April 9, 1929. C. L. HENDERSON 1,708,270

SECTIONAL PAPER MACHINE DRIVE

Filed Dec. 20, 1926 3 Sheets-Sheet 1

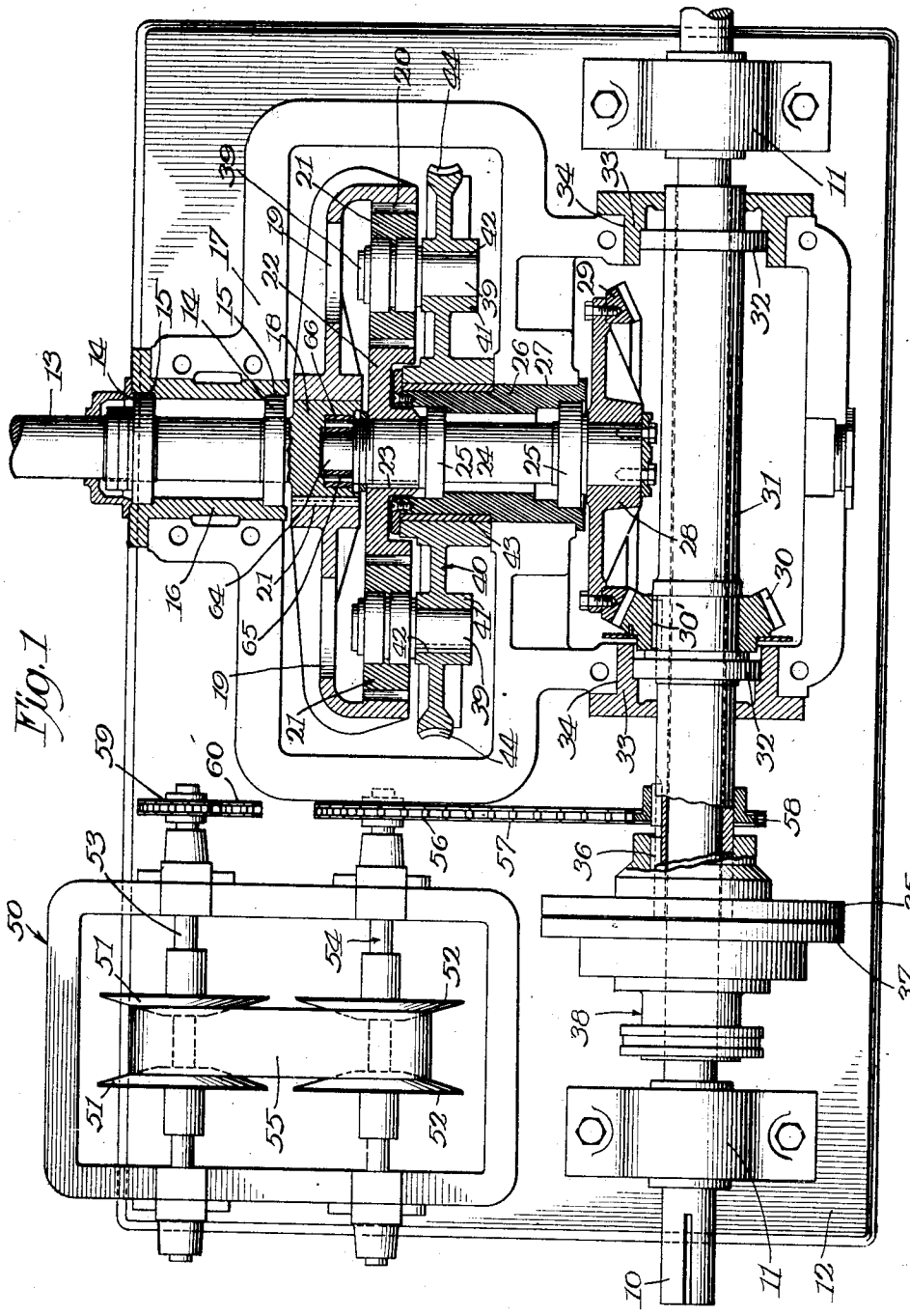


Fig. 1

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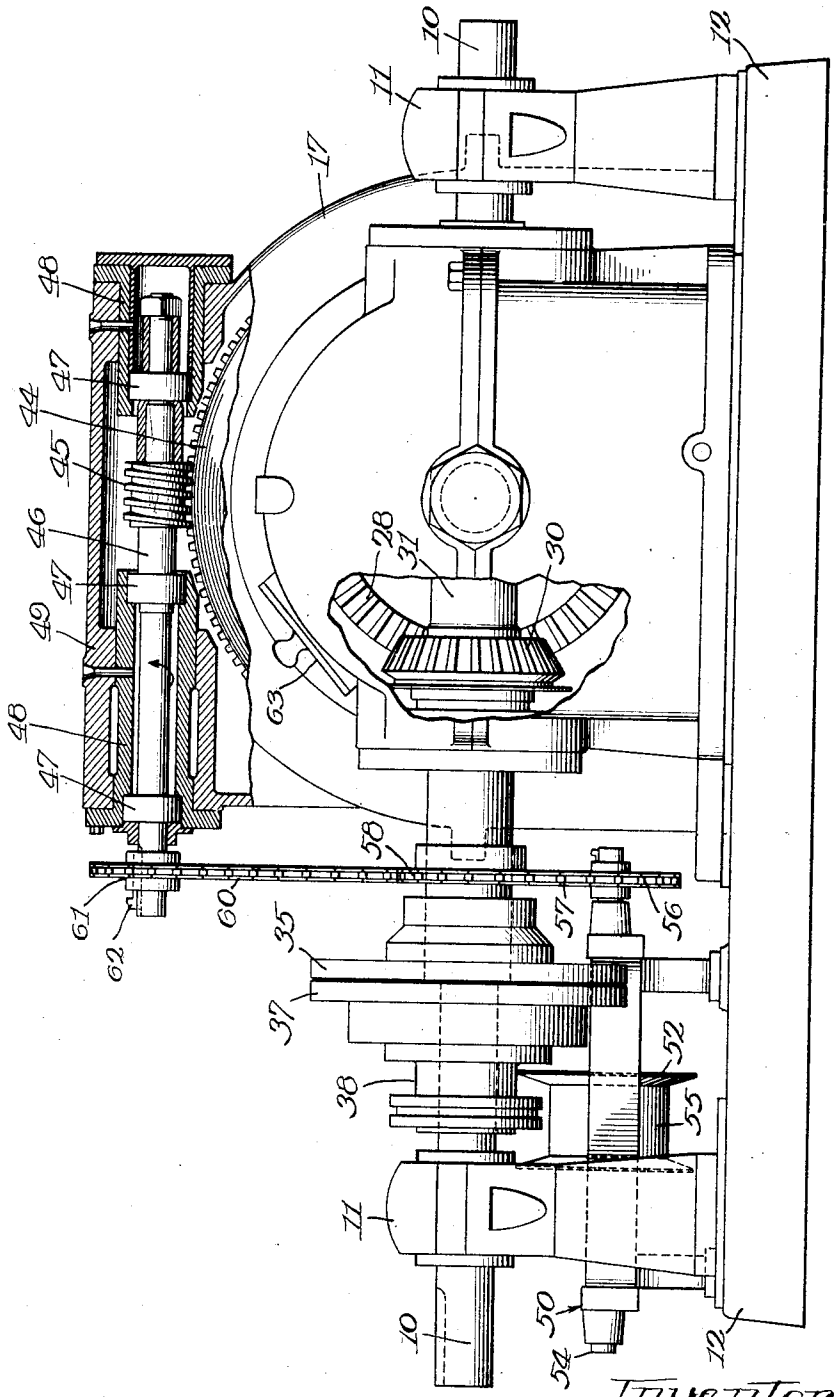


Fig. 2

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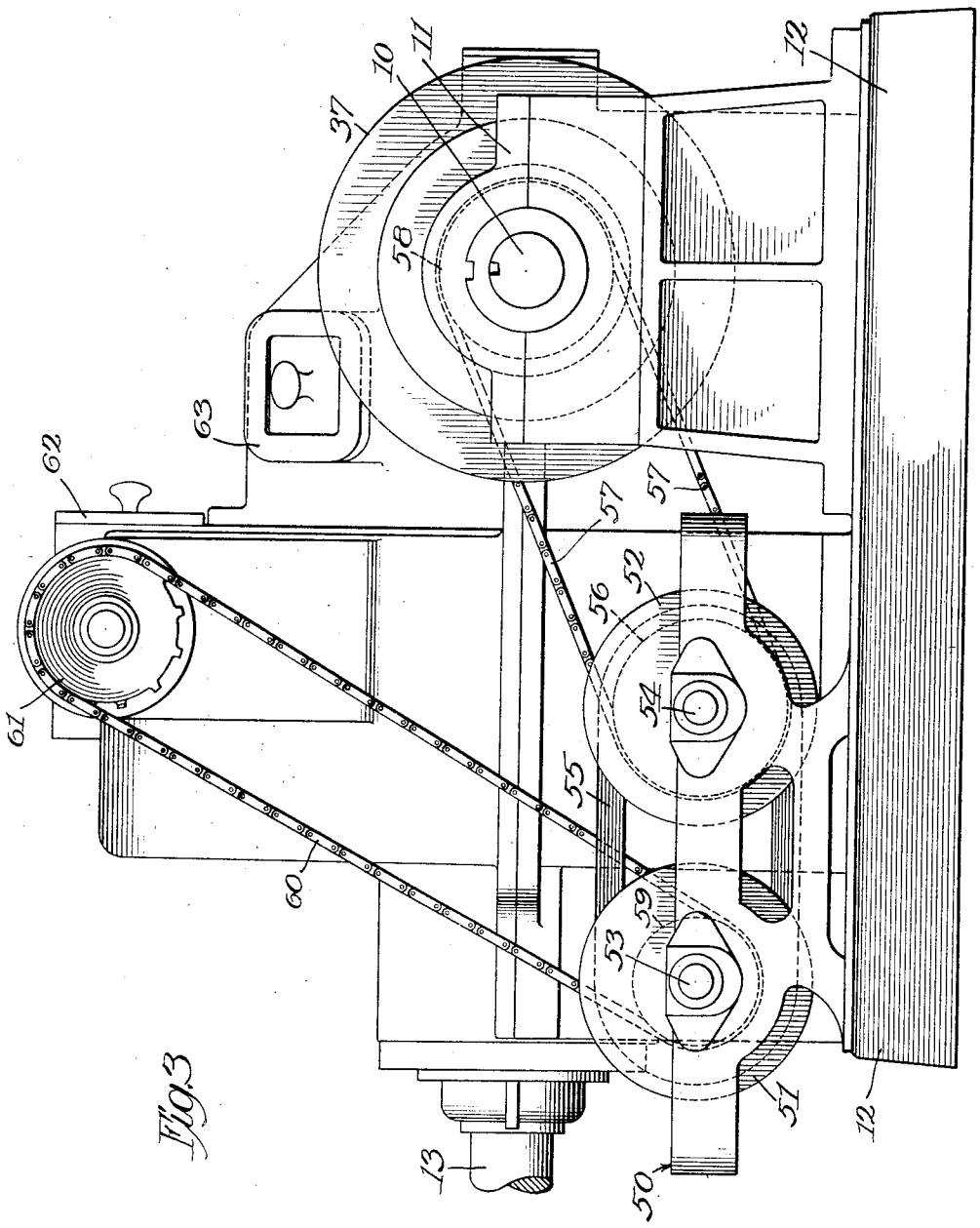


Fig. 3

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UNITED STATES PATENT OFFICE.

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SECTIONAL PAPER-MACHINE DRIVE.

Application filed December 20, 1926. Serial No. 155,995.

This invention relates to sectional paper machine drives, and more particularly to drives which are adapted to use in connection with paper machines, to enable correlation of the speed of various sections of such machines to be more easily and accurately accomplished.

The objects of the invention are to provide an efficient mechanical drive of the class described; to provide a drive which is capable of effecting accurate adjustment or variation of the driven speed; to provide means which will be compact and will consequently require a minimum of floor space; to provide such means, of which a plurality may be simultaneously driven from a common power shaft, and each of which will be independently adjustable so as to control the respective sections of a machine to which they are connected; and further to provide a mechanical drive of the class described, of which a plurality may be driven from a common power shaft, and which may be compactly arranged relative thereto, and in general, to provide an improved drive for paper machines.

Other objects and advantages of the invention will be understood by reference to the following specification when considered in connection with the accompanying drawings, illustrating a selected embodiment of my invention, and in which:

Fig. 1 is a plan section.

Fig. 2 is a side elevation partly in section, and

Fig. 3 is an end elevation of the left-hand end of Fig. 1.

Referring now to the drawings, I have indicated at 10 a power or drive shaft, which may, for the moment, be considered to be a long shaft extending substantially the entire length of a paper machine, and from which shaft the various sections of a paper machine such as the couch, the presses, driers, and the calender may be driven.

According to the present invention, the shaft 10 is journaled in suitable bearings 11 on the base member 12, which base member is adapted to support mechanism for transferring power from the shaft 10 to one of the sections of a paper machine.

A driven shaft is indicated at 13 and is adapted to be directly connected to a roll or other driven element of one of the sections of the paper machine. The shaft 13 is journaled in suitable bearings 14, which are supported in suitable seats 15 in a bushing 16, which bushing is supported in the housing 17. The inner end of the shaft 13 is provided with an enlargement 18 on which is seated an internal gear member 19, which is provided with an internal ring gear 20. The member 19 is keyed to the enlarged end 18 as at 21, so as to rotate therewith.

The internal ring gear 20 is a part of a planetary gear mechanism which includes in addition to the ring gear, a plurality of pinion gears 21 and a sun gear 22. The sun gear 22 is keyed as at 23 to the inner end of a shaft 24, which is journaled in suitable bearings 25 in a bearing sleeve 26, which is supported in a seat 27 provided in the housing 17 for that purpose. The inner end of the shaft 24 is provided with a reduced extension 64, which is supported by means of a suitable bearing such as a roller bearing indicated at 65 in the recess 66, in the enlarged end 18 of the driven shaft 13.

To the outer end of the shaft 24, a bevel gear member 28 is fastened, and this bevel gear member is provided with a removably mounted bevel ring gear 29. The gear 29 meshes with another bevel gear 30, which is keyed to a sleeve 31 by means of a key 30′, and the sleeve 31 is disposed about said driving shaft 10 and is journaled in suitable bearings 32, which are supported by cap members 33. The cap members 33 are mounted in seats 34 provided in the housing 17. It will be noted that the sleeve 31 is rotatably journaled in bearings 32, whereby excessive friction and wear on the shaft 10 is avoided, since the sleeve does not bear directly on the shaft. The sleeve 31 is provided at its left-hand end (Fig. 1) with a clutch member 35, which is keyed thereto by means of a key 36. The clutch member 35 is adapted to be engaged by another member 37, which is keyed to the drive shaft 10, so as to rotate therewith, but is slidable axially thereof. The clutch member 37 is provided with a groove 38, which is adapted to be engaged by a suitable collar for effecting engagement or disengagement of the clutch in a well known manner, and which mechanism is not illustrated in the drawings, since it is believed to be well known and understood by those skilled in the art. The clutch 35—37 is preferably of the magnetic type, although it may be of any other desirable type of friction or positive clutch.

When the clutch members 35 and 37 are

engaged as shown in the drawings, and the shaft 10 is driven by any suitable source of power, the shaft 24 is rotated through the bevel gear driving connection 29—30 and rotation of the shaft 24 is imparted to the driven shaft 13, through the medium of the sun gear 22, planetary pinions 21 and the ring gear 20. The planetary pinions 21 are rotatably mounted on stub shafts 39, which are carried by a spider 40, the stub shafts 39 being securely mounted in suitable bosses 41 in the spider and keyed thereto as indicated at 42 so as to be held against rotation. The spider 40 is rotatably mounted on the bearing sleeve 26, a bushing 43 being provided to facilitate rotation of the spider and to prevent excessive wear on the spider or bearing sleeve. It will be observed that if the spider 40 is held stationary so that the planetary pinions 21 are held in fixed position, the rotation of the sun gear 22 will be transferred through the pinions 21 to the ring gear 20 in accordance with the ratios of the pitch diameters of the gears. It will further be observed that if the spider 40 is rotated in either direction so that the pinion gears 21 are revolved about the shaft 24, as well as rotated on the stub shafts 39, the speed of rotation of the ring gear 20 will be increased or decreased, according to the direction in which the pinions are revolved about the shaft 24, it being assumed that the sun gear 22 is always driven in one direction.

The speed of rotation of the driven shaft 13 may thus be controlled by controlling the pinion carrying spider 40, that is, by holding the spider stationary or by rotating the same, at various speeds. For controlling the spider 40, I have provided a worm wheel 44 around the outer edge of the spider 40, and this worm wheel is engaged by a worm gear 45 secured on a shaft 46, and which shaft is journaled in suitable bearings 47, which are seated in tubular sleeves 48—48 positioned in opposite ends of the cross head portion 49 of the housing 17. The bearing 47 at the right hand end of the shaft 46, (Fig. 2) may conveniently be a suitable type of bearing which is adapted to support the shaft 46 in properly aligned position, and also to take up end-thrust on the shaft 46, resulting from the resistance of the worm wheel 44 to rotation in a counter-clockwise direction as viewed in Fig. 2.

The shaft 46 is adapted to be rotated, and rotation thereof will obviously impart rotation to the spider 40, through the driving connection between the worm gear 45 and worm wheel 44, and by providing means for rotating the shaft 46 at variable speeds, I am able to correspondingly control the speed of rotation of the spider 40, and consequently the speed of rotation of the driven shaft 13. For the purpose of rotating the shaft 46 at variable speeds, I provide a variable speed drive, indicated at 50, and which comprises two pairs of oppositely facing cone pulleys 51 and 52, which are slidably mounted on their respective shafts 53 and 54. A belt 55 is trained over the said pairs of pulleys and is provided with suitable beveled edges to engage the angular faces of the cone pulleys at any point across their said faces.

Assuming that the shaft 54 is driven from a suitable source of power, and that the shaft 53 is driven through the belt 55, it will be noted that the speed of rotation of the shaft 53 will be dependent upon the effective diameter of the respective pulleys 51 and 52. If the pulleys 52 be spread apart, and the pulleys 51 brought closer together, it will be obvious that the speed of the shaft 53 will be accordingly reduced, and vice versa. Suitable mechanism may be provided in accordance with well known practice for effecting spreading of one pair of pulleys and corresponding contraction of the other pair, and which mechanism forms no part of the present invention, and therefore, is not illustrated. In the present instance, I drive the shaft 54 by means of a sprocket 56 secured thereto, and a chain 57 threaded thereover, and over another sprocket 58, which is keyed to the sleeve 31, which sleeve is driven as above explained. To the shaft 53 of the variable speed drive 50, is secured a sprocket 59, over which is threaded a chain 60, which chain is also threaded over another sprocket 61 keyed to the end of said shaft 46 by means of a key 62. It will be apparent that by varying the speed of the shaft 53 of the variable speed control 50, I am able to control the speed of rotation of the shaft 46 and parts driven and controlled thereby, and as above explained, thereby control the speed of rotation of the driven shaft 13.

In the present embodiment of my invention, I prefer to enclose the planetary gear mechanism and driving gears 29—30 in a housing which completely encloses the said mechanism, and which is adapted to contain a quantity of lubricating oil, so that the various operating parts may be constantly well lubricated so as to facilitate operation of the device. The housing is provided with suitable ports as indicated at 62 and 63, through which oil may be poured into the housing.

The base 12 is adapted to support the housing 17 and contained mechanism, as well as the variable speed control device 50, whereby the complete device may be assembled as a single unit. The shaft 10 which is journaled in bearings 11, also supported by the base 12, is preferably of such a length that end portions thereof will project outside of the bearings 11, and which projecting ends may be provided with suitable means for connection to the adjacent end of a driven shaft aligned therewith, or which may be provided with a pulley or sprocket or other means, so that the

shaft 10 may be driven from another shaft running parallel thereto.

The arrangement above described results in a compact unit which affords effective and accurate control of the driven shaft 13 and mechanism connected thereto. By means of the unit construction, I am able to quickly substitute a new unit for an old one which has become defective, whereby tie-ups of such machines as paper machines for a long period of time may be averted.

I am aware that changes in the arrangement and construction of parts may be readily made without departing from the spirit of the invention as defined by the following claims, which should be construed as broadly as possible consistent with the state of the art.

I claim as my invention:

1. In a device of the class described, the combination of a pair of coaxial shafts, planetary gear mechanism connecting said shafts whereby one is operative to drive the other, a housing enclosing said shafts and planetary mechanism, a drive shaft, bearings for supporting said drive shaft, a sleeve disposed about said drive shaft, bearings for supporting said sleeve independently of said drive shaft, means for operatively connecting said sleeve and drive shaft, means for operatively connecting said sleeve and one of said coaxial shafts, and means for controlling the driving effect of said planetary gear mechanism.

2. In a device of the class described, the combination of a pair of coaxial shafts, planetary gear mechanism connecting said shafts whereby one is operative to drive the other, a housing enclosing said shafts and planetary mechanism, a drive shaft, bearings for supporting said drive shaft, a sleeve disposed about said drive shaft, bearings for supporting said sleeve independently of said drive shaft, means for operatively connecting said sleeve and drive shaft, means for operatively connecting said sleeve and one of said coaxial shafts, and a base member for supporting said housing and all of said bearings whereby the device is adapted to be handled as a complete unit.

3. In a device of the class described, the combination of a pair of coaxial shafts, planetary gear mechanism connecting said shafts whereby one is operative to drive the other, a housing enclosing said shafts and planetary mechanism, a rotatably mounted drive shaft, a sleeve disposed about said drive shaft and rotatably mounted independently of said drive shaft, means for operatively connecting said sleeve and said drive shaft, means for operatively connecting said sleeve and one of said coaxial shafts, a variable speed mechanism having a variable speed driven shaft, means for driving said variable speed mechanism from said drive shaft, and means connecting said variable speed driven shaft and said planetary mechanism so as to control the driving effect of the latter and whereby the speed of said driven shaft is variable.

4. In a device of the class described, the combination of a pair of coaxial shafts, planetary gear mechanism connecting said shafts whereby one is operative to drive the other, a housing enclosing said shafts and planetary mechanism, a rotatably mounted drive shaft, a sleeve disposed about said drive shaft and rotatably mounted independently of said drive shaft, means for operatively connecting said sleeve and said drive shaft, means for operatively connecting said sleeve and one of said coaxial shafts, a variable speed mechanism having a variable speed driven shaft, means for driving said variable speed mechanism from said drive shaft, means connecting said variable speed driven shaft and said planetary mechanism so as to control the driving effect of the latter and whereby the speed of said driven shaft is variable, and a base member for integrally uniting and supporting all of said elements whereby the device is adapted to be handled as a unit.

5. In a device of the class described, the combination of a base, a pair of coaxial shafts, bearings on said base for rotatably supporting said shafts, planetary gear mechanism connecting said shafts whereby one is operative to drive the other, a drive shaft, a sleeve disposed about said drive shaft, bearings on said base for independently supporting said drive shaft and sleeve, a gear train operatively connecting said sleeve and one of said coaxial shafts, a clutch for operatively connecting said sleeve and said drive shaft, and said drive shaft having end portions projecting beyond its supporting bearings and adapted to receive means for connecting said drive shaft to another power driven shaft.

6. In a device of the class described, the combination of a base, a housing on said base, a pair of coaxial shafts, means in said housing for rotatably supporting said shafts, planetary gear mechanism operatively connecting said coaxial shafts and whereby said shafts are capable of rotation relative to each other, and whereby one of said shafts is operative to drive the other, a drive shaft disposed at an angle to the axis of said coaxial shafts, bearings on said base for rotatably supporting said drive shaft, a sleeve disposed about a portion of said drive shaft, means in said housing for rotatably supporting said sleeve independently of said drive shaft, a gear train connecting said sleeve and one of said coaxial shafts whereby said sleeve is operative to drive said shaft, and clutch means for operatively connecting said sleeve and drive shaft.

7. In a device of the class described, the combination of a base, a housing on said

base, a pair of coaxial shafts, one of said shafts having its end journaled in the adjacent end of the other, means in said housing for rotatably supporting said shafts, planetary gear mechanism operatively connecting said coaxial shafts and whereby said shafts are capable of rotation relative to each other, and whereby one of said shafts is operative to drive the other, means for controlling the driving effect of said planetary gearing, a drive shaft disposed at an angle to the axis of said coaxial shafts, bearings on said base for rotatably supporting said drive shaft, a sleeve disposed about a portion of said drive shaft, means in said housing for rotatably supporting said sleeve independently of said drive shaft, a gear train connecting said sleeve and one of said coaxial shafts whereby said sleeve is operative to drive said shaft, and clutch means for operatively connecting said sleeve and drive shaft.

8. In a device of the class described, the combination of a pair of rotatably mounted coaxial shafts; a planetary gear mechanism connecting said shafts and comprising a sun gear and an outer gear mounted respectively on adjacent ends of said coaxial shafts, a planetary pinion meshing with both said sun gear and said outer gear, and a pinion carrying member mounted so as to be rotatable about the axis of said coaxial shafts; means for driving one of said coaxial shafts comprising a drive shaft, a sleeve disposed about said drive shaft and rotatable relative thereto, means for interlocking said sleeve and drive shaft whereby the shaft is operative to drive the sleeve, and meshing gear members mounted respectively on said sleeve member and the adjacent coaxial shaft; and means for rotating said pinion carrying means at a variable speed for controlling the driving effect of said planetary gear mechanism, said means including a gear member on said pinion carrying means, a second gear meshing with said gear member, a speed changing device, means for driving said device from said sleeve, and means for operatively connecting said speed changing device and said second gear.

9. In a device of the class described, the combination of a pair of rotatably mounted coaxial shafts; a planetary gear mechanism connecting said shafts and comprising a sun gear and an outer gear mounted respectively on adjacent ends of said coaxial shafts, a planetary pinion meshing with both said sun gear and said outer gear, and a pinion-carrying member mounted so as to be rotatable about the axis of said coaxial shafts; means for driving one of said coaxial shafts comprising a drive shaft, a sleeve disposed about said drive shaft and rotatable relative thereto, means for interlocking said sleeve and drive shaft whereby the shaft is operative to drive the sleeve, and meshing gear members mounted respectively on said sleeve member and the adjacent coaxial shaft; and means for rotating said pinion-carrying means at a variable speed for controlling the driving effect of said planetary gear mechanism, said means including a worm-wheel member on said pinion-carrying means, a worm-gear meshing with said worm-wheel member, a speed changing device, means for driving said device from said sleeve, and means for operatively connecting said speed changing device and said wormgear.

10. In a device of the class described, the combination of a main line power shaft for driving a plurality of machines and a variable speed drive for each of said machines comprising an intermediate shaft disposed at right angles to said line shaft, a third shaft in line with the intermediate shaft for driving said machine, means for positively driving said intermediate shaft from said line shaft comprising a sleeve on said main shaft, a clutch for rotatably connecting said sleeve to said shaft, gearing connecting said sleeve and intermediate shaft for transmitting rotation of the sleeve to the intermediate shaft, a gear on said intermediate shaft, a gear on said third shaft, an independently rotary controlling member coaxial with the intermediate shaft, a gear rotated by said controlling member and operative to transmit rotation between the gears on said intermediate and third shafts, and means for rotating said controlling member comprising a worm gear on the rotating member, a worm meshing with said worm gear and having its axis parallel with the main line shaft, and a variable speed drive mechanism connecting said worm to said sleeve for driving the worm.

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