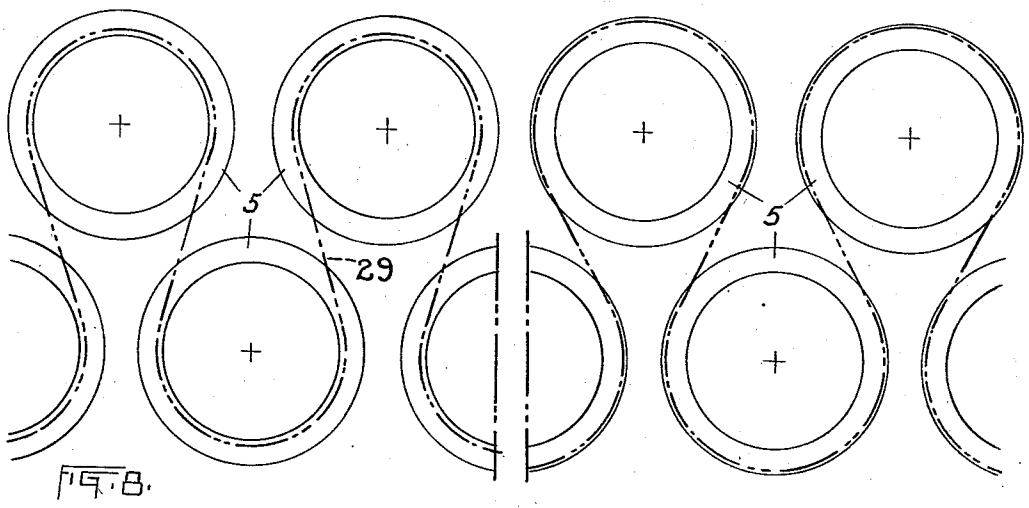


FIG. 8.

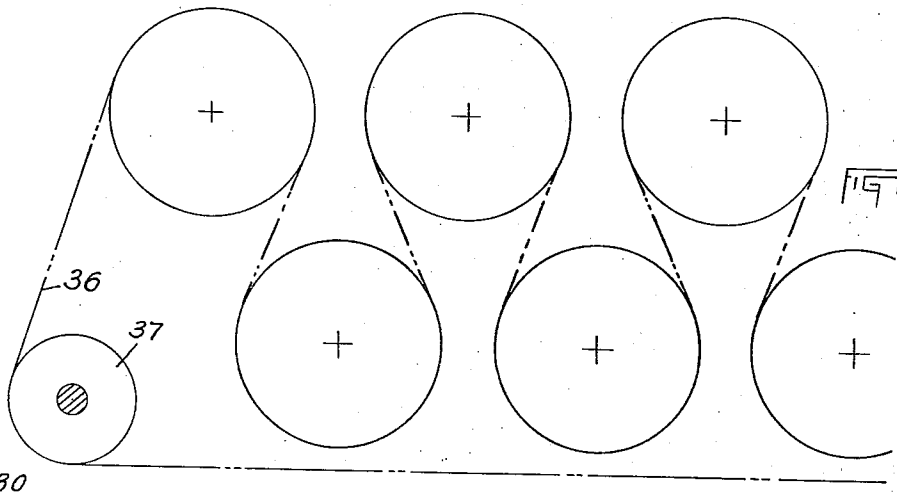


FIG. 9.

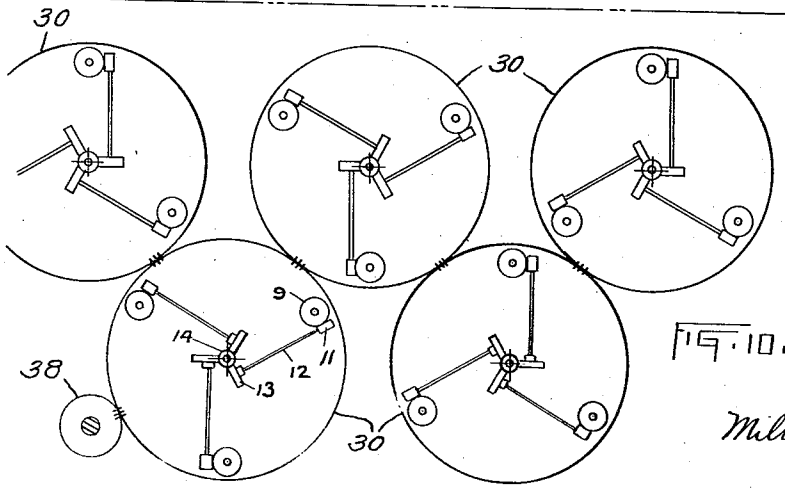


FIG. 10.

INVENTOR

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Patented Oct. 29, 1940

2,219,856

UNITED STATES PATENT OFFICE

2,219,856

MICROVARIABLE PAPER MACHINE DRIVE

Milton T. Weston, Keansburg, N. J., assignor to West Virginia Pulp & Paper Company, New York, N. Y., a corporation of Delaware

Application August 19, 1936, Serial No. 96,805

4 Claims. (Cl. 34—48)

My invention relates to improvements in microvariable paper machine drives and has particular reference to the method of driving the drier section of the paper machine. The present practice is to positively gear all of the drier cylinders in the section together so that the peripheries of all of the cylinders have exactly the same velocity. On account of the snubbing action of so many cylinders, and further because the tension in the felts holds the paper web firmly against the surfaces of the drier cylinders, there can be no slipping of the paper web to allow for the normal shrinkage which, in a modern machine, is very considerable—probably as much as 10 to 20 feet between the first and last drier cylinder. The effect is, in reality, the stretching of the paper web to this extent in the machine direction and causing an abnormal shrinkage in the cross direction. This stretching of the paper results in a pronounced orientation of the fibers in the machine direction at the expense of the cross direction, making the paper much stronger in the one direction than in the other. Repeated tests have shown that the prevention of the normal shrinkage of the paper web produces a sheet 2½ times stronger in the machine direction than in the cross direction—a very undesirable result. Other tests have proven that most of the fiber orientation in the present system occurs at the drier section. If this orientation of the fibers in the machine direction can be prevented by allowing the paper web to shrink normally, a condition will result wherein the paper web will be more nearly equal in strength in both directions—a most desirable result.

The principal object of my invention is to provide a microvariable mechanism which is capable of extremely fine adjustments by almost infinitesimal increments, independent of the rotational speeds at which the drive is operating. My microvariable drive, therefore, makes it possible to obtain the required fineness of adjustment necessary to provide a progressive difference in peripheral speeds of the several drier cylinders, from the first to the last, to allow for the proper shrinkage of the paper web and thus prevent orientation of the fibers in the machine direction.

Other objects are simplicity in construction and operation and economy in manufacture. Further objects will appear in the following specification and are shown in the accompanying drawings in which similar reference numerals refer to like parts in all of the views.

Fig. 1 is a vertical cross sectional view of one embodiment of my invention and is taken on a line 1—1 of Fig. 4.

Fig. 2 is a detail view of a modification in the hub arrangement.

Fig. 3 is a detail sectional view of the rim in Fig. 1 showing the tapered rings in a different relation.

Fig. 4 is a side elevation of the embodiment of my invention shown in Fig. 1.

Fig. 5 is a partial side elevation of another embodiment of my invention. In this view the flanged ring at the right of Figs. 6 and 7 is omitted to show the construction more clearly.

Fig. 6 is a sectional view of the rim and is taken on a line 6—6 of Fig. 5.

Fig. 7 is a sectional view of the rim and is taken on a line 7—7 of Fig. 5.

Fig. 8 is a diagrammatic view intended to illustrate the operation of the embodiment of my invention shown in Figs. 1 and 4.

Fig. 9 is a diagrammatic view illustrating the use of silent chain in connection with the embodiment shown in Figs. 5, 6 and 7.

Fig. 10 is a diagrammatic view illustrating the use of gears in connection with the embodiment shown in Figs. 5, 6 and 7.

In the drawings, 1 is the shaft on which a drier cylinder 2 is revolvably mounted. A spider or hub member 3 constituting a drive receiving member is keyed on the end of the shaft 1 and has a plain rim 4 on which are mounted the axially slidable steel rings 5 having oppositely tapered faces. Mounted in pockets 6 in the rim 4 are the axially parallel shafts 7 revolvable in and held against axial movement by the bearing bosses 8 in the pockets 6. These shafts are threaded right and left hand on either side of the bearing bosses 8 and one end of each shaft 7 projects outwardly and carries a worm wheel 9 keyed on. On the inner peripheries of the tapered rings 5 are securely fixed the threaded lugs 10 in positions registering with the threaded sections of the shafts 7. Clearly the simultaneous rotation of the shafts 7 will cause the two tapered rings 5 to move axially on the plain rim 4 either toward or away from each other depending upon the direction of rotation of the shafts 7. Meshing with worm wheels 9 are the worms 11 mounted in operating relation on the shafts 12 extending somewhat radially toward the center and on the inner ends of these shafts 12 are secured the worm wheels 13 which mesh with a worm 14 common to all of them. In Figs. 1 and 4 this worm 14 is shown integral with a sleeve 15 while in Fig. 2 it is regular.

In drier cylinders on paper machines it is necessary to provide steam for heating and also means for removing the condensate, usually thru the hollow end of the drier shaft 1. I accomplish this by providing a tube 16 which is firmly secured in the hollow end of the shaft 1 and which extends outwardly and terminates in a fixed casting 17. Steam is brought to this casting thru pipe 18 and the condensate is removed thru pipe 19. The construction is regular and therefore the details are not shown.

In Figs. 1, 4 and 5 I show a housing 20, attached to the face of the hub member 3, in which the central worm wheels 13 and the co-operating worm 14 are located. The end of the housing 20 is closed by the disc 21 which carries a bearing 22 designed to support the sleeve 15 and to take the thrust from the integral worm 14. The sleeve 15 is revolvable on the tube 16 and extends outward thru the disc 21 and carries a sprocket wheel 23 which is driven by the chain belt 24 from a motor 25.

In drying cylinders or rolls which do not require heating, such as the upper press rolls of paper machines, the motor mounting shown in Fig. 2 may be used. Here a standard flanged motor 26 is attached to the houseing 20 and a standard worm 27 is mounted on the armature shaft in proper position to mesh with the central worm wheels 13. Current is brought to the revolving motor 26 thru wiring and the usual collector rings 28.

The foregoing embodiment of my invention contemplates the use of my driving chain as covered by my U. S. Patent No. 1,997,284 dated April 9, 1935, which will operate on an infinite number of pitch diameters and is designed to run on the tapered rings 5. Fig. 8 illustrates the operation as follows. The tapered rings 5 on my unit driving the first drier cylinder are widely separated, as in Fig. 1, which allows the chain 29 to run on a pitch diameter toward the bases of the rings—practically the minimum pitch diameter. At each succeeding drier cylinder the rings 5 are moved toward each other by extremely small increments by running the motors successively for a limited time which has the effect of progressively slowing down the drier cylinders just enough to allow for the proper shrinkage of the paper web. The position of the chain at the last drier cylinder at the right of Fig. 8, and as illustrated in Fig. 3, is toward the outer periphery of the rings 5 which have moved to their closest positions, thus causing the chain to run on its maximum pitch diameter at which time the corresponding drier cylinder is running at its slowest speed relative to the preceding cylinders. In practice the difference between the minimum and maximum pitch diameters will be sufficient to provide for the greatest amount of shrinkage in the paper web that may occur at the drier section of the paper machine. Any desired pitch diameter, of the infinite number available, is obtained and maintained by simply stopping the motor when that pitch diameter is reached.

In order to make it possible to use a driving chain of standard make, I show a modification in the rim design in Figs. 5, 6 and 7. Instead of the tapered rings 5 I use an annular ring 30 having sprocket teeth on its outer periphery and gear teeth on its inner periphery. This ring 30 is revolvable on the rim 4a which has an annular recess 32 to accommodate the internal teeth. One flange 33 is removable to permit assembling of the parts. Instead of the threaded shafts 7 I provide similar shafts 7a with integral pinions 35 meshing with the internal teeth of the annular ring 30. The worm wheels 9 are mounted on the outer ends of pinion shafts 7a and operate exactly as before described. This arrangement, using a "silent" chain 36, is illustrated in Fig. 9. However, in this case, the variation is a continuing process and will follow the speed of the variable speed motors 25 and 26. The higher the motor speed the greater the amount of variation obtained. The progressive variation in the successive drier cylinders is therefore obtained by operating each of the several motors progressively at a slightly higher speed than the preceding one.

Similarly, we may regard the teeth on the outer periphery of the annular ring 30 as gear teeth which may mesh with the teeth on annular rings in adjacent units as shown in Fig. 10. Since each of the drier cylinders equipped with my microvariable unit is operating at a slightly reduced speed with respect to the preceding one, there can be no snubbing action and the paper web will be free to shrink proportionately between any two of the lower cylinders driven by my microvariable units. In practice the chain 36, Fig. 9, is driven by drive pinion 37 at a speed which is properly related to the other parts of a papermaking machine as is customary in the art. In Fig. 10 the gear train, comprising the gears 30, is driven by pinion 38. Similarly the chain 29 of Figs, 1, 3 and 8 is driven by a driving sheave, not shown.

The operation of my invention has been made clear in the foregoing. The extremely fine adjustments required to allow for the relatively small shrinkage of the paper web between any two adjacent drier cylinders is made possible in applicant's microvariable mechanism by the compounding of mechanical elements having very high speed-reducing characteristics.

Claims to the arrangement according to Figs. 5, 6 and 7 are made in my copending application Serial No. 183,745 filed January 7, 1938.

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

1. In a nest of positively driven paper drier cylinders, supporting shafts or trunnions for said cylinders, co-axial drive receiving members respectively secured to said cylinders for the purpose of driving same and including a pair of opposed, tapered sheave members adapted to receive between them a drive chain, a drive chain for driving the cylinders of the nest through said members, said sheave members of at least some of said drive receiving members being capable of simultaneous movement toward and away from each other by equal increments, screw devices for accomplishing said movement, and means for actuating said screw devices comprising a driven member concentric with its drier cylinder, driving means for said driven member and a plurality of drive shafts operatively connecting said driven member with said screw devices whereby the effective diameter of such drive receiving member can be varied to produce minute variations in speed of a cylinder to which it is connected to compensate for shrinkage of the paper in drying

2. The combination of elements according to claim 1 including means for heating said cylinders.

3. The combination of elements according to

claim 1 in which said driving means for said driven member is comprised of an electric motor attached to and mounted concentrically of said drive receiving member.

4. The combination of elements according to claim 1 in which said driven member is comprised of a sleeve, such combination of elements further including a pipe passing through said sleeve for introducing heating fluid within the drying cylinder.

MILTON T. WESTON.