Oct. 16, 1962 D. J. MATTHEWS 3,058,366

INTERMITTENT REVERSING DRIVES

Filed July 28, 1960 2 Sheets-Sheet 1

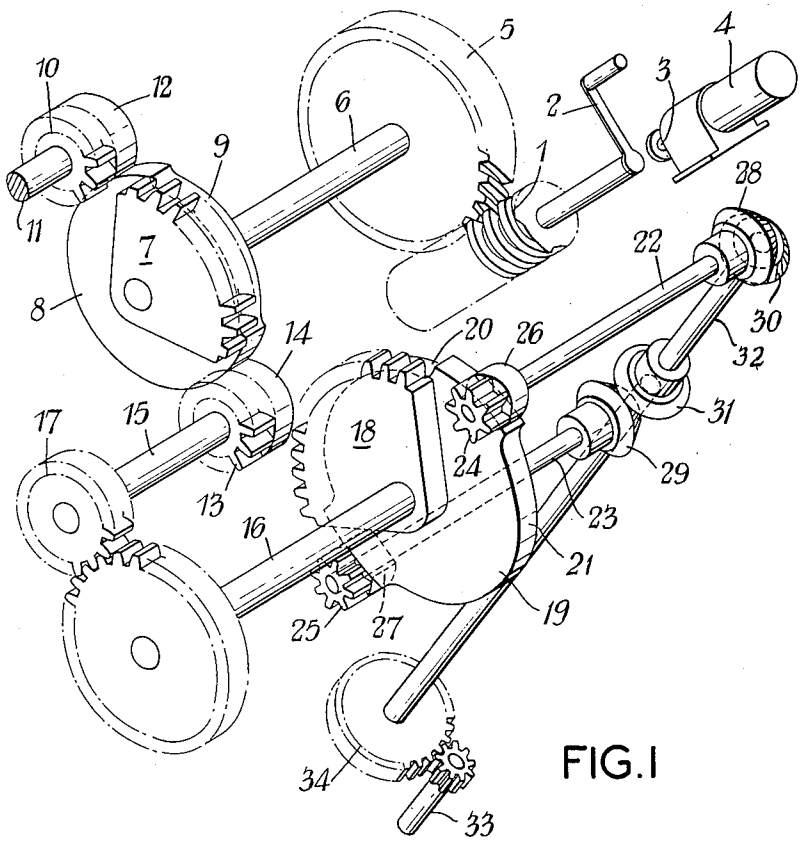

FIG.1

INVENTOR:
DENNIS JOSEPH MATTHEWS
By
Richardson, David and Verdon
Atty's

Oct. 16, 1962 D. J. MATTHEWS 3,058,366

INTERMITTENT REVERSING DRIVES

Filed July 28, 1960 2 Sheets-Sheet 2

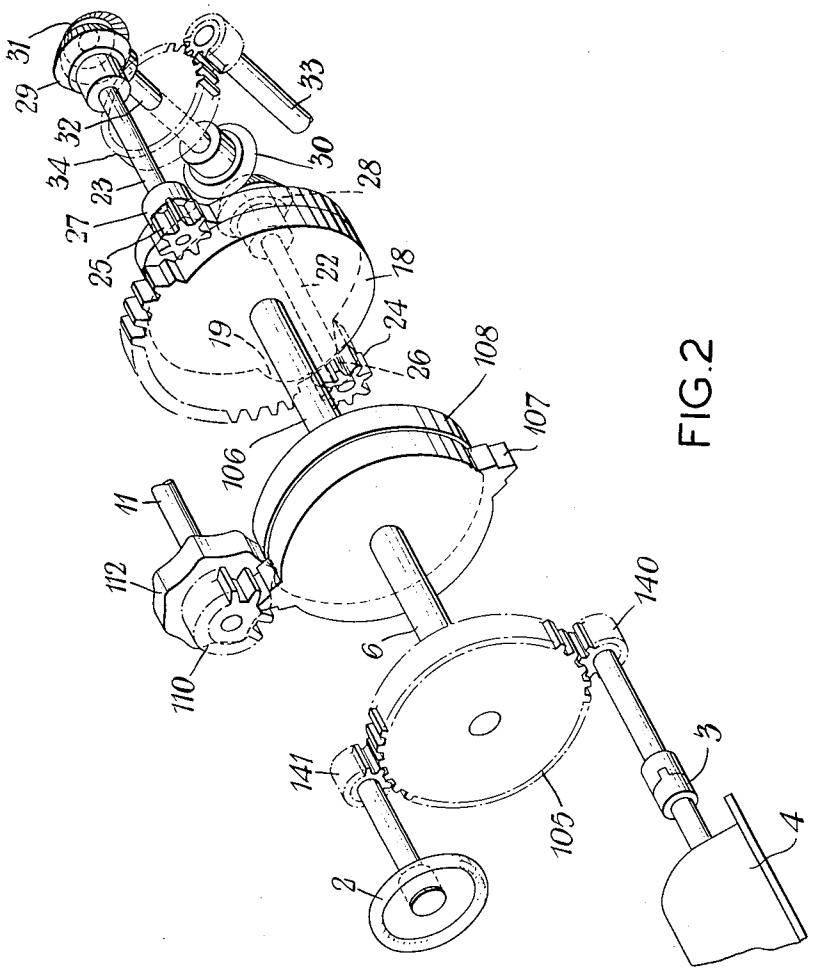

FIG.2

INVENTOR:
DENNIS JOSEPH MATTHEWS
By
Richardson, David and Nardon
Atty's.

United States Patent Office 3,058,366 Patented Oct. 16, 1962

3,058,366

INTERMITTENT REVERSING DRIVES

Dennis Joseph Matthews, Tilgate, Crawley, England, assignor to Brentford Transformers Limited, Crawley, England, a British company

Filed July 28, 1960, Ser. No. 45,930
Claims priority, application Great Britain Sept. 15, 1959
8 Claims. (Cl. 74—435)

This invention concerns improvements in intermittent reversing drives for particular use in interlocking the motions of the contacts of a regulator with a switch. In arrangements such as, for example, that described in the British Patent 780,166 a regulator is associated with switching means and the arrangement is such that the regulator contacts must be traversed from end to end of a coil and must, therefore, be driven by some suitable reversing drive mechanism. It is also necessary in such an arrangement that, when the regulator contacts reach the end positions on the regulator, a switch should be operated, for example to connect or disconnect a booster transformer into the circuit. In the prior arrangements separater motors were provided for driving the switch and the regulator contacts and these separate motors were inter-connected by electrical, mechanical or electro-mechanical interlocks. Both the switch motor and the contact motors were reversible.

It is an object of the present invention to provide an intermittent reversing drive whereby a single motor can drive both the regulator contacts and the switch mechanism.

According to the present invention there is provided an intermittent drive comprising a reversible rotary output member, a pair of driving pinions for said output member driven alternately in opposite directions, unidirectionally driven segmental gearing meshing with said pinions to provide said alternating drive of the pinions, a further output rotary member, a pinion transmitting intermittent rotation to said further output rotary member, an input drive connected to said segmental gearing and said latter pinion, and means breaking the drive to said latter pinion during rotation of each one of the said pair of pinions.

According to a further aspect of the invention, there is provided an intermittent reversing drive, comprising a first sector gear intermittently driving a pinion providing an intermittent non-reversing drive to a first output shaft, and a driving connection from said first sector gear to a further sector gear and double pinion arrangement in which the two pinions are driven alternately, such pinions both being coupled to a second output shaft in such manner that said second output shaft is driven reversingly, said first and second output shafts being driven alternately.

Desirably the input to the first sector gear is a reversible input.

A cam locking device is desirably associated with each sector gear and its pair of pinions to hold the pinions stationary at the times when this is desirable.

In order that this invention may more readily be understood, two embodiments of the same will now be described with reference to the accompanying drawings wherein:

FIGURE 1 is a diagrammatic perspective view of the lay out of one arrangement, and

FIGURE 2 is a perspective view of a second arrangement.

Referring now to FIGURE 1 of the drawings, a worm 1 is arranged for selective driving in either direction either by a hand crank 2 or, via a clutch 3, from a motor and gear unit 4. The worm 1 drives a worm wheel 5 which is coupled to a main input drive shaft 6. On this main drive shaft 6 is a first sector gear 7 which, in

this embodiment, comprises 10 teeth of a 28 tooth wheel and associated with the sector gear 7, being rigidly connected thereto, is a locking cam disc 8 which is cut away over a portion 9 adjacent to the toothed part of the sector gear 7.

A first pinion 10 also having 10 teeth is arranged to be driven by the teeth of the sector gear 7 and this pinion is mounted upon a first output shaft 11. Also fixed upon this first output shaft is a locking cam 12 which is so shaped and positioned that an arcuate recess in its periphery will engage with the periphery of the locking disc 8 except when the sector gear 7 is in driving engagement with the pinion 10. It will be clear that the output shaft 11 is driven intermittently and in a direction corresponding to the direction of rotation of the input shaft 6 and executes one revolution for each revolution of the input shaft 6.

Also associated with the sector gear 7 is a second pinion 13 and locking cam 14 identical to the pinion 10 and cam 12, such pinion 13 and cam 14 being mounted upon an intermediate shaft 15 arranged diametrically opposite to the output shaft 11. Thus the arrangement is that the intermediate shaft 15 is driven through one revolution for each revolution of the input shaft 6, being driven during the time when the output shaft 11 is held locked by the inter-engagement of the cam 12 and disc 8.

The intermediate shaft 15 drives a second intermediate shaft 16 through a 1:2 reduction gear arrangement 17 and mounted upon the second intermediate shaft is a further sector gear 18 which, in this embodiment, comprises 12 teeth of a 34 tooth wheel. Rigidly associated with this further sector gear 18 is a locking cam disc 19 which, as can be seen, is provided with two peripheral recesses 20 and 21 of substantially identical form and arranged symmetrically, the first such recess 20 being located in alignment with the teeth of the sector gear 18 and the second such recess 21 (which is of slightly greater angular width) being located diametrically opposite to the recess 20.

A pair of intermittent drive shafts 22 and 23 carry pinions 24 and 25 respectively, these pinions 24 and 25 each having 6 teeth shaped to mate with the 12 teeth on the sector gear 18 and each being associated with locking cams 26 and 27 respectively. Thus the arrangement is that during each complete revolution of the intermediate shaft 16, first the shaft 22 is driven positively through 2 revolutions and then the shaft 23 is driven in the same direction through 2 revolutions and, when either of the shafts 22 and 23 is being driven positively, the other such shaft is free to rotate. Furthermore there is a dwell period between the double revolutions of the shafts 22 and 23 and during such dwell period these shafts are locked.

The shafts 22 and 23 are provided with bevel gears 28 and 29 respectively mating with bevel gears 30 and 31 respectively, and the gears 30 and 31 being mounted upon an output shaft 32. The arrangement is clearly that the output shaft 32 executes a double revolution in opposite direction for each revolution of the intermediate shaft 16. In the arrangement shown, the output shaft 32 drives a transmission shaft 33 through a gear 34.

Thus to sum up if the input shaft 6 is driven through two revolutions in an appropriate direction from the position in which it is shown in the figure, the output shaft 11 is first driven through one revolution while the output shaft 32 is held locked. Then, while the output shaft 11 is held locked, the output shaft 32 executes two revolutions in one direction. Thereafter the output shaft 11 is again driven through one revolution in the same direction as before, and then the output shaft 32 is driven through two revolutions in the opposite direction to that

in which it was driven originally. This cycle of events is repeated during each succeeding two revolutions of the input shaft in the same direction.

In the arrangement shown in FIGURE 1 it will be understood that the output shaft **11** executes a complete revolution each time it is moved by the input shaft **6**, but it is not always desired that the output shaft **11** should turn to such an extent, for if this shaft is used merely to operate a switch a much smaller degree of movement may be preferred. Thus, in the arrangement shown in FIGURE 2, which is a modification of a portion of FIGURE 1, the output shaft **11** executes only a 45° movement.

Referring now to FIGURE 2, the parts have, where practicable, been given the same reference numerals as in FIGURE 1 and it will be seen that the motor **4** drives a clutch **3** connected to a pinion **140** which is engaged with a gear wheel **105** replacing the worm wheel **5** of FIGURE 1. The hand wheel **2** also drives the gear wheel **105** through a pinion **141**. The gear wheel **105** drives the main input drive shaft **6** upon which is mounted a first sector gear **107**, this sector gear **107** being a double sector gear having only two teeth of a 36 tooth wheel and these two teeth being separated by 180°. Also associated with the sector gear **107** is a locking cam disc **108**.

The teeth of the sector gear **107** drive a first pinion **110** associated with a locking cam **112** and mounted upon the output shaft **11** and it will be clear that since the first pinion **110** has 8 teeth the output shaft **11** executes two separate 45° movements for each revolution of the main input shaft. If a 90° movement is required it is merely necessary to provide 2 adjacent teeth in each half of the sector gear **107**.

In contradistinction to the arrangement of FIGURE 1, the intermediate shafts **15** and **16** are not required but a further sector gear **18** is mounted directly upon an extension **106** of the main input shaft **6**, the locking portions of the locking cam disc **19** being so arranged as to hold the pinions **24**, **25** associated with the further sector gear **18** stationary during movement of the output shaft **11**.

As in FIGURE 1, the pinions **24**, **25** respectively drive intermittent shafts **22**, **23**, arranged diametrically opposite to each other each of the pinions being associated with a locking cam **26**, **27** respectively. The shafts **22**, **23** carry bevel gears **28**, **29** respectively these bevel gears mating with further bevel gears **30**, **31** respectively and the gears **30**, **31** being mounted upon an output shaft **32**. The output shaft **32** drives a transmission shaft **33** through a gear **34**.

Thus to sum up the movement of the shafts in FIGURE 2 if the input shaft **6** is driven through one revolution in an appropriate direction from the position in which it is shown in the figure, the output shaft **11** is first driven through 45° while the output shaft **32** is locked. Then while the output shaft **11** is held locked the output shaft **32**, as in FIGURE 1, executes two revolutions in one direction. Thereafter the output shaft **11** is again driven through 45° in the same direction as before and then the output shaft **32** is driven through two revolutions in the opposite direction to that in which it was originally driven. This cycle of events is repeated during each succeeding revolution of the input shaft **6** in the same direction.

I claim:

1. An intermittent reversing gear drive comprising a reversible input shaft; a first sector gear rigid with said input shaft; a first cam locking disc also rigid with said input shaft; an output pinion intermittently meshing with said first sector gear and, rigid therewith, a second cam locking disc co-operating with said first cam locking disc to lock the output pinion against rotation except when meshed with the first sector gear; a first intermediate pinion mounted upon a first intermediate shaft and meshing with said first sector gear; a third cam locking disc co-operating with the first cam locking disc and rigid with the first intermediate pinion to lock the same against rotation except when meshing with the first sector gear; a second sector gear; first driving means providing a continuous driving connection from said intermediate shaft to said second sector gear; second and third intermediate pinions spaced diametrically of said second sector gear and positioned to mesh therewith; second and third intermediate shafts driven by said second and third intermediate pinions; fourth, fifth and sixth cam locking discs respectively rigid with said second sector gear and said second and third intermediate pinions, said fourth cam locking disc co-operating with said fifth and sixth cam locking discs to lock the second and third intermediate pinions against rotation except at the times when one of the second and third intermediate pinions is meshing with the second sector gear; an output shaft; second driving means providing a continuous driving connection from said second intermediate shaft to said output shaft; and third driving means providing a continuous driving connection from said third intermediate shaft to said output shaft, the direction of rotation of the output shaft for a given direction of rotation of the intermediate shafts when the second driving means is operative being opposite to that when the third driving means is operative.

2. An intermittent reversing gear drive comprising a reversible input shaft; a double sector gear fast on said shaft; a first cam locking disc fast on said input shaft; an output pinion positioned to mesh with said double sector gear; a second cam locking disc positioned to co-operate with the first cam locking disc to lock said output pinion except when meshed with the double sector gear; a single sector gear fast on said input shaft; first and second intermediate pinions located diametrically of said single sector gear and positioned to mate therewith; a third cam locking disc fast on said input shaft; fourth and fifth cam locking discs positioned to mate with said third cam locking disc and rigid with said intermediate pinions to lock the same against rotation except when the double sector gear meshes with the output pinion; first and second intermediate shafts driven by said first and second intermediate pinions; first driving means providing a continuous driving connection from said first intermediate shaft to said output shaft; and second driving means providing a continuous driving connection from said second intermediate shaft to said output shaft, the direction of rotation of the output shaft for a given direction of rotation of the intermediate shafts when the first driving means is operative being opposite to that when the second driving means is operative.

3. An intermittent drive comprising a reversible rotary input member; a first rotary output member; first driving means providing a continuous drive from said input member to said first output member in a direction corresponding to the direction of rotation of said input member during at least one part of each rotation of said input member; a second rotary output member; and second and third driving means; the second driving means providing a continuous drive from said input member to said second output member when said first and third driving means are inoperative, the third driving means providing a continuous drive from said input member to said second output member when said first and second driving means are inoperative, the direction of rotation of said second output member for one direction of rotation of the input member when said second driving means is operative being opposite to that when said third driving means is operative.

4. An intermittent drive according to claim 3 comprising means for locking the first output member against rotation when one of the second and third driving means is operative.

5. An intermittent drive according to claim 3 com-

prising means for locking the second output member against rotation when the first driving means is operative.

6. An intermittent drive comprising a reversible rotary input member; a first output member; first driving means providing a continuous drive from said input member to said first output member in a direction corresponding to the direction of rotation of said input member during at least part of each rotation of the input member; an intermediate member; second driving means providing a continuous drive from said input member to said intermediate member in a direction corresponding to the direction of rotation of said input member when said first driving means is inoperative; a second rotary output member; and third and fourth driving means; said third driving means providing a continuous drive from said intermediate member to said second output member during part of each rotation of said intermediate member; said fourth driving means providing a continuous drive from said intermediate member to said second output member when said first and said third driving means are inoperative the direction of rotation of said second output member for one direction of rotation of said intermediate member when said third driving means is operative being opposite to that when said fourth driving means is operative.

7. An intermittent drive according to claim 6 comprising means for locking the first output member against rotation when the second driving means is operative.

8. An intermittent drive according to claim 7 comprising means for locking the second output member against rotation when the first driving means is operative

References Cited in the file of this patent

UNITED STATES PATENTS

1,748,390	Otto	Feb. 25, 1930
1,846,785	Breitling	Feb. 23, 1932
1,937,326	Pick	Nov. 28, 1933
2,593,416	Dawson	Apr. 22, 1952
2,680,164	Lennox	June 1, 1954
2,881,630	Opocensky	Apr. 14, 1959