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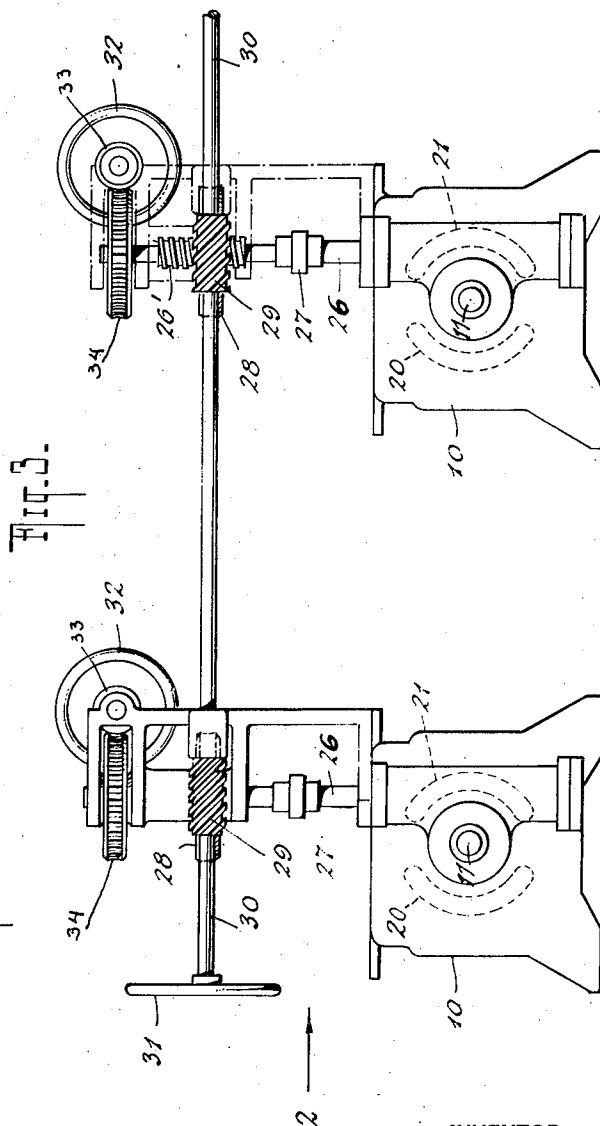
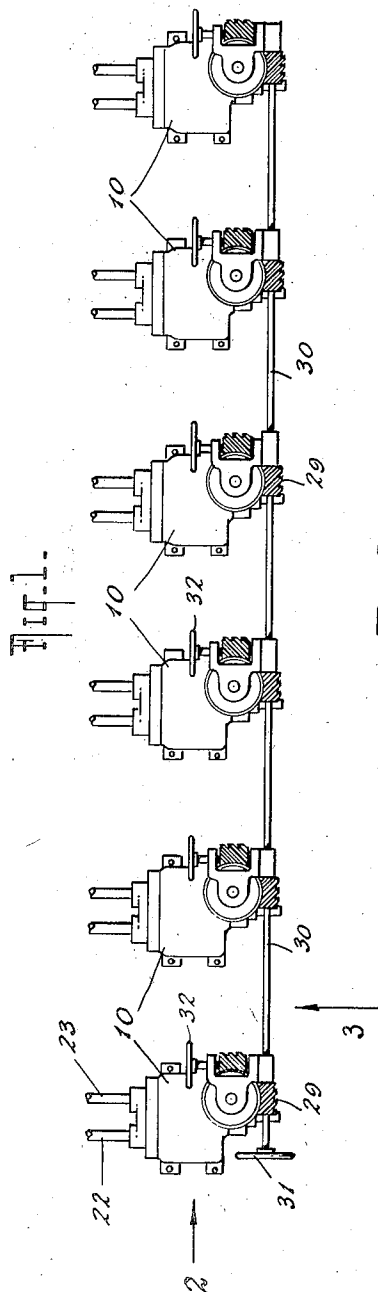
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ADJUSTING DEVICE FOR VARIABLE SPEED DRIVING MECHANISMS

Filed Sept. 1, 1926

2 Sheets-Sheet 1



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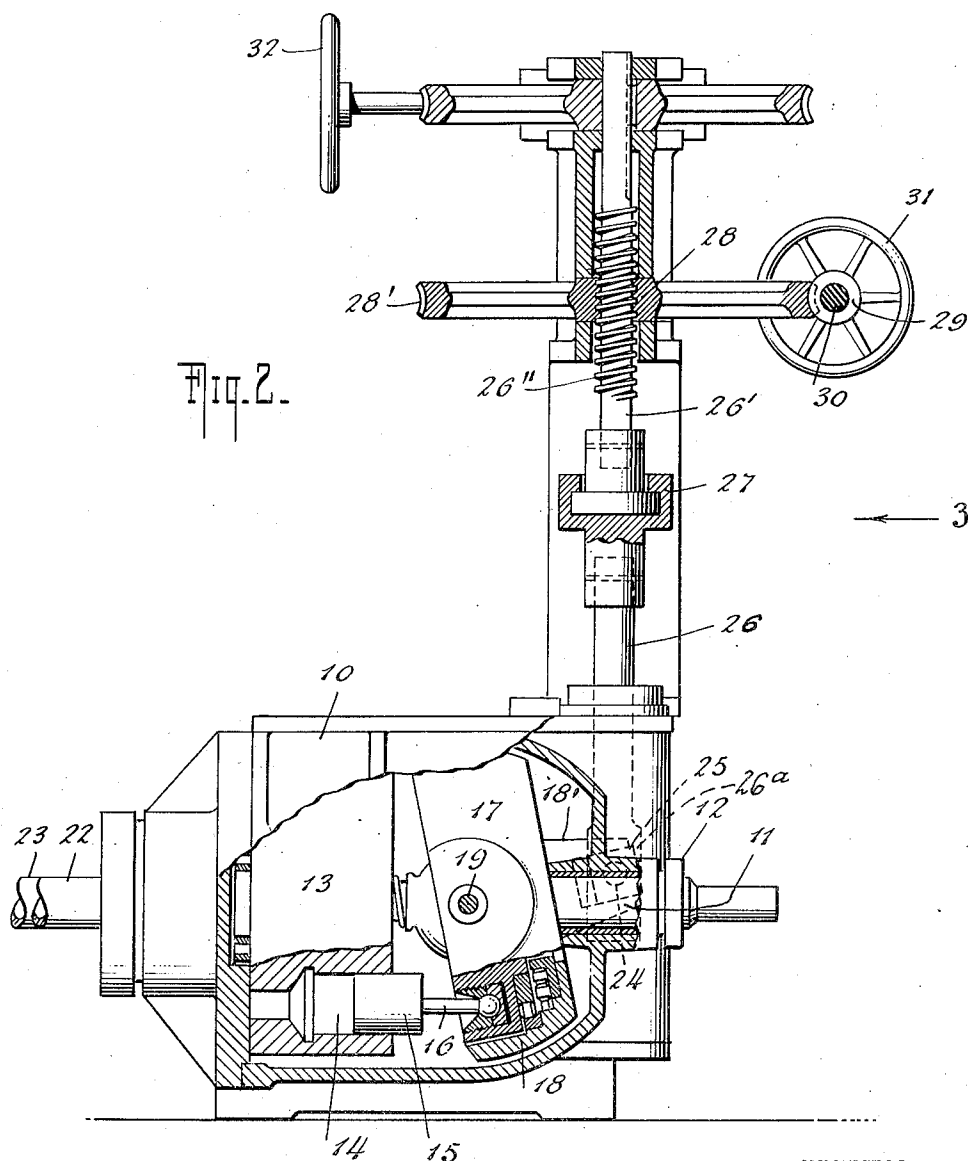
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UNITED STATES PATENT OFFICE.

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ADJUSTING DEVICE FOR VARIABLE-SPEED DRIVING MECHANISMS.

Application filed September 1, 1926. Serial No. 132,914.

My invention relates to plants comprising a plurality of machines each having its own driving mechanism yet normally operated simultaneously. For instance, in paper making plants the material under treatment is in continuous motion and passes successively from one of a series of machines to the next. In plants of this character, it is desirable that provision should be made for adjusting the speed of all the machines simultaneously and preferably equally, and that there should also be a separate provision for adjusting the speed of any one of such machines individually, without affecting the speed of the other machines. It is further important, in many cases, that both the individual speed adjustment and the simultaneous speed adjustment of all the machines should be of such character as to enable the changes or variations to be made very gradually. Hydraulic drives are particularly suitable for obtaining very gradual changes of speed and accurate adjustments. I prefer to use, for the purposes of my invention, hydraulic gears or driving mechanisms of the type manufactured by The Waterbury Tool Company and disclosed in various patents, for instance United States Letters Patent of Harvey D. Williams No. 925,148 dated June 15, 1909 and No. 1,044,838 dated November 18, 1912.

A satisfactory and preferred embodiment of my invention is illustrated by the accompanying drawings, in which Fig. 1 is a plan view of a multiple unit drive provided with my duplex speed adjusting device; Fig. 2 is an elevation of one of the units shown in Fig. 1, looking in the direction of the arrow 2 in Figs. 1 and 3, with parts in section; and Fig. 3 is an elevation of two of said units, looking in the direction of the arrow 3 in Figs. 1 and 2, with parts in section.

At 10 I have indicated a plurality of pumps of the character of those disclosed in the Williams patents referred to above. Each pump comprises a suitable casing in which is journaled the shaft 11 driven continuously by any suitable mechanism (for instance, an electric motor, not shown) connected with such shaft, as by a clutch indicated at 12, or in any other suitable manner. With this shaft rotates the barrel 13 having longitudinal cylinders 14 in which are adapted to reciprocate the pistons 15 connected by rods 16 with a swash plate 17

adapted to be placed either perpendicular to the shaft 11, or at an angle thereto, by rocking the race or track 18 of said swash plate about an axis 19 transverse to said shaft, all according to the principles disclosed in the patents referred to above. The swash-plate is connected with the shaft so as to rotate in unison therewith. The ends of the cylinders 14 opposite to the swash plate have ports adapted to communicate alternately, during the rotation of the barrel, with two segmental ports 20, 21, in the end plate of the pump casing, one of these ports being a suction port and the other a delivery port, their functions depending on the direction in which the barrel rotates. By pipes 22, 23 said ports are connected with corresponding ports in a fluid motor of the same general construction as illustrated for the pump, except that in such motor the swash plate race (corresponding to the race 18) is preferably stationary, at a fixed angle or inclination to the motor shaft. The general operation of such devices is well known, so that a brief explanation will suffice. If the swashplate 17 rotates in a plane perpendicular to the pump shaft, the pistons 15 will not reciprocate, and there will be no flow of the oil or other liquid through the pipes 22, 23, and the motor adapted for operation by such fluid will remain at rest. If, however, the swashplate race 18 is inclined, the pistons 15 will be caused to reciprocate so that the fluid will pass out through one of the pipes 22 or 23, operate the fluid motor and return to the pump through the other pipe 23 or 22. The greater the inclination of the race 18, the greater will be the velocity of the fluid in the circulation path, and the greater the speed of the motor operated by the fluid propelled by the pump. The inclination of the race 18 is adjusted, for instance, by providing thereon, to one side of the shaft 11, a fork 18' into which fits slidably a block 25 provided with a pin 24 projecting as a pivot into a vertically guided slide 26^a at the lower end of a rod 26. The latter is connected with an aligning rod 26' by a joint 27 of such character that the two rods are compelled to move lengthwise in unison, but the rod 26' will be allowed to rotate independently of the rod 26, the latter having only a longitudinal motion.

Two separate mechanisms are provided

for operating the rods 26' of the several devices in such a manner as to move the slides 26^a lengthwise to vary the inclination of the corresponding swashplate races 18.

5 One of these mechanisms is constructed to adjust all the slides 26^a in unison, while the other mechanism provides for the individual adjustment of each of the slides, or more strictly speaking, there are as many of individual mechanisms of this second kind as
10 there are individual machines to be controlled. In the embodiment illustrated, each of the rods 26' is made with a screw thread 26'' in engagement with a corresponding internal thread on a member 28, held against
15 axial movement and here shown as the hub portion of a wheel provided at its periphery with worm teeth 28' in mesh with a worm 29, the worms of the several machines or units being in axial alignment and mounted rigidly on a shaft 30 common to all of them. This
20 shaft is normally stationary, but may be rotated by means of a hand wheel 31, or in any other suitable manner. Each of the rods 26' is also adapted to be rotated individually, for instance by means of a handwheel 32 which as shown is adapted to rotate the rod through a second worm 33 and worm wheel 34 or which may be secured to such rod
30 rigidly, or at least held to turn therewith.

By turning the handwheel 31, all the worms 29 (which are alike in construction, as are also the several other parts of the units) are rotated to turn all the worm
35 wheels 28, 28' with equal effect. As the said worm wheels are held against axial movement, the rotation of the hub portions or nuts 28 will cause the rods 26' to move lengthwise or axially, the threads 26'' on
40 said rods and those on the nuts 28 being of proper pitch to insure such action. By this operation, therefore, the swashplate races 18 of the several units will be adjusted equally in unison and all the machines operated by said units will be given at least
45 approximately the same speed. When it is found that to obtain the proper operation, one of the machines should be speeded up or slowed down relatively to the others, the
50 handwheel 32 of the respective unit is turned in one direction (for greater speed) or the other (if speed reduction is desired). Since the nuts 28 are held stationary by the considerable resistance of the gearing 28', 29, turning any one of the rods 26' will screw
55 it up or down in its nut 28, and thus, for that one unit only, the inclination of the swashplate race 18, will be altered to increase or decrease the speed of the particular machine controlled by such unit. A very
60 fine and accurate adjustment of the speed of the individual machines is thus obtainable, so as to cause each of them to run at the exact speed required for their proper co-operation.

While I have described the driving units as pumps of variable output, it will be obvious that the same results might be obtained by applying the duplex adjusting mechanism illustrated, to the motors actuated by the fluid propelled by pumps of the character above referred to. In this case, the velocity of the liquid circulating through pump and motor would be constant or practically so, but the motors would run
70 faster or slower according to the smaller or greater inclination of their swashplate races. In fact, the accompanying drawings may also be interpreted as illustrating this alternative mode of using my invention, if the
80 units 10 are taken as representing motors, receiving liquid from a suitable pump or pumps (not shown) through one of the pipes 22, 23 and returning such liquid through the other pipe. The shaft 11 would
85 in this case be the motor shaft transmitting power, as through the clutch 12, to the shaft of the machine to be operated by such motor.

Various modifications may be made without departing from the nature of my invention as set forth in the appended claims.

I claim:

1. An adjustable drive for a plurality of machines, comprising a plurality of driving units of the type in which a circulating
95 liquid is used for the transmission of power and in which there is employed a swashplate of adjustable inclination to vary the speed at which the respective machine is driven, a slide for each of said units, each slide having
100 operative connections to adjust the inclination of the respective swashplate, a screw rod connected with such slide to be rotatable relatively thereto but compelled to move lengthwise in unison therewith, normally stationary
105 nuts held against longitudinal movement and engaging the respective screw rods, means for rotating said screw rods individually, and mechanism, operatively connected with a plurality of said nuts, for rotating
110 them in unison.

2. An adjustable drive for a plurality of machines, comprising a plurality of driving units of adjustable effect, a slide for each of said units, mechanism associated with said
115 slide to vary the driving effect of such unit as said slide is moved, a screw rod connected with such slide to be rotatable relatively thereto but compelled to move lengthwise in unison therewith, normally stationary nuts
120 held against longitudinal movement and engaging the respective screw rods, means for rotating said screw rods individually, and mechanism, operatively connected with a plurality of said nuts, for rotating them in
125 unison.

3. An adjustable drive for a plurality of machines, comprising a plurality of driving units of adjustable effect, a slide for each of said units, mechanism associated with said
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slide to vary the driving effect of such unit as said slide is moved, a screw rod connected with such slide to be rotatable relatively thereto but compelled to move lengthwise in unison therewith, normally stationary worm wheels held against longitudinal movement and formed at their hub portions as nuts engaging the respective screw rods, means for rotating said rods individually, and a shaft provided with worms engaging a plurality of said worm wheels.

4. A drive for a plurality of machines or sections of a machine, comprising a plurality of driving units, one for each machine or section, each of said units being of the type wherein a circulating liquid is used for the transmission of power and wherein an adjusting device is provided for regulating its speed, characterized by the provision of a manually operable control for actuating each adjusting device independently of the others, each control including a rotatable but normally stationary nut and a manually operable control shaft in screwthreaded engagement with said nut and connecting with said adjusting device and means for actuating all of said adjusting devices simultaneously and in unison including a shaft common to all of said driving units and driving connections between said shaft and said nuts.

In testimony whereof I have hereunto set my hand.

HARRY P. FOWLER.