

March 24, 1953

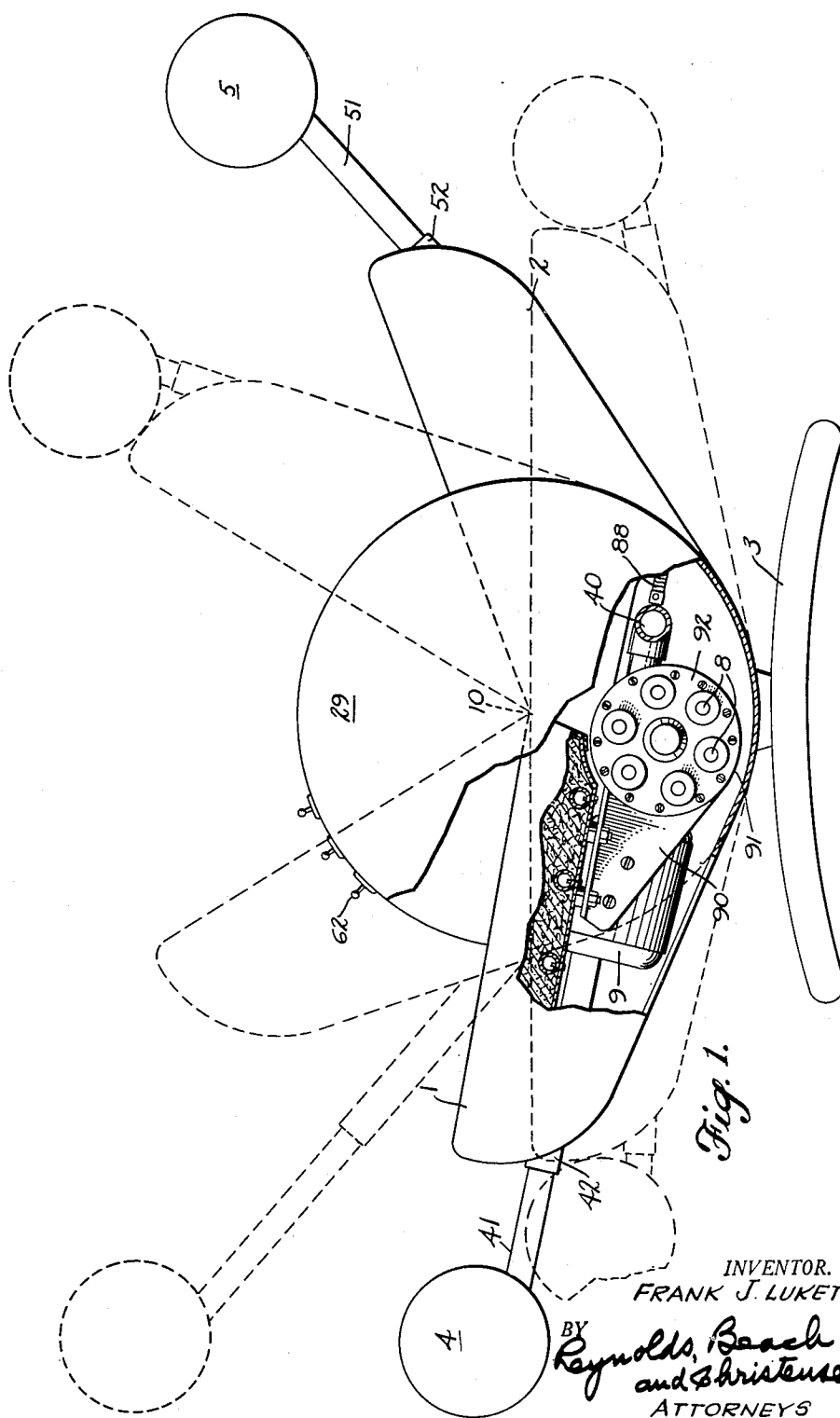
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2,632,336

POWER UNIT FOR ADJUSTABLE LOUNGE CHAIRS

Filed June 6, 1950

3 Sheets-Sheet 1



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Fig. 2.

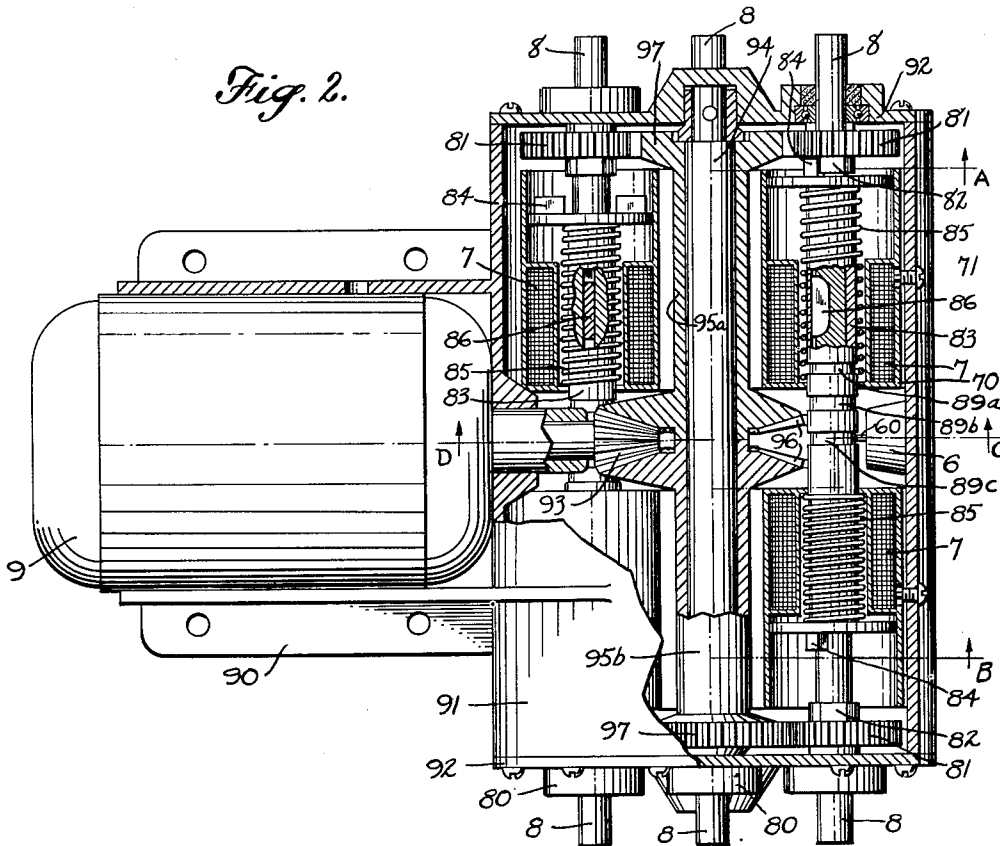
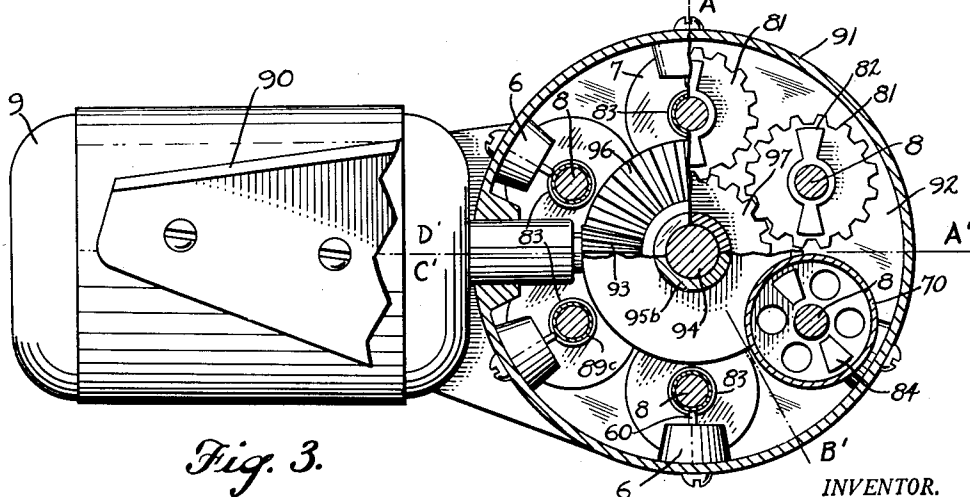


Fig. 3.



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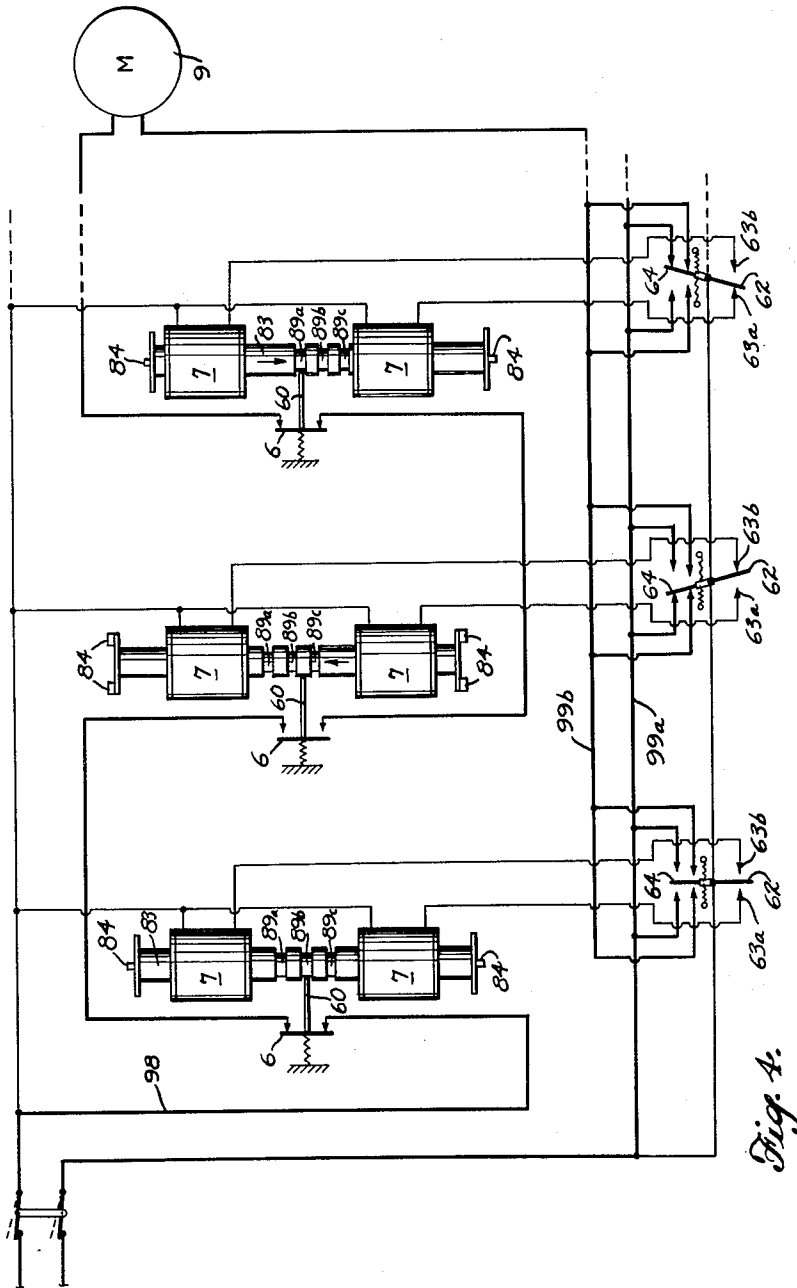
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POWER UNIT FOR ADJUSTABLE
LOUNGE CHAIRS

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9 Claims. (Cl. 74-472)

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In various copending applications I have disclosed and claimed a lounge chair and the various components thereof arranged and operable in such manner that each of the seats and backs may be independently tilted about a common axis, and whereby a legrest and a headrest may be tilted, and, in some forms, projected and retracted, each with respect to the seat or back whereby the same is supported. In certain of those applications, and particularly in Serial No. 127,218, filed November 14, 1949, Serial No. 98,511, filed June 11, 1949, Serial No. 103,987, filed July 11, 1949, and Serial No. 142,825, filed February 7, 1950, I have disclosed how these various elements may be adjusted in one sense or both, and sometimes, as in the case of the legrest at least, both for tilting and for retraction and projection, by a single power unit and selective transmission conveniently located within the chair structure, as for example within the seat portion. Application Serial No. 98,511 discloses a particular form of power unit for such a purpose, and the manner of its connection to the operative parts of the chair, but not the details of its controls.

The present invention concerns a power unit of the type just mentioned and suited for use in such a lounge chair, whereby to accomplish any of the individual movements or to accomplish simultaneously two or more such movements.

One of the objects of the present invention is to provide in a single unit, readily mountable and dismountable from the chair structure, and readily connected to the operating parts, a complete, compact power and transmission unit, capable of furnishing two-way drives, if need be, for each and all of six different adjustments.

It is an object to provide a unit of this nature in which all parts may be housed and closed against ingress of dust, lint, or other foreign matter, and which may include the lubricant necessary for the use of the mechanism during the entire operative life of the power unit and of the chair.

It is also an object to provide mechanism of this nature in which, from the mechanical standpoint, the parts are simply located and held in proper operative position without the likelihood of binding, and yet may be disassembled readily if need arises.

Still a further object is to provide in such a power unit means which will automatically disconnect the electric motor from its source of power, so that it will slow down during the actual clutching engagement of complementary clutch

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elements, to the end that the clashing and wearing incident thereto, when a device such as a clutch jaw rotating at considerable speed is clutched to a similar stationary device, may be avoided, and so that as an additional advantage, the mechanism will operate quietly and gently, yet positively.

It is a further object, from the electrical standpoint, to provide control means in the nature of two-way switches which, when thrown into one or the other operative position, will initiate rotation of the motor, but which in neutral position will deenergize the motor unless at the same time some other control switch is requiring its energization, all to the end that the motor will run only during a shifting operation, but will run continuously during that operation, excluding the time during actual engaging of the clutching elements.

Many additional objects could be recited, but other and incidental objects will be ascertainable as this specification progresses, or will become apparent as the understanding of the invention is improved by further detailed disclosure.

In the accompanying drawings the invention is shown embodied in a form such as is presently preferred by me, but the principles which characterize this invention will be ascertainable from the claims, after the disclosure of the typical form in the drawings and specification.

Figure 1 is a side elevational view, partly broken away, illustrating the power unit installed within a lounge chair.

Figure 2 is in part an axial sectional view through the power unit, and in part an elevation thereof; and Figure 3 is a sectional view on several different planes, that is to say, the portion from A' to A' is on the plane represented at A in Figure 2, the portion from A' to B' of Figure 3 is on the plane indicated at B in Figure 2, the portion from B' to C' of Figure 3 is on the plane indicated by C in Figure 2, and the portion from C' to A', clockwise about Figure 3, is represented at the line D in Figure 2.

Figure 4 is a wiring diagram.

The chair includes two main body-supporting elements, a seat 1 and a back 2, both pivotally mounted in a floor engaging frame 3, to tilt independently of one another about an axis which preferably is at the point 19, corresponding to the junction of the upper or forward body-supporting planes of the seat and back respectively. An arm portion 29 might be a part of the frame 3, or may be mounted for tilting with the back

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or with the seat, normally with the back. A secondary body-supporting element consisting of the legrest 4 is mounted on supporting arms 41 which are projectable in and out with respect to a guide tube 42, and this guide 42 is pivotally mounted at 40 for up and down or tilting movement. A further secondary body-supporting element consisting of the headrest 5 is similarly supported on arms 51 which are slidable in and out of guides 52, and the latter may be pivotally mounted within the back 2 for tilting forwardly and rearwardly. Details of such structure, and of operating means therefor, are included in the copending applications referred to, and need not be repeated here in order to understand this invention.

One of the main body-supporting elements of the chair, such as the seat or the back (usually the seat) is made hollow, and mounts a motor 9, which is carried upon brackets 94, by which it may be semipermanently, though removably, supported upon the underside of the seat 1, as is best seen in Figure 1. The same brackets support a housing 91 carrying removable end caps 92, and the housing 91 is more or less cylindrical, with its axis crossing that of the motor 9. The motor shaft within the housing 91 carries a bevel pinion 93.

Mounted within the housing 91, preferably coincident with the axis thereof, is a journal support 94, whereon are journaled two spool-like elements, 95a and 95b, freely rotatable about the support 94. Each at its inner end is formed with a bevel gear 96, each of which is continuously in mesh with the bevel pinion 93, and at their outer ends each carries a sun gear 97, and as a consequence of the arrangement shown and described, the sun gears 97 rotate in respectively opposite rotative senses, so long as the motor 9 is energized.

Grouped around the central journal support 94, and parallel thereto, are a series of driven shafts 8. These are retained by thrust bearings 80 against axial movement, but they may rotate within their bearings 80 with respect to the end caps 92. Externally each is connected to a particular mechanism to operate a given chair element in reverse senses, so that whenever the given shaft is rotated the corresponding mechanism is actuated in the corresponding sense. A single flexible shaft 88, in Figure 1, is representative of the operative connections between all the shafts 8 and their respective mechanisms. Journaled at each end of each such shaft is a planet gear 81 which meshes with the sun gear 97 at this end, so as to be continuously rotated thereby. However, these planet gears 81 are loose upon their respective shafts 8, and hence do not drive the shaft unless and until they are clutched thereto. For the purpose of clutch engagement, each planet gear 81 is provided with clutching elements 82, preferably in the form of a positively engaging jaw.

Surrounding, slidable axially of, and keyed at 86 to each shaft 8 at each end is a magnetic armature in the form of a sleeve 83. The shaft must be of nonmagnetic material, so that the armature will slide freely. At each end each such armature is provided with clutching elements 84 which are complementary to and at proper times are engaged with the clutching elements 82 on the planet gears. Normally, however, the complementary clutching elements are held out of engagement by means of the centering springs 85, and except when the armature is attracted by

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energization of solenoid means shortly to be described the clutches are held by the spring means 85 in neutral or disengaged position.

Two-way solenoid means, or windings 7, are retained in housings 70, surrounding each armature 83, and each such housing is loosely retained in position against rotative or axial displacement by the set screw 71 entering a hole therein through the housing 91. Upon energization of one end or the other of a given two-part solenoid, the corresponding armature 83 is attracted toward that end of the housing 91, and its clutching members 84 are operatively engaged with the clutching elements 82 of the planet gear 81 at that end. This, however, only removes the clutching elements 84 and 82 the farther from one another at the opposite end of the same driven shaft 8, so that it is never possible to drive any given driven shaft two ways at once.

The motor 9 operates, when energized, at fair speed, and for quietness and for longevity it is undesirable to clash the jaw clutch elements 84 and 82 as they engage, to commence movement of a stationary chair element. In consequence, means are provided to automatically deenergize the motor 9 momentarily during the actual engagement of these clutching elements, and to that end normally closed switch means 6 are provided in the motor circuit, as will shortly appear more clearly, but fixedly located each in the vicinity of its respective armature 83. Each such armature is provided with circumferential grooves 89a, 89b and 89c, located in positions such that a switch actuator 60 will project into that groove which is opposite its location, but during the shifting the lands intermediate the grooves will depress the switch actuator 60 and thereby will open the switch 6 in the motor circuit, and hence will momentarily deenergize the motor. The solenoid, however, is not thus deenergized and completes the movement into or from clutch-engaged position, and when the armature reaches any position wherein a groove is opposite the switch actuator 60, that switch closes automatically and the motor circuit is in condition for energization of the motor, and will again energize the motor if the circuit is otherwise closed.

Referring to the wiring diagram of Figure 4, it will be observed that each of the switches 6 is in a series lead 98 to the motor, so that if any one of these normally closed switches 6 is open, the motor will be deenergized, but if all are closed, the motor can be energized. It will also be observed that a control switch member 62 is biased to remain in neutral position, but can be moved to contact one or the other of contacts 63a or 63b, running respectively to and controlling energization of, one end or the other of the double-ended solenoid 7 for any given driven shaft. Closure of the switch element 62, in one sense or the other, energizes the corresponding armature and effects clutch engagement of its shaft to the motor. Indeed, two or more such switches 62 may be closed at one time, and so long as any one of them remains closed, as is the one at the right in Figure 4, although clutch engagement is completed, its corresponding shaft will be rotated and adjustment of a chair element will result. Whenever the control switch element 62 is released, it automatically returns to neutral position, and the centering springs 85 automatically return parts to declutched position, and adjustment ceases.

Likewise it will be observed that during the

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actual shifting, as, for instance, in the central solenoid pair of Figure 4, the switch control element 60 rides upon a land intermediate the grooves of the armature, and thereby breaks the corresponding motor control switch 6, and the motor is momentarily deenergized and slows down sufficiently to permit the engagement of the clutching elements.

Optionally, but preferably a further switch element 64 is also associated with each control switch 62. This switch element 64 is normally biased into neutral or open position, but may engage switch points in the parallel leads 99a and 99b to the side of the motor circuit opposite the series lead 90. When all the switch elements 62 are in normal neutral position, this side of the motor circuit is broken and the motor is deenergized, regardless of the closure of the switches at 6. When any one of the switches 62 is closed in either sense, the motor circuit is completed through the parallel leads 99a and 99b, and if it is closed at the switches 6, as normally it would be, energization of the motor results, and also there results energization of the two-way solenoid means corresponding to the switch 62 which has been closed; shifting occurs there, with clutch engagement and shifting of the corresponding chair element, so long as the switch 62 remains closed. Upon release of the switch 62, and its return to its normal open position, the corresponding solenoid means at 7 are deenergized, its armature resumes its neutral, declutched position, but reverse actuation does not occur until the same switch 62 has been closed in the opposite sense.

By locating the control switches 62 conveniently to the occupant of the chair, as, for instance, on the chair arm 29, the occupant, without change of position, can readily accomplish any adjustment in either sense to achieve the most comfortable position. Any one or more adjustable chair elements can be adjusted at one time in one sense or the other; once adjusted each will stay in its adjusted position, provided only its adjusting mechanism is self-locking, as usually it would be; engagement of the individual drives is gentle and quiet, yet positive. The entire power unit is easily installed or removable; the housing 91 can be filled with lubricant, and needs no replenishment, or can be cleaned and refilled if need be; the individual solenoid housings 70 are not rigidly held within the housing 91, hence do not bind, but float, and are located by their shafts 8 and by the single set screw 71, which is readily releasable for removal of a solenoid pair if need arises. The entire arrangement is compact, as it must be to fit within the small space available. Each driven shaft has two ends available for connection of a flexible shaft such as 80, so that duplicate drives can extend thence to duplicate operating mechanisms at the opposite sides of the chair, if the latter so requires, and both such duplicate operating mechanisms will operate in the same sense at any given time, for the sense of rotation of the shaft is controlled by the clutch at one end or the other.

I claim as my invention:

1. A power unit for a purpose as specified, comprising an electric motor, a plurality of individual driving gears operatively connected to and driven from said motor at all times, a like number of individual driven shafts and a gear on each driven shaft in constant mesh at all times with a corresponding driving gear, paired complementary clutching members carried by each driven

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gear and its shaft, respectively, clutch-engaging means electrically energizable to shift any given pair of clutching members into engagement, thereby to drive the corresponding driven shaft, normally open control switch means closable to energize any selected clutch-engaging means, a plurality of normally closed switches in the motor's circuit, one for each pair of driving and driven elements, and means operatively associated with said clutch-engaging means to open the corresponding motor-circuit switch momentarily during shifting of the clutching members into engagement.

2. A power unit as defined in claim 1, wherein two driving gears are provided for and paired with each driven shaft, and two complementary driven gears are provided for and secured to each driven shaft, each in mesh with its corresponding driving gear, one of which driving gears is rotatable by the motor in one sense and the other in the opposite sense, such power unit including also two clutch-engaging means for each driven shaft, one of which is operatively connected to each such driven gear, characterized in that the switch means for control of energization of the clutch-engaging means are normally open switches, closable individually to energize either one but not both the corresponding clutch-engaging means, and in that the motor-circuit switch-opening means are duplicated, to open the corresponding motor switch during either sense of shifting of the clutch-engaging means.

3. A power unit as defined in claim 1, wherein two driving gears are provided for and paired with each driven shaft, and are located adjacent the respectively opposite ends thereof, one being rotatable by the motor in one sense and the other in the opposite sense, and wherein two driven gears, each meshing with its corresponding driving gear, are similarly provided and located, such power unit including also a clutch-engaging means individual to each driven gear and its shaft, and those two which are associated with a given shaft being connected for conjoint movement axially thereof, intermediate the two driven gears of that shaft, so that either one of the clutch-engaging means may be operatively engaged with its driven gear and so with its driving gear, but not both simultaneously, the arrangement being characterized in that the motor-circuit switch-opening means are duplicated, to open the corresponding motor switch during shifting of the corresponding clutch-engaging means in either axial sense.

4. A power unit as in claim 1, including means for automatically restoring the clutch-engaging means to disengaged position, a normally open supplemental motor control switch operatively associated with each of said normally open control switches such as effect energization of the clutch-engaging means, to be closed when the latter are closed, and open when the latter are open, whereby the motor is energizable only while a clutch is engaged.

5. A power unit for a purpose as specified, comprising an electric motor, a plurality of individual driven shafts, a magnetic armature rotatively coupled to and slidable lengthwise of each such driven shaft, clutching members carried by the opposite ends of and shiftable with said armature, a plurality of rotary driving elements, each carrying complementary clutching members, journaled coaxially of and one at each end of each shaft, resilient means normally holding said clutching members disconnected from the paired

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clutching members at the opposite ends of its shaft and its armature, two-way solenoid means mounted operatively adjacent each shaft, and when energized attracting the corresponding armature in one axial sense or the other to engage its clutching members with those of the paired rotary driving elements, means connecting said rotary driving elements to the electric motor, to drive those at one end of the shafts continuously in one rotary sense and those at the opposite end in the reverse sense, so long as the motor is energized, normally open control switch means connected electrically to each of the solenoid means and selectively closable to energize the latter and shift the corresponding armature into one or the other clutch-engaged position, a plurality of switches in the motor's circuit, one for each driven shaft, biased towards closed position, and means interconnecting each such motor circuit switch with its shiftable armature for opening of such switch momentarily, and consequent interruption of the motor circuit, during shifting of the armature into either clutch-engaging position.

6. A power unit as defined in claim 5, including a central journal support, two sun gears carried on the opposite ends thereof and operatively connected to the electric motor for rotation in opposite senses, and wherein the several shafts are grouped around and parallel to the journal support, and the rotary driving elements are formed as planet gears intermeshed with the respective sun gears.

7. A power unit as in claim 5, characterized in that each armature has three circumferential grooves, one for normal neutral position and one for each clutch-engaged position, and a motor circuit switch actuator for each switch projecting for engagement in said grooves to leave its switch in closed position, and to be depressed to open the switch as the intervening lands pass the actuator.

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8. A power unit for a purpose as specified, comprising an electric motor the shaft whereof carries a bevel pinion, a housing mounting a central journal support the axis whereof crosses that of the motor shaft, two rotative spools journaled at the respective ends of said journal support, formed at their inner ends as bevel gears meshing with opposite sides of said bevel pinion, and at their outer ends as sun gears, a plurality of driven shafts parallel to and grouped about said spools, a planet gear journaled about each end of each driven shaft, in mesh with the respective sun gears for continuous rotation, but in opposite senses at the opposite ends, so long as the motor is energized, two-way solenoid means, including axially shiftable armatures normally biased to remain in a neutral position, operatively associated with each driven shaft, and for rotation therewith, complementary clutching elements interengageable between each end of each armature and its planet gear, and control means to energize any solenoid means in one or the other sense, to effect driving interengagement of its shaft with its planet gear.

9. A power unit as in claim 8, including circuit-breaking means connected in the motor circuit, and means positioned for operation by the several solenoid means, during clutch-engaging shifting thereof, to actuate said circuit-breaking means during actual shifting.

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