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The Patents, Designs and Trade Marks Act 1921-1922

COMPLETE SPECIFICATION

"IMPROVEMENTS RELATING TO SPEED EQUALISING APPARATUS"

WE, AUBREY CARLYLE JAMIESON, Machinery Merchant, of 15 Bradford Avenue, Kew, JOHN FRANCIS GARDINER, Engineer, of 14 Hamilton Street, Elsternwick, and JOHN ALFRED HUGHES DREW, Engineer, of 64 Regent Street, Elsternwick, all in the State of Victoria, Commonwealth of Australia, British subjects, do hereby declare the nature of this invention and in what manner the same is to be performed to be particularly described and ascertained in and by the following statement:-

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49418

THIS INVENTION RELATES to apparatus for equalising the speed of a machine or device driven from a prime mover or driving-element the speed of which is liable to vary or fluctuate under varying loads, driving forces or other conditions.

As an example of the practical application of the invention it may be utilised to equalise the variable speed transmitted from a windmill or falling-weight motor to thereby produce a substantially constant driving-speed in an electric generator for lighting or other purposes where such a constant speed is desirable. It will be hereinafter evident, however, that the invention is applicable in general to frictional transmission apparatus for automatically converting the variable speed of a driving element into the substantially constant speed of a driven element.

It has hitherto been proposed in frictionally operated speed equalising devices to arrange the peripheral face of one friction wheel in engagement with the side or radial face of another wheel and to relatively traverse the first named wheel across the radial face of the second wheel to thus vary the effective radius of the latter and the speed ratio of the two wheels in accordance with variations of the speed of the driving wheel so that a substantially constant speed is imparted to the driven wheel. Such devices are more or less suitable where comparatively small variations or fluctuations of speed are encountered but owing to the relatively large distance of traverse required and consequent cross grinding of the periphery of one wheel against the radial face of the other such a device is objectionable and unsuitable for rectifying relatively large variations in speed.

10

The primary object of the present invention is to provide a simple, compact and generally efficient speed-equalising apparatus embodying a plurality of friction-wheels which are so arranged and operated that a maximum range of speed-variations may be corrected within a relatively small compass or short distance of traverse. The objectionable cross-grinding action referred to is thus reduced to a minimum.

A further object of the invention is to provide a speed-equalising apparatus as aforesaid in which the mechanism for relatively traversing the friction-wheels to produce the desired variations of speed-ratios, is operated from a variable speed element so that the rate of such traverse varies proportionately to the varying gear-ratios and the fluctuating speed of the driving-element or prime mover for the purposes hereinafter described.

Further features of the invention reside in the employment and arrangement of a centrifugal governor to operate the traversing-mechanism, and in the special screw-and-nut arrangement for producing the desired traversing motion. An important characteristic of such traversing-mechanism resides in the arrangement of a pair of subsidiary friction-wheels adapted to operate the screw-and-nut traverse-mechanism, these two friction-wheels being selectively engaged with the radial face of one of the main friction-wheels to thereby operate the traversing-gear in opposite directions according respectively to the increase or decrease of the speed of the driving-element.

A further characteristic feature resides in the arrangement whereby the governor fluctuations are adapted to

merely press one or other of said subsidiary friction-wheels into action against the side face of the adjacent main friction-wheel so that the power for driving the subsidiary wheels and consequently operating the traversing-mechanism is furnished by said main wheel and not through the governor, which is left free for the comparatively light duty of "balancing" or selectively moving the subsidiary wheels into action under the opposite impulses of the governor.

Other features of the invention will be apparent from the following description and appended claims.

BUT IN ORDER that this invention may be better understood reference will now be made to the accompanying sheet of drawings which are to be taken as part of this specification and read herewith:-

FIGURE 1 is a semi-diagrammatic view illustrating a preferred embodiment of the invention.

FIGURE 2 is a similar view of a modification.

FIGURE 3 shows a modified arrangement of the traversing mechanism seen in Figure 1 and illustrated the employment of a reversing gear whereby the relative directions of traverse for increasing and diminishing speeds of the driving element remain the same irrespective of whether such driving element is running in a forward or reverse direction.

FIGURE 4 illustrates a power storage device and automatic control mechanism therefor which may be advantageously employed when the speed equalising apparatus is driven

12

from a wind motor.

Referring first to figure 1 the numbral 2 indicates a variable speed driving wheel in the form of a friction disc which may receive its rotary motion from any available motor or driving element the varying speed of which is to rendered constant. The periphery of the wheel 2 may bear against the side or radial face of an intermediate transmission wheel 3 which is engaged on the opposite side of its axis by the periphery of a driven wheel 4 the speed of which is rendered substantially constant or uniform as hereinafter described.

It will be evident that by radially traversing the wheel 3 in relation to the wheels 2 and 4, the effective radii of the wheel 3 on opposite sides of its axis, or in relation to the wheels 2 and 4, will be simultaneously varied so that the speed ratio of wheel 2 to wheel 3 and of the latter wheel to the wheel 4 will be simultaneously and proportionally increased or diminished according to the radial direction in which the wheel 3 is traversed relatively to the wheels 2 and 4. By this means a "compound" or "double" variation in the relative speed ratios of the three wheels is obtained and consequently only a minimum distance of traverse is required to equalise the speed of the driven wheel 4 for a given increase or reduction in the speed of the driving wheel 2.

The mechanism for imparting such relative traversing movement to the wheel 3 preferably comprises an eggaging screw 6 and nut 7. As seen in Figures 1 and 3 respectively the nut 7 or screw 6 may be pivoted to oscillate about a fulcrum point 8 and carried by said nut or screw as the case may be, is a pair of oppositely disposed subsidiary friction

wheels 9 and 11 which are adapted to respectively operate the traversing mechanism in opposite directions as hereinafter described. The two subsidiary friction wheels 9, 11 may be arranged as in Figures 1 and 3 to respectively engage the same side face of the wheel 3 at diametrically opposite points so that the nut 7 and the traversing friction wheel 3 will be moved in opposite directions along the screw 6 according to the particular wheel 9 or 11 which is in frictional engagement with the wheel 3.

This selective operation of the subsidiary wheels 9 and 11 is automatically effected in accordance with the increase or reduction of speed of the driving wheel 2 preferably through the medium of the spring controlled centrifugal governor 12 which may be arranged upon the shaft 13 of the driven wheel 4 and as seen in Figure 1, is operatively connected with a lever 14 fulcrumed at 15 and suitably connected at 17 to the screw 6 so that any tendency of the wheel 4 to increase or diminish its speed will cause the governor 12 to move the lever 14 in one direction or the other and thus swing or oscillate the screw and nut mechanism bodily about the pivot 8 to thereby bring the requisite wheel 9 or 11 into engagement with the side face of wheel 3. This causes the nut 7 and wheel 3 to traverse bodily along the screw 6 in the requisite direction to simultaneously and proportionately vary the speed ratios of the wheels 2 and 3 and of the wheels 3 and 4 to thereby equalise the speed of the latter wheel as aforesaid.

In the alternative embodiment seen in Figure 2 it will be seen that the opposite side or radial faces of the variable speed driving wheel 2 and the constant speed driven wheel 4 are arranged to engage the peripheral face of the intermediate transmission wheel 3. The subsidiary friction

wheels 9 and 11 are, in this case, adapted to selectively engage the opposite side faces of the friction wheel 4 according to the direction of movement of the lever 14 by the governor 12. According to this embodiment the screw and nut mechanism 6, 7 with the wheels 9 and 11 may be mounted to move bodily on a suitable frame or support 18 connected by a link 19 or the like with the lever 14 so that as the latter is moved in opposite directions by the fluctuations of the governor 12 the appropriate friction wheel 9 or 11 is pressed against the adjacent side face of the wheel 4 to thus turn the nut 7 and move the screw 6 in the requisite direction for traversing the wheel 3. The speed ratios of the wheels 2 and 3 and wheels 3 and 4 are thus simultaneously and proportionately increased or diminished as the speed of the driving element respectively diminishes or increases. It will be evident that in this embodiment it is necessary to provide some means of rotating the nut 7 from the wheel 11 and such means may conveniently comprise three engaging spur wheels 21, 22 and 23, the latter spur wheel being adapted to rotate with the nut and the intermediate spur wheel 22 being introduced to rotate the wheel 23 in the same direction as the wheel 21 which rotates with friction wheel 11.

To prevent "overwinding" of the aforesaid screw and nut mechanism in either direction a free or unthreaded section indicated at 20, is provided on the screw spindle at each end of the thread thereof to freely accommodate the nut 7 as the latter disengages the screw thread at each end of the traverse. Adjoining each of the free spaces 20 is a coiled spring 25 which acts to press the nut 7 into operative engagement with the screw thread immediately the direction of rotation of the nut or screw is reversed.

It will be seen from the foregoing that the requisite distance of traverse of the wheel 3 relative to the wheels 2 and 4 for given variations in the speed of the driving wheel 2, is reduced to a minimum, the objectionable "cross grinding" of the friction wheels against each other during such traverse being consequently minimised and the efficiency and accuracy of the device increased. Relatively large speed variations may thus be rectified within a comparatively small compass and with a simple and compact apparatus.

When the wheel 3 is near one end of its traversing movement it will be evident that a relatively large variation in the speed ratios of the main friction wheels occurs over a comparatively small distance of traverse but this relative variations of the speed ratios gradually diminishes throughout the length of traverse until the opposite condition obtains at the other end of the traversing movement, that is to say, a relatively small variation of the speed ratios occurs over a comparatively large distance of traverse where the effective diameters of the engaging friction wheels 2 and 3 are most alike.

By driving the subsidiary or traverse operating friction wheels 9 and 11 from a variable speed element such, for instance, as the wheel 3, (Figure 1) it will be evident that the latter wheel will be traversed at relatively slow speed near one end of the traversing movement when the driving speeds are slowest and where the speed ratios are changing most quickly, the rate of traverse being gradually increased as the driving speed rises to a maximum at the other end where the speed ratios are changing most slowly. The variation of speed ratios is thus effected at a comparatively uniform rate throughout the traversing movement owing to the varying gradation of the traversing speed to compensate for the varying gradation in the relative speed ratios of the main friction wheels 2, 3 and 4. This

feature, although not essential as will be seen from Figure 2 where the traversing mechanism is operated from the substantially constant speed wheel 4, is preferable as shown in Figure 1 where the traversing mechanism is driven from the varying speed wheel 3. The same result may obviously be obtained with the construction seen in Figure 2 by operating the subsidiary friction wheels 9 and 11 and attendant gears 21, 22 23 from the variable speed element 2 instead of the constant speed wheel 4.

It will also be evident as before mentioned that the fluctuations of the governor are utilised merely to press or engage the oppositely disposed traverse operating or subsidiary wheels 9 and 11 against the adjacent main wheel 3 or 4 whilst the necessary power for driving the traversing mechanism being furnished by the wheel 3 in Figure 1 or the wheel 4 in Figure 2. The governor is thus free for selectively moving the subsidiary friction wheels 9 and 11 into action according to the tendency of the driven wheel 4 to increase or diminish its speed.

In certain applications of the invention, for instance, when it is to be applied to power-driven vehicles or the like wherein the prime mover or driving element is subject to reversal, consequently reversing the direction of rotation of the variable speed driving wheel 2, it is necessary to introduce some means whereby the relative directions of traverse for increasing and decreasing speeds respectively, will remain the same irrespective of whether the driving element and consequently the wheels 2 and 3 are moving in a forward or reverse direction. Various devices may be provided for this purpose, one example of a suitable reversing mechanism to produce the desired result being shown in Figure 3

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wherein the position of the parts for forward motion of the driving wheel 2, is indicated in full lines, whilst the relative position of the parts for reverse movement of said driving wheel is indicated in broken lines. It will here be seen that the shaft 13 is provided with a reversing screw 26 and nut 27. This nut is prevented from turning by the stationary member or abutment 28 and is adapted to move in opposite directions along the screw 26 according to whether the main friction wheels are rotated in a forward or reverse direction.

Pivoted to the nut 27 is a link 29 the outer end of which is connected as shown to a pin 31 working in a slot 32 of a T-shaped lever 33 which is suitably fulcrumed at 34. This lever takes the place of the bell-crank lever 14 before referred to and its end 36 is similarly moved along the shaft 13 by fluctuations of the governor 12. The pin 31 is connected by a second link 37 to the nut 7 which engages the traversing screw 6 and is adapted to swing bodily with the latter and the friction wheels 9 and about the pivot 8 as indicated by the broken lines in Figure 3. The respective attitudes of the wheels 9 and 11 to the wheel 3 are thus reversed according to the direction of rotation of the driving element and consequently of the main friction wheels 2, 3 and 4.

It will thus be evident that in the event of the driving element being reversed and the wheels 2, 3, and 4 consequently rotated in opposite directions, as indicated by the dotted arrows in Figure 3, the reverse movement of the shaft 13 will cause the nut 27 to move along the screw 26 to the position indicated in broken lines. This causes the link 29 to move to the other end of the slot 32 with the result

that the link 37, nut 7 and traversing screw 6 also move over to the position indicated in broken lines, the traversing screw and nut 7 swinging about the axis of the pivot 8. This obviously moves the other subsidiary wheel 9 into action and the companion wheel 11 out of action. Consequently when the main friction wheels are rotating in the direction of the unbroken arrows the fluctuations of the governor 12, acting through the lever 33 and link 37 will cause the wheel 9 to be brought into action by an increase in the governor speed and consequent downward movement of the end 36 of lever 35 in Figure 3, whilst the opposite wheel 11 is brought into action by a decrease in such speed. When, however, the friction wheels 2, 3, and 4 are rotating in the reverse direction, and the parts are consequently in the position shown in broken lines, the relative attitude of the wheels 9 and 11 to the wheel 3 is reversed the wheel 11 being brought into action for increases of the governor speed, whilst the other wheel 9 is actuated for decreases in such speed.

The reversing screw 26 is also provided at each end with the aforesaid free or unthreaded sections 20 to stationarily accommodate the nut 27 at opposite ends of its travel. The spring of the adjoining governor 12 may function as one of the previously mentioned springs 25 to press the nut 27 into engagement with one end of the screw whilst at the other end thereof a spring 25^a may be provided to press the nut into engagement with the adjoining end of screw. This latter spring is controlled by centrifugally operated weighted arms 30, which at relatively high speeds, tend to compress the spring 25^a and thus leave the nut 27 free of the screw 26 whereas when the screw slows down and stops rotating the nut is pressed into engagement with the thread. The governor 12 acts in a similar manner on the nut 27 when

the latter is at the opposite end of its travel. It will thus be evident that whilst under normal running conditions the nut 27 lies idle in one or other of the free sections 20 at the screw ends, immediately the screw 26 slows down and stops to reverse its motion, the nut is pressed into engagement with the adjoining end of the screw thread and thus proceeds to travel along the same as before mentioned.

By the above or other suitable reversing gear the relative directions of traverse for increasing and decreasing speed respectively will always remain the same irrespective of the direction of rotation of the driving machine and the main friction wheels 2, 3, and 4. The desired variation in the speed ratios of such wheels is thus obtained under all conditions to produce a substantially uniform speed of the driven wheel 4 and any machine that may be operated thereby.

It will be understood that the opposite movements of the governor and the consequent oscillating motion of the subsidiary friction wheels 9 and 11 to operate the traversing gear in opposite directions, is very slight and the fluctuations in the speed of the driven wheel 4 are scarcely appreciable owing to the sensitiveness of the governor controlled mechanism.

In some instances, for example, when the equalising apparatus is operated from a driving machine or element such as a windmill, the reciprocating or crank mechanism of such a driving element may come to rest in a "dead centre" position and thus possibly cause the friction wheels 2, 3, 4 to rotate in a reverse direction on restarting. In such cases any suitable well known mechanical device may be incorporated to ensure that the driving element and consequently the main

friction wheels of the equalising apparatus will always rotate in the same direction thus rendering the reversing gear seen in Figure 3 unnecessary.

When the invention is applied to the equalisation of the speed of a wind-motor the power derived from such motor or driving element will at times be in excess of immediate requirements, whilst at other times owing to lower wind velocities the driving power and consequently the speed of the driving wheel 2 will become excessively low. In order to conserve such surplus power or energy when the wind is strong and to utilise same when the wind force is relatively low a power storage device and automatic control mechanism therefor may be provided as shown by way of example in Figure 4. By this means, when the wind force exceeds a certain limit and the variable speed driving wheel 2 is consequently rotating at relatively high velocity the surplus energy is stored up in the power storage device and when the wind and consequently the speed of the driving element drops below a certain predetermined limit the potential energy in the power storage device is automatically applied to drive or assist in driving the wheel 2 of the speed equalising apparatus. As seen in Figure 4 this result may be obtained by operatively connecting a shaft 41 with the variable speed driving wheel 2 so as to permanently rotate therewith. This shaft 41 carries freely thereon a clutch wheel 42 having a clutch face 43 adapted to be engaged by a co-operating clutch member 44 slidably mounted on the shaft 41 so that when the clutch member 44 is moved into engagement with the wheel 42 the latter drives, through transmission gears 46, on to a winding drum 47 to thereby wind up the cable 48 and raise the weight 49. The winding drum 47 is permitted to rotate independently of the shaft 51 when raising the weight but when the drum is turned in a

A.N.

reverse direction by the falling of the weight the shaft 51 is driven through the pawl 52 and ratchet wheel 53. The shaft 51 is operatively connected through transmission gear 54 with a spur wheel 56 freely mounted on the shaft 41.

The sliding clutch member 44 is controlled by a heavily weighted governor 57 which may act as a fly wheel for the whole machine and revolves with the shaft 41 and the variable speed driven wheel 2. The spring 58 of this governor is adapted to normally force the clutch member 44 out of engagement with the wheel 42 but when the wind and consequently the speed of the shaft 41 increases beyond a certain limit, the governor weights swing outwardly and cause the arms 59 of the governor to compress the spring 58 and thus engage the clutch member 44 with the wheel 42. The winding drum 47 is thus operated to raise the weight.

The clutch member 44 may be connected by sliding rods 61 or other suitable means with another slidable clutch member 62 which permanently rotates with shaft 41 and is adapted to force a sliding disc 63 out of engagement with a stationary brake band or holding member 64, when the speed of the shaft 41 falls below normal. The disc 63 is slidably mounted on and turns with the boss of the wheel 56 and a spring 66 tends to force the disc 63 against the stationary brake band or holding member 64, the axial thrust on the wheel 56 being taken by a ball bearing collar 67 or the like.

Should excess driving power become available the increased speed of the shaft 41 causes the weights of the governor 57 to fly outwardly, thus compressing the spring 58 to throw in clutch 44 and thus rotate the wheel 42 and operate

winding drum 47 to raise the weight 49 as aforesaid thus storing up surplus energy for subsequent use. When the wind velocity and the speed of the shaft 41 again falls to a predetermined normal degree the weights of governor 57 move inwardly thus permitting the spring 58 to throw out the clutch 44 so that the drum 47 is no longer driven and the whole of the driving power is utilised, through the speed equalising apparatus, to operate the desired driven machine. Under such normal conditions the disc 63 is pressed against the stationary member 64 and the wheel 56 is thus held stationary, the weight 49 being held in suspension until the disc 63 is freed from the stationary member 64.

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Should the driving speed fall below a certain limit the weights of the governor 57 will swing further inwards with the result that the governor arms 59 move the clutch member 62 axially into engagement with the disc 63 and force the latter away from the stationary member 64 against the action of the spring 66. The braking effect being thus removed from the disc 63, the latter and the wheel 56 are permitted to rotate freely on the shaft 41 the wheel 56 being now driven by the falling weight 49 through the transmission gears 54. Owing to the sliding clutch member 62, which is keyed to the shaft 41, being now pressed into engagement with disc 63 the shaft 41 and driving friction wheel 2 of the speed equalising apparatus are now also operated by the falling weight which supplies the necessary reserve power to operate the speed equalising apparatus and the driven machine until the wind again increases to the requisite extent. The clutch 62 thereupon becomes disengaged from the disc 63 so that the wheel 56 is again

hold stationary with the weight 49 suspended until again required.

By suitable means such as a pawl 68 and ratchet wheel 69 interposed between the wheel 2 and the driving shaft 70 from the windmill, the wheel 2 and the shaft 41 to which said wheel is fixed, are permitted to overrun the windmill shaft 69 in the event of the falling weight driving the mechanism at a greater speed than the speed of the windmill, as for instance when the wind velocity drops below the speed imparted by the falling weight.

It will be obvious that various arrangements of mechanism other than those specifically described and illustrated may be employed to produce equivalent results without departing from the spirit and scope of the invention. It will also be understood that the necessary traversing movement of the speed equalising apparatus may be imparted to the wheels 2 and 4 instead of to the intermediate wheel 3 as above described and the term "relatively" as applied to this traversing motion in the appended claims will therefor be interpreted accordingly.

HAVING NOW particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:-

1st. In a speed equalising apparatus a train of main friction wheels comprising a variable speed driving wheel, a substantially constant speed driven wheel, and an intermediate transmission wheel having its radial or peripheral face respectively engaging the peripheral or radial faces of said driving and driven wheels, and means for

traversing said intermediate wheel relatively to said driving and driven wheels whereby the respective speed ratios of the driving wheel to the intermediate wheel and of the intermediate wheel to the driven wheel, are simultaneously and proportionately varied, for the purpose set forth.

2nd. Apparatus according to claim 1 wherein the traversing means is controlled by a centrifugal governor which is actuated by fluctuations in speed of the apparatus to thereby operate the traversing means in opposite directions to compensate for increasing and diminishing speeds respectively.

3rd. Apparatus according to claim 2 wherein the governor is operated from the substantially constant speed driven wheel whereby the tendency of said wheel to increase or diminish its speed causes the governor to fluctuate accordingly and thus operate the traversing means in the requisite direction.

4th. Apparatus according to any of the foregoing claims wherein the traversing means comprises a screw and nut mechanism adapted to operate in opposite directions to thereby compensate for increasing and decreasing speeds respectively of the driving friction wheel.

5th. Apparatus according to claims 2 and 4 wherein the screw and nut traversing mechanism is operatively connected with the governor for the purpose set forth.

6th. Apparatus according to claims 4 or 5 wherein the screw and nut traversing mechanism has associated therewith a pair of oppositely disposed subsidiary friction wheels which are adapted to be selectively and independently driven to respectively operate the screw and nut mechanism in opposite

directions.

7th. Apparatus according to claims 4, 5, or 6 wherein the traversing screw is provided at each end with an unthreaded section to freely accommodate the nut, and springs adjoining said unthreaded sections and adapted to press the nut into engagement with the screw thread for the purpose set forth.

8th. Apparatus according to claim 6 wherein the peripheral faces of the subsidiary friction wheels are adapted to be selectively engaged with the adjacent radial driving face of another friction wheel in such a manner as to rotate said subsidiary wheels in relatively opposite directions for the purpose set forth.

9th. Apparatus according to claims 2 and 8 wherein the oppositely disposed subsidiary friction wheels are bodily oscillated about a pivotal point by the fluctuations of the governor to thereby delectively engage said subsidiary wheels with the adjacent driving face, for the purpose set forth.

10th. Apparatus according to claim 9 wherein said oscillating movement is imparted to the subsidiary friction wheels through a pivoted lever which is operatively connected with the governor for the purpose set forth.

11th. Apparatus according to claims 9 or 10 wherein the subsidiary friction wheels are carried by or operatively connected with the screw and nut traversing mechanism said screw and nut mechanism and friction wheels being adapted to oscillate bodily about a common pivotal axis under the influence of the governor fluctuations for the purpose set

forth.

12th. Apparatus according to any of the foregoing claims wherein the traversing means is operated from a variable speed element to thereby vary the rate of traverse in accordance with the varying speed ratios of the main friction wheels for the purpose set forth.

13th. Apparatus according to any of the foregoing claims characterised by a reversing gear operatively connected with said traversing means and adapted to be automatically controlled by the reversal of the direction of rotation of said driving wheel whereby the traverse operates in the same relative directions for increasing and diminishing speeds respectively, irrespective of the direction of rotation of said driving wheel.

14th. Apparatus according to claims 9 and 13 wherein the reversing gear is adapted to oscillate the screw and nut traversing mechanism to thereby selectively actuate the subsidiary friction wheels according to the direction of rotation of said driving wheel.

15th. Apparatus according to claim 14 wherein the reversing gear includes a screw and travelling nut thereon and a link mechanism operatively connecting said nut with the traversing mechanism for the purpose specified.

16th. In a speed equalising apparatus a driving friction wheel and a driven friction wheel, one of said wheels having its peripheral face in engagement with the radial face of the companion wheel, automatic means for relatively traversing said wheels to thereby vary the effective radius of the

latter wheel in accordance with variations in the speed of the driving wheel, said traversing means being actuated from a variable speed element whereby the rate of traverse varies in accordance with variations in the speed ratios of said wheels for the purpose set forth.

17th. In speed equalising apparatus a driving friction wheel and a driven friction wheel one of said wheels having its peripheral face in engagement with the radial face of the other wheel, automatic means for relatively traversing said wheels to thereby vary the effective radius of the latter wheel in accordance with varying speeds of the driving wheel, said traversing means comprising a screw and nut device, a pair of oppositely rotating subsidiary friction wheels adapted to respectively operate said screw and nut device in opposite directions as the speed of said driving wheel respectively rises and falls, and a centrifugal governor acting in synchronism with said driven friction wheel, said governor being adapted to respectively engage said subsidiary wheels with an adjacent frictional driving face for the purpose set forth.

18th. A speed equalising apparatus consisting in the combination and arrangement of parts adapted to co-operate substantially as described for the purposes specified.

19th. A speed equalising apparatus constructed and adapted to operate substantially as described with particular reference to Figure 1 of the accompanying drawings.

20th. A speed equalising apparatus constructed and adapted to operate substantially as described with particular reference to Figure 2 of the accompanying drawings.

B.J.

21st. A speed equalising apparatus embodying a reversing gear substantially as described with particular reference to Figure 3 of the accompanying drawings.

22nd. Apparatus according to any of the foregoing claims in combination with a power storage device associated with the speed equalising apparatus and adapted to accumulate energy from a driving wind motor at relatively high wind speeds, and automatic means whereby said power storage device is operatively connected with the driving friction wheel of the speed equalising apparatus to thereby operate the latter at relatively low wind speeds.

23rd. Apparatus according to claim 22 wherein the power storage device comprises a winding drum and suspended weight, said winding drum being controlled by a centrifugal governor which actuates a clutch mechanism whereby the suspended weight is caused to drive said friction wheel when the wind force drops below a predetermined limit.

24th. Apparatus according to claim 23 wherein the power storage device and governor actuated clutch mechanism associated therewith, are arranged to operate substantially as described with reference to Figure 4 of the accompanying drawings.

Dated this 4th day of January A.D. 1923.
at Wellington

(Sd) HIGGS AND O'DONNELL

Patent Attorneys for the Applicants.

Certified to be a true copy.

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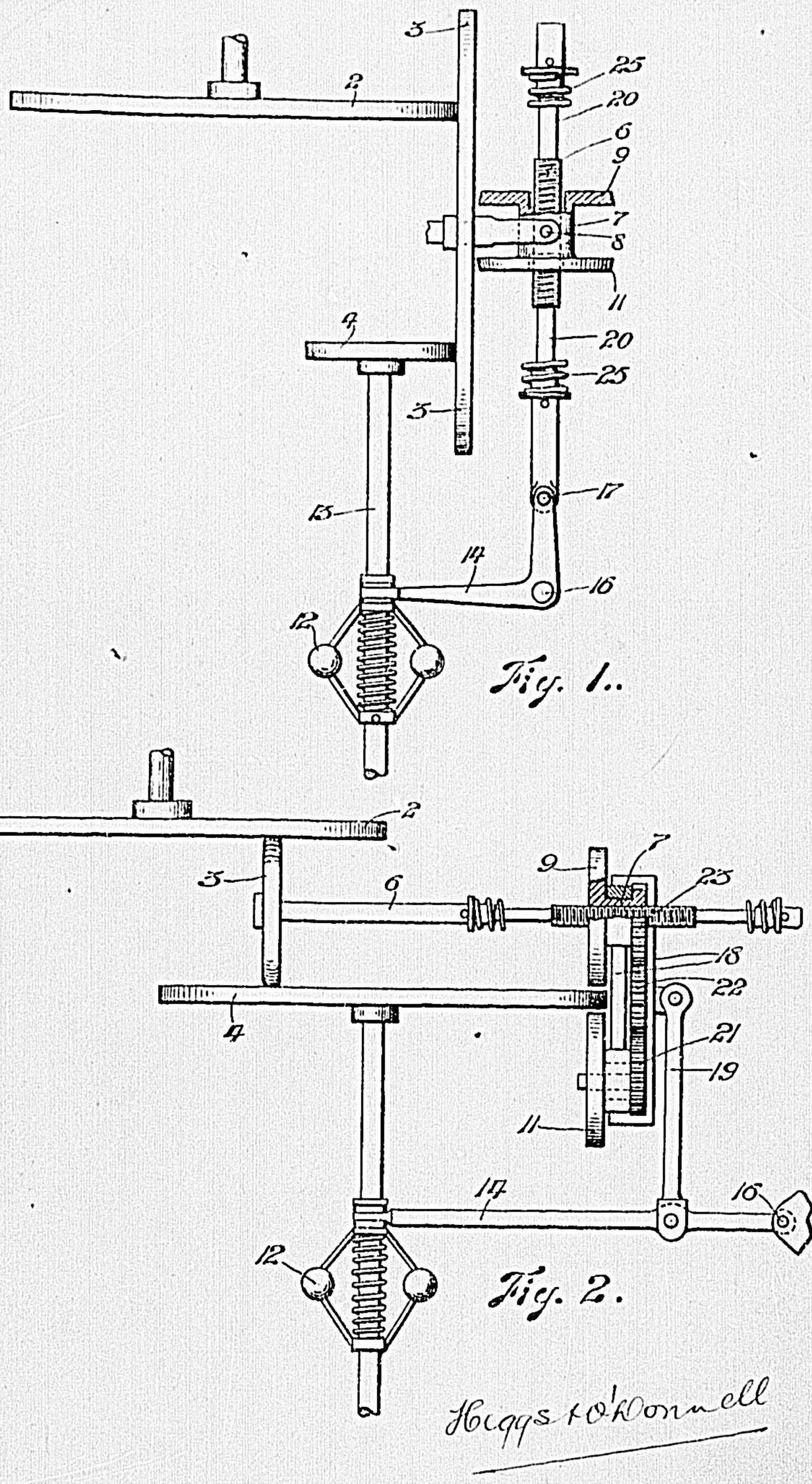


Fig. 1.

Fig. 2.

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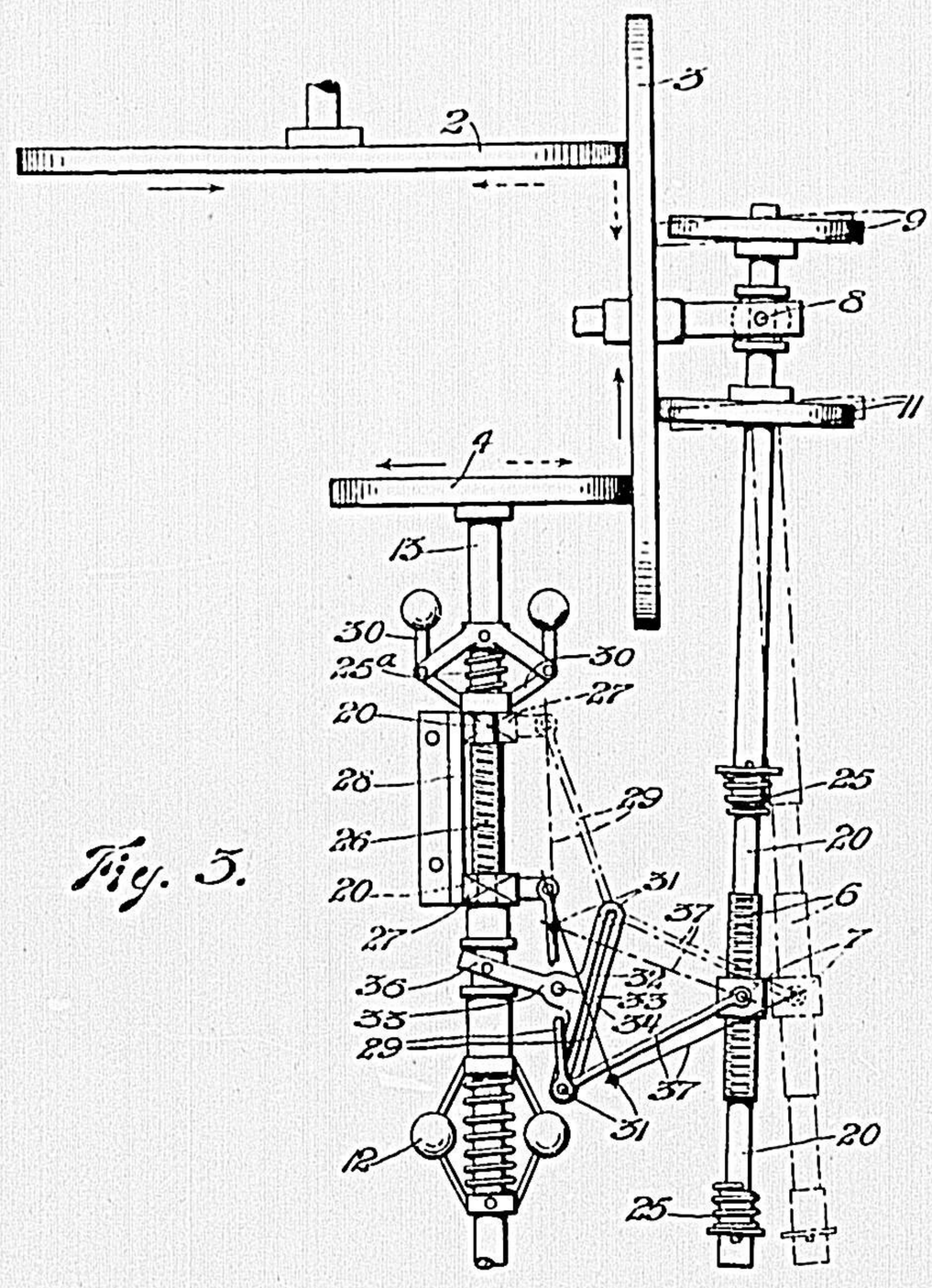


Fig. 5.

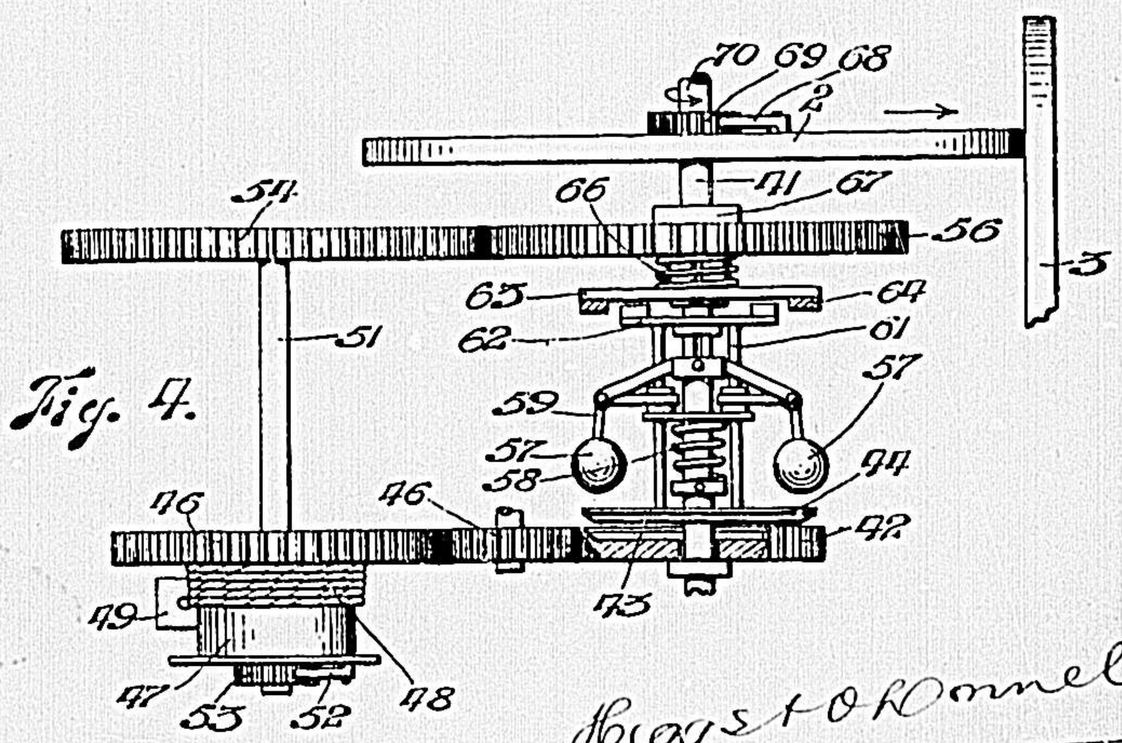


Fig. 4.

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