June 19, 1928.

1,673,838

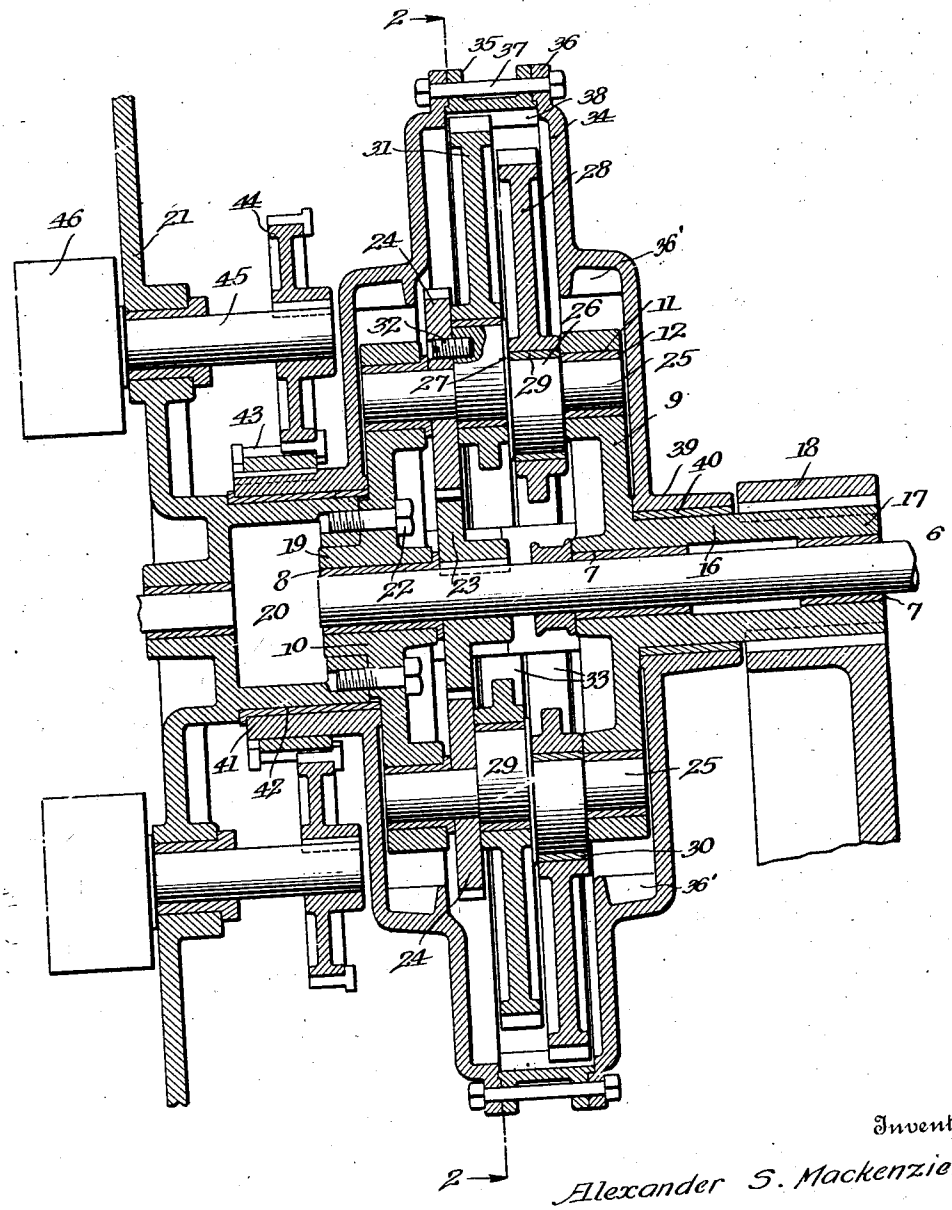
A. S. MACKENZIE

SPEED CHANGING MECHANISM

Filed July 9, 1925

3 Sheets-Sheet 1

Fig. 1.



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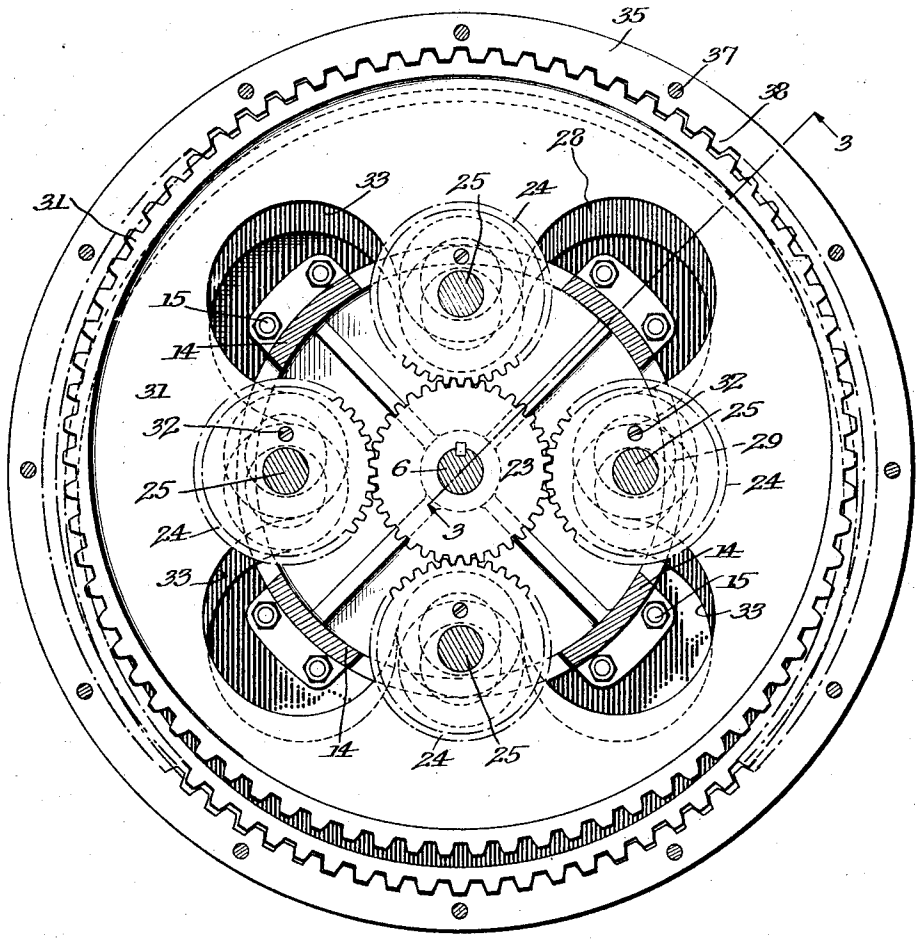
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Fig. 2.



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Fig. 3.

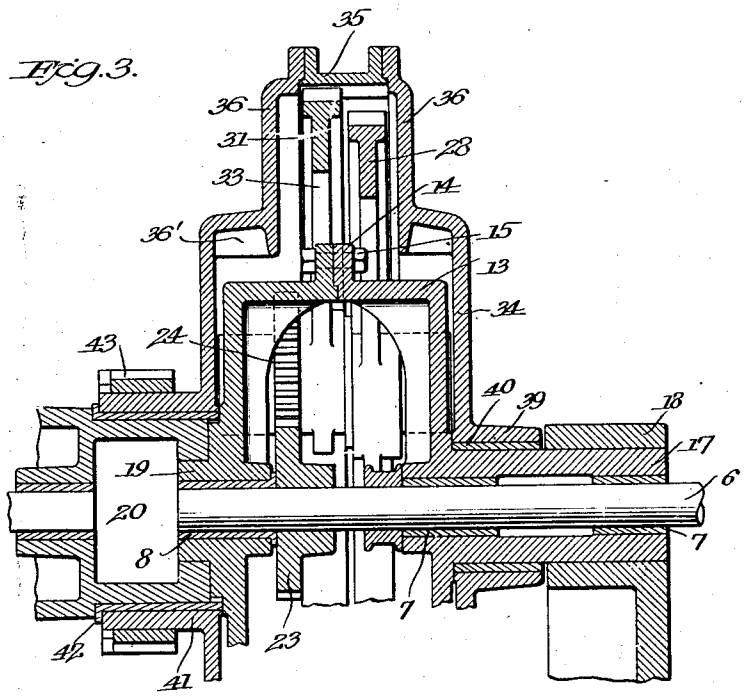
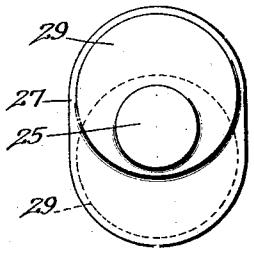


Fig. 5.



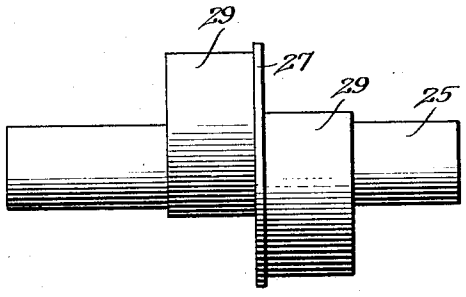


Fig. 4.

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UNITED STATES PATENT OFFICE.

ALEXANDER S. MACKENZIE, OF HOUSTON, TEXAS, ASSIGNOR TO CLAYTON GIN COMPRESS COMPANY, OF HOUSTON, TEXAS, A CORPORATION OF TEXAS.

SPEED-CHANGING MECHANISM.

Application filed July 9, 1925. Serial No. 42,491.

This invention relates to new and useful improvements in speed changing mechanisms.

An important object of the invention is to provide a speed changing mechanism which includes an arrangement of parts for effecting the proper balance of the device, equalizing the bearing pressure and reducing the amount of vibration which is prevalent and detrimental in devices of this type.

Another important object of the invention is to provide a speed changing mechanism wherein the drive can be taken off from either of two different points.

A further object of the invention resides in the provision of a device of the above character, which includes balanced gyrating members provided with eccentric means and driving means arranged with respect to the axes of the gyrating members as to effect perfect balance of the mechanism, and to cause all bearing and tooth pressures to act in a straight line at right angles to the axis of rotation, thereby eliminating tortion in line with the axis of rotation.

In the drawings, wherein for the purpose of illustration is shown the type of invention as at present preferred, and in which like numerals are employed to designate like parts throughout the several views:

Figure 1 is a longitudinal section through the mechanism.

Figure 2 is a transverse section taken on the line 2—2 of Figure 1.

Figure 3 is a fragmentary longitudinal section through the mechanism on the line 3—3 of Figure 2.

Figure 4 is a side elevation of one of the double eccentrics for driving the gyrating members, and

Figure 5 is an end elevation of the same.

Referring in detail to the drawings, the numeral 6 designates a driving shaft which is journaled in bushings 7 and 8 of supporting plates 9 and 10 constituting a cage. This cage comprises a pair of disc-shaped members which are each provided adjacent their peripheries with openings 11 arranged at points spaced equi-distant circumferentially thereof. Each opening 11 is provided with a suitable bushing 12. The openings in the two supporting members 9 and 10 are arranged in horizontal alignment as shown for a purpose which will be hereinafter described.

These supporting members 9 and 10 form the cage, since they are provided at diametrically opposite points with extensions 13, extending toward each other, which extensions are provided with interfitting flanges 14, having aligned apertures for the reception of bolts 15, for fastening the two supporting members together.

The supporting member 9 is equipped with an axially extending sleeve portion 16 which surrounds the driven shaft 6, and is mounted on the bushings 7. One end of this sleeve portion 16 is extended as at 17 to be mounted in a bracket 18 or any other suitable support.

The other supporting member 10 of the cage is equipped with a center bearing sleeve 19, which extends slightly to either side thereof. The outer end of this bearing fits snugly within an opening in a hub portion 20 of an end plate 21, of a round bale cotton press, or may be mounted in any other desirable manner. In the present illustration the supporting member 10 is adapted to remain stationary and is fastened to the hub portion 20 by machine screws 22.

A drive pinion 23 is keyed to the driving shaft 6 within the cage as best seen in Figures 1 and 3, and meshes with a plurality of pinions 24 arranged at equal distances apart around the axis of the driving shaft upon eccentric shafts 25, the ends of which are supported in the bushings 12 in the supporting members 9 and 10 of the cage, as best seen in Figure 1. To promote the balance of the mechanism, I have illustrated four pinions 24 and eccentric shafts 25, but it is to be understood that I do not limit my invention to this number, although it will be found that more than two are necessary for perfect balance and smooth operation. Each of the eccentric shafts is provided with a pair of diametrically opposed eccentrics or cams 29, which are arranged upon opposite faces of a spacing plate 27 integral with each shaft.

The set of eccentrics 29, adjacent the supporting member 9 provide support and actuating means for a gyrating gear 28, by reason of the fact that this set of eccentrics is mounted within spaced openings 26 provided with bushings 30 arranged equi-distant around the axis of the gyrating gear. A second gyrating gear 31 of exactly the

same dimensions as the gyrating gear 28 is arranged beside the latter on the opposite side of the spacing plate 27, and adjacent the center of gravity of the mechanism in order to effect perfect balance of the mechanism and thereby reduce vibration and friction between the parts. For this reason, I term these members 28 and 31, balanced gyrating means. This second gyrating gear is mounted upon the second set of eccentrics 29, adjacent the pinions 24 in the same manner as the cooperating gear 28. Any suitable means, such as set screws 32 are employed for attaching or fastening the pinions 24 to their respective eccentrics 29 or shafts, as clearly shown in Figure 1. Each of the gyrating gear members is provided with suitable openings 33, as seen in Figures 2 and 3 for permitting the passage and fastening of the extensions 13 of the supporting members 9 and 10.

From Figure 2 it will be particularly noted that the two supporting plates 9 and 10 are rigidly bound together by means of the extensions 13 and interfitting flanges 14 at points lying within a circle concentric with, but larger than a circle passing through the eccentric shafts 25. It will also be noted that these two supporting plates 9 and 10 are secured together by means of the interfitting extensions 13 and 14 at four points spaced substantially 90° apart and that the pairs of extensions are arranged at diametrically opposite points on the supporting discs 9 and 10. The foregoing arrangement provides a most rigid mounting for the eccentric shafts 25 due to the fact that the supporting plates 9 and 10 are rigidly bound together at points spaced from the drive shaft 6, thereby relieving the bearings for the two ends of the eccentric shafts from any relative movement due to torsion and consequently provides a mechanism which will operate with minimum friction under maximum loads.

For enclosing the mechanism just described, and for effecting a change of speed from the driving shaft, a case or housing 34 is provided to enclose the mechanism hereinbefore described, and in the present instance, consists of three separable sections, an intermediate annulus 35 provided with peripheral outwardly extending flanges, and a pair of substantially similar end plates or sections 36, all of which are removably fastened together by means of the bolts 37. The inner periphery of the annulus 35 is provided with internal gear teeth 38 as shown. The end section 36 adjacent the gyrating gear 28 is provided with a bearing portion 39 which is mounted upon a bushing 40, mounted upon the sleeve portion 16 of the supporting member 9. The other end section 36 of the casing is equipped with a bearing sleeve 41 mounted on a bushing 42 surrounding the hub 20, and from this arrangement it will be seen that in the present illustration the case is adapted for rotation. To provide for proper lubrication of the device, the interior walls of the end sections 36 are equipped with oil buckets or chambers 36′, adapted upon rotation of the case, to carry oil from the bottom of the case, and dump it upon the parts therein.

The bearing sleeve 41 in the present illustration is provided with master gear teeth 43 adapted for mesh with roll gears 44 mounted upon roller shafts 45, of a round bale cotton press, for revolving the rollers 46 thereof in a manner well understood. These roller shafts 45 are journalled in the stationary frame 21 of the press in the customary manner, and a further description of this press is unnecessary in view of the fact that it forms no part of the present invention, but is merely illustrated in connection therewith to show one application of the speed changing mechanism.

From the foregoing arrangement of parts, and the fact that the supporting cage is a stationary element in the present illustration, it will be seen that clockwise rotation of the driving shaft 6 will cause corresponding rotation of the pinion 23, which, in turn, will cause counter-clockwise rotation of the pinions 24. These later pinions being secured to the eccentrics 29, will cause counter-clockwise rotation of the eccentric shafts 25 and corresponding movement of the eccentrics 29, which causes the gears 28 and 31 to gyrate and move their teeth into engagement with the internal gear 38 to effect counter clockwise rotation of the casing 35 and consequently the master gear 43 which is in fact the driven body. From the disposition of the eccentrics with respect to the gyrating gears, and the proportions of the various parts, it will be obvious that diametrically opposite portions of the gyrating gears will at all times be in mesh with the internal gear, in other words when the relative upper portion of one gear is in mesh, the relative lower portion of the other gyrating gear will be in mesh with the internal gear.

The present invention also has another phase to its operation, and that is when the casing 35 is held stationary and the supporting members 9 and 10, or cage, mounted to rotate. When the parts are thus supported, clockwise rotation of the driving shaft 6 will transmit corresponding movement of the drive pinion 23, which in such an arrangement is, in effect, a sun gear. Due to the fact that some parts of the gyrating members 28 and 31 are always in mesh with diametrically opposite points on the internal gear 38, the reaction between these gears taking place as the driving shaft is rotated, causes the pinions 24 to rotate and planetate around the axis of the driving shaft, carry-

ing with them the eccentric shafts 25 and supporting members 9 and 10. Since the gyrating members are mounted upon the eccentrics 26 of the shafts 25, these members will be caused to gyrate and roll around the internal gear 38 in a clockwise movement, it being appreciated that while one toothed portion of one gyrating member is in engagement with the internal gear, the diametrically opposed tooth portion of the other gyrating member will be engaged with the diametrically opposed portion of the internal gear. Consequently, it will be seen that as these gyrating members roll around the internal gear they will have the effect of alternately stepping forward into mesh with the internal gear, which cooperation effects reaction between the gears, which causes the pinions 24 to planetate about the axis of the driving shaft. Since the ends of the eccentric shafts 25 are mounted and supported in the end plates 9 and 10, or cage, it will be seen that the cage is driven when the casing is held stationary.

When the casing is maintained stationary and the drive is taken off through the cage, it will be obvious that the mechanism cannot be moved by application of power to the end plates, since the gyrating gears, always being in mesh with the internal gear, lock and prevent movement of the speed changing mechanism.

In the present illustration the internal gear has eighty-two teeth, each of the gyrating members seventy-nine teeth, each pinion 24 has forty teeth, and the drive pinion 23 has thirty-six teeth, so that when the case 35 is adapted to rotate, the case rotates one revolution while the driving shaft rotates through thirty revolutions, and when the case 35 is maintained stationary, the ratio is 31 to 1. However, it is to be understood that I do not limit the invention to these ratios or to any other, as the ratio may be changed by merely changing the number of teeth of the gears.

By reason of the fact that the gyrating members 28 and 31 are of identical construction and are mounted upon eccentrics 29, which have equal throw as well as the fact that the pinions 24 and eccentric shafts are arranged at points equi-distant around the axis of the gyrating members, and near the center of gravity of the case, so they will balance each other, it will be clearly seen that an arrangement has been provided in which there will be perfect balance and harmony of action of parts, and consequently vibration of the mechanism will be reduced to a minimum and effect a smoothly operating speed reducing mechanism.

I claim:

1. In a speed changing mechanism, the combination of a casing forming an internal gear, a pair of gyrating gears adapted to mesh therewith and having openings, supporting plates at opposite sides of the gyrating gears and having extensions projecting through the openings thereof and secured together, and driven shafts journaled in said plates and having eccentrics co-operating with the gyrating gears.

2. Speed reducing means comprising in combination, a rotary internal gear casing having oil means for carrying lubricant to the upper portion thereof and discharging it at said upper portion of the casing, balanced gyrating gears for operating the same, stationary supports at either side of said gyrating gears, eccentric shafts extending through said gyrating gears and having opposed ends mounted in said supports, eccentrics on said shafts for operating the gyrating gears, said shafts being arranged equidistant around the axis of the gyrating gears, a drive body, a pinion secured to each eccentric shaft, and a drive pinion on the drive body and meshing with the first named pinions.

3. In a speed changing mechanism, the combination of an internal gear, a gyrating gear meshing therewith, supporting members at opposite sides of said gyrating gear, driven shafts journaled in said supporting members and having eccentrics cooperating with said gyrating gear, and means rigidly connecting said supporting members, said means being spaced equi-distant on a circle substantially as large as a circle passing through said driven eccentric shafts.

4. In a speed changing mechanism, the combination of an internal gear, a gyrating gear meshing therewith, supporting members at opposite sides of the gyrating gear, driven shafts journaled in said supporting members and having eccentrics cooperating with said gyrating gear, and means rigidly connecting said supporting members outside of a circle passing through said driven eccentric shafts.

5. In a speed changing mechanism, the combination of a casing forming an internal gear, a pair of gyrating gears meshing therewith and having openings, supporting plates at opposite sides of said gyrating gears, driven shafts journaled in said plates and having eccentrics cooperating with said gyrating gears, and means extending through said openings in the gyrating gears and rigidly connecting said supporting plates.

6. In a speed changing mechanism, the combination of an internal gear, a gyrating gear meshing therewith, supporting discs at opposite sides of said gyrating gear, driven shafts journaled in said supporting discs and having eccentrics cooperating with said gyrating gear, and means extending through said gyrating gear for rigidly connecting said supporting discs, said means being ar-

ranged at diametrically opposite points and being spaced apart substantially 90°.

7. In a speed changing mechanism, the combination of an internal gear, a gyrating gear meshing therewith, supporting discs at opposite sides of said gyrating gear, shafts journaled in said supporting members and having eccentrics cooperating with said gyrating gear, extensions carried by said supporting discs extending toward each other, said extensions being provided with interfitting flanges, and bolts extending through said flanges for rigidly connecting the extensions of the supporting discs together.

8. In a speed changing mechanism, the combination of an internal gear, a gyrating gear meshing therewith, supporting members at opposite sides of said gyrating gear, driven shafts journaled in said supporting members and having eccentrics cooperating with said gyrating gear, and means extending through said gyrating gear for rigidly connecting said supporting members, said means being arranged at diametrically opposite points.

In testimony whereof I have hereunto set my hand.

ALEXANDER S. MACKENZIE.