Sept. 19, 1939. W. H. NEWELL 2,173,656

FOLLOW-UP

Filed Oct. 28, 1938 2 Sheets-Sheet 1

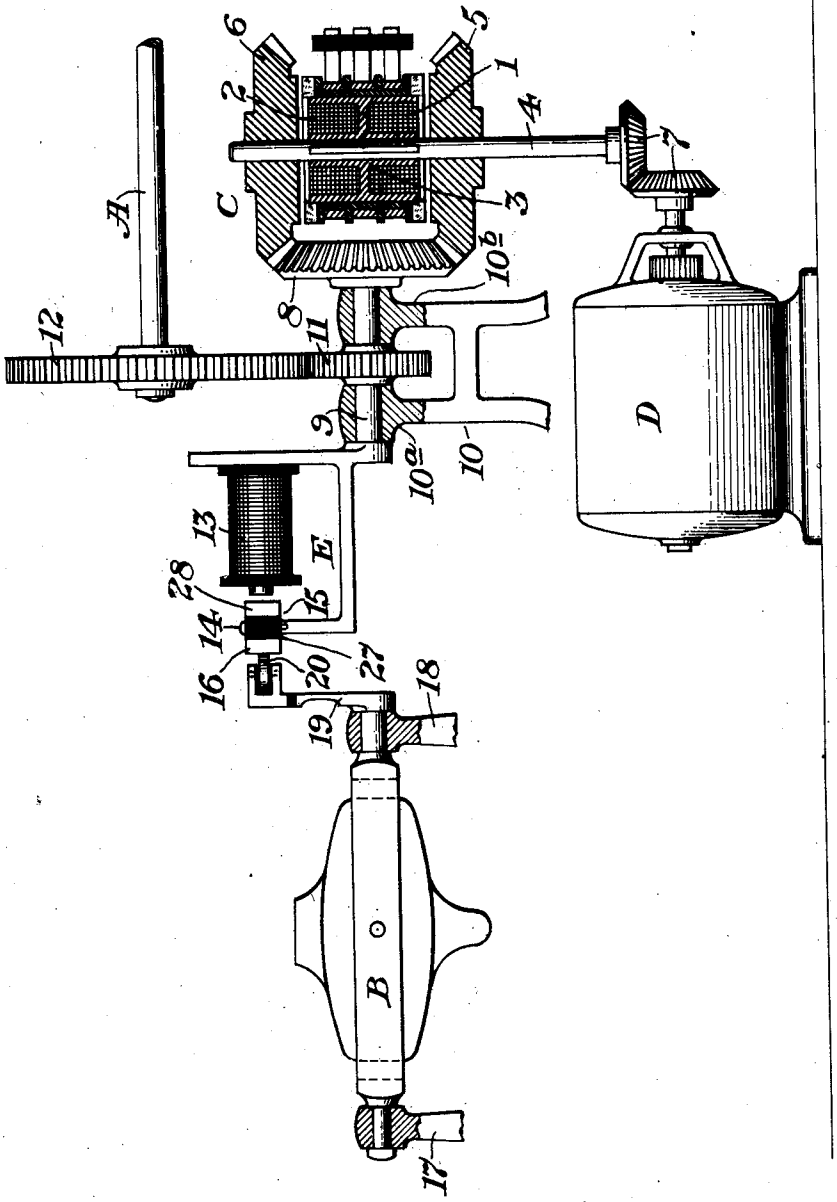


Fig. 1

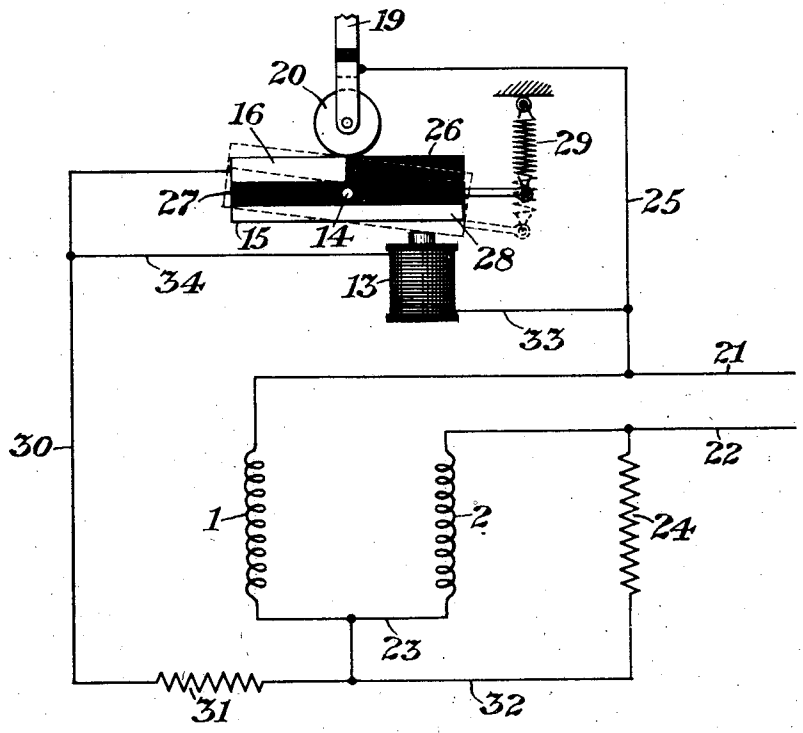
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Fig. 2



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FOLLOW-UP

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5 Claims. (Cl. 172—239)

The invention herein disclosed relates to a follow-up mechanism in which a power driven object or following member is caused to operate in accordance with a controlling member. More particularly, the invention relates to a follow-up mechanism of the type disclosed, for example, in United States Patent No. 1,784,504, issued December 9, 1930.

In the mechanism disclosed in the aforementioned patent the power actuating means for driving the following member is electrically controlled through electrical circuits. The effective energization of these circuits depends upon the relative position of certain contact elements. One of these contact elements consists of a roller that is moved bodily by the controlling member. The other contact element includes two spaced electrical contacts, aligned in the path of the roller contact and insulated from each other. These contacts are positioned to engage the roller contact. When the roller makes contact with one of the two aligned electrical contacts, the following member and the aligned contacts are driven in one direction and when the roller contacts engage the other aligned contact, the following member and the aligned contacts are driven in the opposite direction.

An object of this invention is to simplify the control circuits of such a follow-up mechanism and to provide an arrangement in which the danger of a short circuit between contacts is eliminated. This object and certain advantages that will hereinafter appear are attained in accordance with this invention by providing a control circuit in which the reversal of the following member is attained by an off and on contact. The control circuit includes but two electrical contacts, one actuated in accordance with the controlling member and the other in accordance with the following member. When these contacts engage the following member is driven in one direction and when the contacts are separated the following member is driven in the opposite direction.

A control circuit embodying this invention and suitable for an electromagnetic clutch follow-up mechanism is illustrated in the accompanying drawings in which:

Fig. 1 is an elevation partly in section of a follow-up mechanism; and

Fig. 2 is a diagrammatic illustration of a control circuit that is used to control the operation of the electromagnetic clutch of the follow-up mechanism shown in Fig. 1.

In Fig. 1 there is shown a follow-up mechanism by means of which a shaft A is driven in accordance with the movement of a gyroscope B. Movement of the shaft A is effected through an electromagnetic clutch C. The clutch C has opposed coils 1 and 2 mounted in a central clutch ring 3 splined to a shaft 4 between bevel gears 5 and 6 rotatably mounted on the shaft 4. The coils 1 and 2 continually rotate with the shaft 4, which is driven by an electric motor D, through bevel gears 7. Gears 5 and 6 mesh with a bevel gear 8 attached to one end of a shaft 9 journaled in a rigid standard 10 having bearing brackets 10*a* and 10*b*. Mounted on the shaft 9 between the arms 10*a* and 10*b* of the standard there is a gear 11 which meshes with a gear 12 attached to one end of the shaft A. The other end of the shaft 9 carries a channel-shaped bracket E. On one arm of the bracket E there is mounted an electromagnet 13, and on the other arm there is pivotally mounted at 14, a contact block assembly 15 which includes a contact 16. The contact block assembly 15, and the electromagnet 13, are bodily moved by the bracket E, in accordance with the movement of the driven shaft A.

The gyroscope B, or controlling member, is suspended in a gimbal ring in the usual manner, which is trunnioned in standards 17 and 18. A resilient arm 19 is mounted on one of the trunnions of the gimbal ring and carries a roller contact 20 rotatably mounted between the arms of an insulated bifurcated end section of the arm 19. Any movement of the gyroscope B is communicated through arm 19 to the roller 20 which is moved bodily therewith and cooperates with the contact block assembly 15 and its contact 16, in a manner hereinafter described. In this manner energization of coils 1 and 2 of the clutch C is controlled and the shaft A is caused to move in accordance with movement of the gyroscope B.

When one of the coils of the electromagnetic clutch is effectively energized the following member or shaft A is caused to operate in one direction and when the other is effectively energized, the following member operates in the other direction. This operation is effected through the bevel gears 5 and 6 which are attracted by the electromagnet when coils 1 and 2 are respectively energized. When coil 1 is effectively energized, gear 5 is caused to rotate with shaft 4 and through gear 8 rotates shaft 9 in one direction. When coil 2 is effectively energized, gear 6 is caused to rotate with shaft 4 and drives shaft 9, and in consequence shaft A, in the other direction.

The control circuit for effectively energizing

coils 1 and 2 is illustrated in Fig. 2. In accordance with that circuit these coils are connected in series and across the line wires 21 and 22. The line wire 21 is connected to one side of coil 1 and the line wire 22 is connected to one side of the coil 2. A conductor 23 connects the other sides of the two coils together, thus placing the coils in series and across the line.

The coils are of equal strength and branch circuits are utilized for causing a greater current flow through one or the other of the coil to effectively energize the coils. One such branch circuit consists of a resistance 24 connected in parallel with the coil 2. This resistance serves to shunt a part of the current that would otherwise flow through the coil 2 and so disturbs the balance that exists between the electromotive force of the two coils. Coil 1 having a greater current flow therethrough is thus effectively energized and causes the following member, through the clutch as described above, to operate in one direction.

To effectively energize coil 2 and thus cause the following member to operate in the opposite direction another branch circuit is provided. This branch circuit includes a conductor 25 connected to the line wire 21 and a roller contact 20. The roller contact 20 is rotatably mounted in the bifurcated arm 19 that may represent the controlling member as described and illustrated in Fig. 1. This contact 20 cooperates with a contact device that includes the electrical contact 16 and a strip of insulating material 26 aligned with the contact 16 in the direction of bodily movement of the roller contact. The contact 16 and insulating material 26 are mounted on a block of insulating material 27 to the opposite side of which there is secured a metal armature 28. The contact block assembly just described is pivotally mounted on the pivot 14. The electromagnet 13 positioned under the insulation strip 26 is arranged, when energized, to attract the armature 28 and so tilt the contact block. A spring 29 returns the contact block when the magnet is deenergized. The foregoing constitutes the follower contact device and is connected to be moved bodily in accordance with movement of the following member. It may be considered as the following member.

The contact 16 is connected by a conductor 30 to one side of a resistance 31, the other side of which is connected by a conductor 32 to the conductor 23. The electromagnet 13 is connected across the conductors 25 and 30 by conductors 33 and 34. The resistance 31 is such that it passes more current than the resistance 24, that is, it has a lesser resistance or ohmic value than the resistance 24.

It will be seen from the foregoing that when contacts 20 and 16 are engaged, the resistance 31 is connected in parallel with the coil 1. This circuit is as follows: line wire 21, conductor 25, contacts 20 and 16, conductor 30, resistance 31, conductor 23, coil 2 and resistance 24 to line wire 22. When the contact 20 is on the strip 26, this circuit through the resistance 31 is broken. In consequence when contacts 20 and 16 are thus separated, coil 1 is effectively energized and predominates. When contacts 20 and 16 are engaged, more current is shunted around coil 1, because of the lower resistance of resistance 31, than is shunted around coil 2. Coil 2 is then effectively energized and predominates.

The making and breaking of contacts 20 and 16 also causes the deenergization and energization respectively of electromagnet 13. When contacts 20 and 16 are separated a circuit is established through the electromagnet 13 as follows: line wire 21, conductors 25 and 33, electromagnet 13, conductors 34 and 30, resistance 31, conductor 23, and coil 2 and resistance 24 to the line wire 22. When these contacts engage, a shunting circuit is established between conductors 25 and 30 and the electromagnet 13 is deenergized. In this way this single electromagnet together with the spring 16 effects the vibration of the contact block.

From the foregoing description of the control circuit illustrated in the drawings, it will be seen that by this invention there is provided a simplified control system for a follow-up mechanism in which there is no danger of short circuit between the contacts. It will be apparent that coils 1 and 2 may be the coils of a reversing motor instead of a clutch. Likewise other forms of follow-up action of contacts may be used, such for example, as differential control of a make and break contact.

It will be obvious that various changes may be made by those skilled in the art in the details of the embodiment of the invention illustrated in the drawings and described above within the principle and scope of the invention as expressed in the appended claims.

I claim:

1. In a follow-up mechanism for causing one member to operate in accordance with another, the combination comprising a movable electrical contact, another movable electrical contact positioned to cooperate with said first mentioned contact and movable relative thereto, electrically actuated power means connected to move said second mentioned contact, and a control circuit for said power means connecting the power means across the line including branch circuits for shunting a part of the current in the circuit and connected to effect operation of the power means in one direction upon engagement of the contacts and in the opposite direction upon separation of the contacts.

2. In a follow-up mechanism for causing one member to operate in accordance with another, the combination comprising a movable electrical contact, another movable electrical contact positioned to cooperate with said first mentioned contact and movable relative thereto, electrically actuated means connected to move said second mentioned contact including opposing electromagnetic coils, and a control circuit for said electrically actuated means connecting the coils across the line and including branch circuits for shunting a part of the current in the circuit around the coils, the said contacts being connected in circuit to effect a shunting of current around one of the coils upon engagement of the contacts, whereby movement of the second mentioned contact is effected in one direction upon engagement of the contacts and in the opposite direction upon separation of the contacts.

3. In a follow-up mechanism for causing one member to operate in accordance with another, the combination comprising a movable electrical contact, another movable electrical contact positioned to cooperate with said first mentioned contact and movable relative thereto, electrically actuated means connected to move said second mentioned contact including opposing electromagnetic coils, a control circuit for said electrically actuated means connecting the coils across the line in series, a branch circuit including a

resistance for shunting a part of the current around one of said coils, and another branch circuit including another resistance and the said contacts for shunting a part of the current around the other of said coils.

4. In a follow-up mechanism for causing one member to operate in accordance with another, the combination comprising a roller constituting an electrical contact, a contact device positioned to cooperate with the roller and movable with respect thereto, the contact device including an electrical contact and a strip of insulating material, electrically actuated means connected to move said contact device relative to said roller including opposing electromagnetic coils, a control circuit connecting the coils across the line in series, a branch circuit including a resistance for shunting a part of the current around one of the coils, and another branch circuit for shunting a part of the current around the other coil including a resistance, said roller contact and the contact of said contact device.

5. In a follow-up mechanism for causing one member to operate in accordance with another, the combination comprising a movable roller constituting an electrical contact, a contact device positioned to cooperate with the roller and bodily movable with respect thereto, the contact device including a pivotally mounted electrical contact and aligned strip of insulating material and means for vibrating the same, electrically actuated means connected to move said contact device relative to said roller including opposing electromagnetic coils, a control circuit connecting the coils across the line in series, a branch circuit including a resistance for shunting a part of the current around one of the coils, and another branch circuit for shunting a part of the current around the other coil including a resistance, said roller contact and the contact of said contact device.

WILLIAM H. NEWELL.