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3,477,027

VARIABLE RELUCTANCE PICKOFF AND SWITCH TO SHORT
CIRCUIT AN OUTPUT WINDING

Filed June 12, 1967

2 Sheets-Sheet 1

Fig. 1.

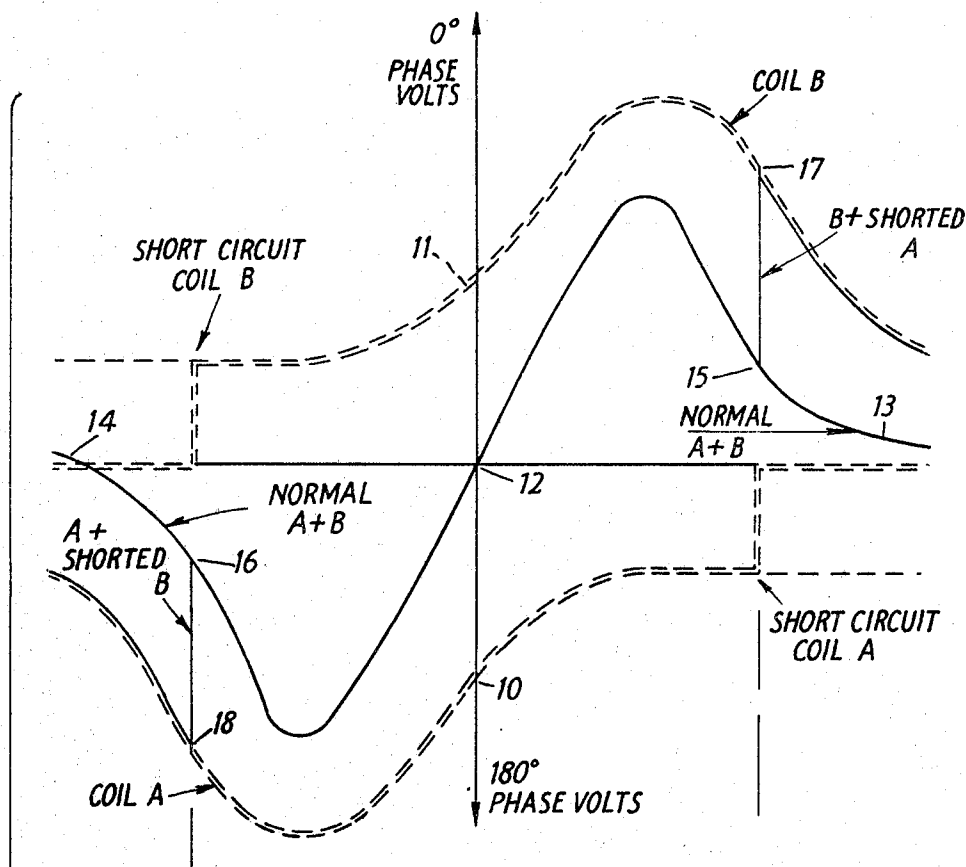
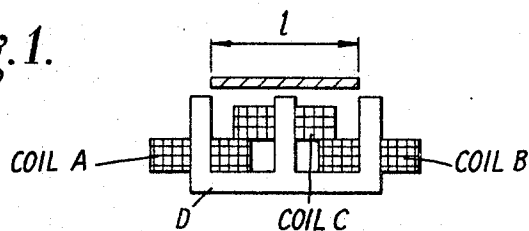
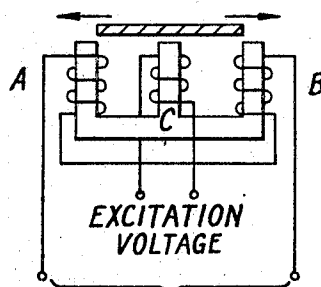


Fig. 2.

SWITCH OPERATES



SWITCH OPERATES

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OUTPUT SIGNAL By, Wendueth, Lind and Ponack
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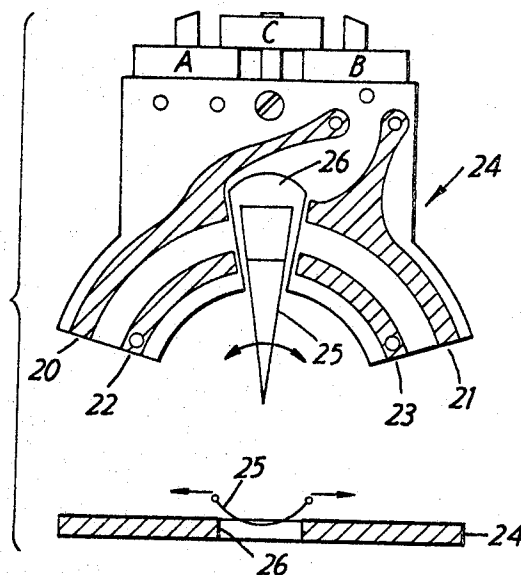
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Fig.3.



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VARIABLE RELUCTANCE PICKOFF AND SWITCH TO SHORT CIRCUIT AN OUTPUT WINDING

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27,332/66

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7 Claims

ABSTRACT OF THE DISCLOSURE

A variable reluctance pick-off having one member movable in either direction from a central datum position to cause corresponding differential induced currents in two windings on another member, the members being effective to operate a switch to short circuit or shunt each winding when the one member moves sufficiently far in the opposite direction.

The invention relates to variable reluctance pick-offs.

According to the invention there is provided a variable reluctance pick-off comprising an excitation winding; two output windings; a transformer coupling member movable to control the electromagnetic coupling between the windings, being movable in opposite directions from a datum position at which the couplings between the excitation winding and the two output windings are substantially equal; and switch means; the arrangement being such that when the coupling member has a displacement from the datum position in either direction of more than a predetermined value, the switch means short circuits or shunts the output winding which is the further from the coupling member.

Preferably the windings are wound on a common core which is an E core on which the excitation winding is wound on the control limb and the output windings on respective outer limbs, the coupling member being an I bar armature.

The switch means may comprise a wiper and contact portions movable together relative to the wiper, the switch condition being determined by whether the wiper is making contact with a contact portion and, if so, which contact portion or portions, the contact portions and wiper being coupled mechanically with the windings and coupling member to move relatively therewith.

In a preferred embodiment of the invention the contact portions are conductive tracks formed on an insulating board which has a slot cut in it, the arrangement being such that the wiper moves with the armature to make contact with the tracks and at the datum position rests within the confines of the slot so as to have no mechanical or electrical contact with the board at the datum position or in positions a small predetermined distance away from the datum position. Conveniently, the contact tracks are arcuate and the wiper rotates about a pivot point at the centre of the arcs.

The wiper may be a bridging wiper which bridges adjacent contact portions to effect the necessary switching.

The invention will further be described with reference to the accompanying drawings, of which:

FIGURE 1 shows diagrammatically an E coil I bar variable reluctance pick-off;

FIGURE 2 shows graphically the output voltages of the E-I pick-off related to movement of the I bar, and

FIGURE 3 shows switch means associated with the pick-off.

In FIGURE 1 is shown a typical E coil I bar variable reluctance pick-off in which, to ensure good null resolution, the length I of the I bar is approximately limited to

the length between the outer arms of the E core. The pick-off includes the output coils A and B and the excited central coil C all mounted on their respective arms of the E shaped laminated core D. The output coils are connected together to give a composite output signal.

In FIGURE 2 in normal operation, at a null condition the voltage 10 induced in coil A is equal in amplitude and opposite in phase to that 11 induced in coil B resulting in bear zero output as shown at 12. Although coils A and B are reasonably matched there is always some residual voltage output when the I bar as having no effect on the coils and this signal together with any extraneous pick-up seen at 13 and 14, will drive a servo in the same direction no matter what the position of the I bar. If the pick-up is included in a closed loop system in which a servo responsive to the composite output signal is arranged to maintain the pick-off at the null position, the wrong sign of the error signal obtained as at 14 under the above circumstances will make the system unstable and cause the pick-off to be driven in the wrong direction. Thus the I (driving member) and E (driven member) can become more and more separated in one direction and render the pick-off inoperative.

However, in an arrangement in accordance with the invention switch means are provided which, when the output voltage is still fairly large at 15, 16, short-circuits the appropriate coil A or B thus leaving a resultant output 17, 18 from the other coil. This is accomplished by connecting coils A and B to conductor tracks 20, 21, 22, 23 (FIGURE 3) on a printed circuit board 24 and short-circuiting adjacent tracks by means of a bridging wiper 25. Normal voltages and currents as generally used require no precautions other than the use of suitable contact materials for the wiper and tracks. If higher currents or voltages are used a shunt resistance is incorporated in the shorting circuit, giving less than maximum signal output but sufficient to operate correctly.

In FIGURE 3 under normal operating conditions the wiper 25 has no contact with the tracks or board and no frictional load is imposed on the rotating I bar assembly as the wiper moves to and fro in the cut away slot 26 in the board 24.

The invention is not restricted to the details of the foregoing description of one embodiment thereof. For example, it is envisaged that the switch means may be effective to short circuit or shunt the respective output coils at positions within, and preferably near the ends of the nominally linear portion of the composite output curve shown in FIGURE 2, that is, the portion between the opposed peaks. Furthermore, the E-I pick-off described is only one example of a suitable pick-off, the invention being applicable also, for example, to a differential transformer arrangement.

I claim:

1. A variable reluctance pick-off comprising an excitation winding; two output windings; a transformer coupling member movable to control the electromagnetic coupling between the windings, being movable in opposite directions from a datum position at which the couplings between the excitation winding and the two output windings are substantially equal; and switch means; the arrangement being such that when the coupling member has a displacement from the datum position in either direction of more than a predetermined value, the switch means short circuits or shunts the output winding which is the further from the coupling member.

2. A variable reluctance pick-off as claimed in claim 1 wherein the windings are wound on a common core.

3. A variable reluctance pick-off as claimed in claim 2 wherein the core is an E core on which the excitation winding is wound on the control limb and the output

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windings on respective outer limbs, the coupling member being an I bar armature.

4. A pick-off as claimed in claim 1 wherein the switch means comprises a wiper and contact portions movable together relative to the wiper, the switch condition being determined by whether the wiper is making contact with a contact portion and, if so, which contact portion or portions, the contact portions and wiper being coupled mechanically with the windings and coupling member to move relatively therewith.

5. A pick-off as claimed in claim 4 wherein the contact portions are conductive tracks formed on an insulating board which has a slot cut in it, the arrangement being such that the wiper moves with the armature to make contact with the tracks and at the datum position rests within the confines of the slot so as to have no mechanical or electrical contact with the board at the datum position or in positions a small predetermined distance away from the datum position.

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6. A pick-off as claimed in claim 5 wherein the contact tracks are arcuate and the wiper rotates about a pivot point at the centre of the arcs.

7. A pick-off as claimed in claim 4 wherein the wiper is a bridging wiper which bridges adjacent contact portions to effect the necessary switching.

References Cited

UNITED STATES PATENTS

3,217,240 11/1965 Grant et al. ----- 323—51

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