Aug. 10, 1954 W. LEATHERS 2,686,235

ELECTRIC SIGNAL PICK-OFF DEVICE

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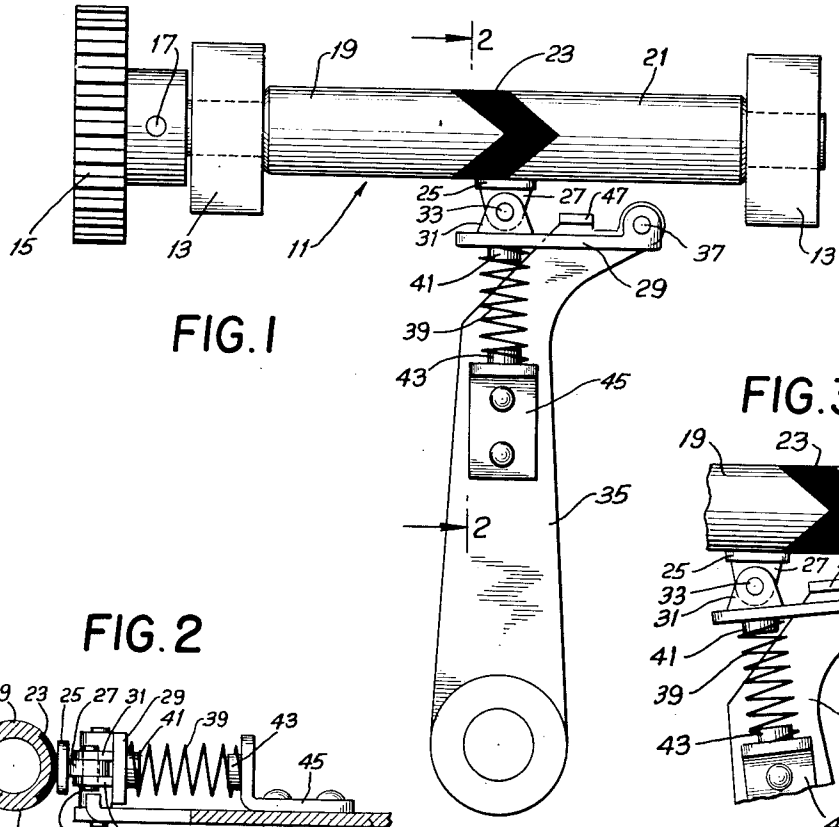


FIG. 1

FIG. 3

FIG. 2

FIG. 4

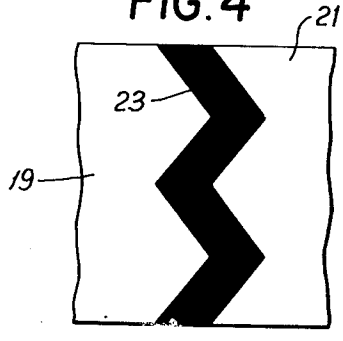
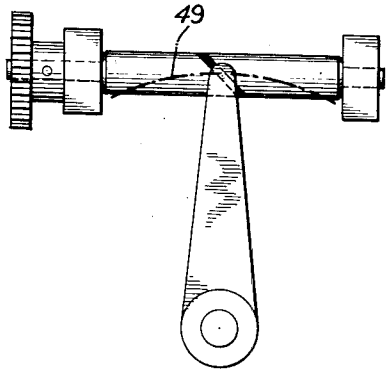


FIG. 5



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ELECTRIC SIGNAL PICK-OFF DEVICE

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Application February 27, 1953, Serial No. 339,497

5 Claims. (Cl. 200—8)

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This invention is concerned with a pick-off device and more specifically with an electric circuit making and breaking device for a pair of circuits, of the type employed as a control element in a hydraulic servo system such as that disclosed in a copending application, Serial No. 284,606 filed April 26, 1952.

The object of this invention is to provide an improved sliding contactor which employs a parallel sliding movement along the surface of the contact drum, this parallel movement being parallel to the rotation axis of the contact drum so that the errors or non-linearity of the signals, obtained from the previous type of pick-off will be eliminated.

Another object of this invention is to provide an improved configuration for the insulation strip which divides the contact drum into separate contact areas. The improved configuration thus contemplated allows a great reduction in speed of revolving the contact drum and therefore greatly reduces the amount of wear which takes place at the sliding contact. To these and other ends, one embodiment of the invention is illustrated in the drawings, in which:

Fig. 1 is a plan view of the pick-off;

Fig. 2 is a cross-section view of the contactor and drum taken along the line 2—2 of Fig. 1;

Fig. 3 is a detail plan view showing the relative position of the parts when the contactor is displaced to one side of its neutral position illustrated in Fig. 1;

Fig. 4 is a detail view of the surface of the drum unrolled showing the configuration of the insulating strip and

Fig. 5 is a plan view of a previous type of pick-off illustrating the path of its contactor over the drum.

A pick-off, as the term is being used in this disclosure, is a device for producing error signals in a servo system. The servo system will be energized when error signals other than zero are present, and the energized servo system will produce movement of controlled elements and at the same time will produce a reduction of the error signal toward zero. This same pick-off might be used merely as a control element, in a system which does not have any follow-up element for reducing the energizing signal to zero, but which system merely uses the amount of signal to determine the amount of energization of the system.

Other uses may be found for this pick-off unit which is basically an electric switching device having a common contactor which makes alternate contact with two separate conducting surfaces on a rotating drum. The common contactor is supported from a pivoted arm for movement over the surface of the drum. At a neutral position the contactor makes contact for equal periods of time with each of the conducting surfaces alternately; while on either side of neutral the contactor will increase the periods of contact with one of the conducting surfaces, and correspondingly decrease the periods of contact with the other surface. When the device is being used in a servo system, such as that disclosed in the aforementioned copending application, Serial No. 284,606, the neutral position corresponds to zero error.

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In Fig. 1, the whole pick-off unit is illustrated and it will be observed that the unit consists of a contact drum 11 which has a surface composed of some metallic material which is a good electrical conductor, such as copper. This contact drum 11 is carried for rotation by a pair of bearing members 13 and may be continuously rotated by means of a gear 15 which is secured to one end of the shaft for the drum 11 by means of a pin 17. The surface of contact drum 11 is divided into two separate areas 19 and 21, which are separated by a strip of insulating material 23. Each of the surface areas 19 and 21 may be electrically connected to a separate circuit by any convenient means (not shown) such as contact brushes or the like. Under the surface of the drum 11, there is a layer of insulating material 24 (see Fig. 2) in order to insulate the surface areas 19 and 21 from the supporting structure, including bearing members 13. This layer 24 may be the same material as insulating strip 23 if desired, or any other suitable insulating material.

Electrical contact with each of these surface areas 19 and 21 is made alternately as the drum 11 is rotated by means of a contactor 25 which may be made of any convenient electric brush material depending upon the current rating and related considerations. The contactor 25 is supported by a bracket 27 which is fastened to a short cross arm 29 by means of a corresponding pair of brackets 31 and a pin 33. The cross arm 29 is pivoted to the end of a pick-off arm 35 by means of an upstanding pin 37. The contactor 25 is kept pressed against the surface of drum 11 by means of a coil spring 39 which is held in place by means of two lugs 41 and 43. Lug 41 is located on the cross arm 29 behind the brackets 31 which support the contactor 25, while lug 43 is located on the face of an angle bracket

45 which in turn is fastened onto the upper surface of the arm 35 by means of rivets as illustrated. There is a turned-up stop member 47 which is located near the end of pick-off arm 35 and which acts to limit the movement of cross arm 29 so that when the pick-off unit is being assembled or disassembled the coil spring 39 will not tend to fall away from its lugs 41 and 43.

It will be noted that the pick-off arm 35 is pivoted about an axis which lies at right angles to the longitudinal axis of the drum 11. Furthermore, the location of the arm 35 along its pivot axis relative to the drum 11 (see Fig. 2) is such that the center of the contactor 25 touches the surface of drum 11 on a line which lies in a horizontal plane passed through the longitudinal axis of drum 11. By this means, when pick-off arm 35 is pivoted to one side or the other of the neutral position illustrated in Fig. 1, contactor 25 will slide back and forth on a line which is parallel to the longitudinal axis of drum 11. This movement of contactor 25 is in distinction to the movement which would take place for a contactor of the old style pick-off such as that illustrated in Fig. 5. It will be noted that the contactor of the old style pick-off will follow an arcuate path on the surface of its drum such as that illustrated by a dashed line 49 (Fig. 5). It is pointed out that such arcuate travel of the contactor over the surface of the drum will produce non-linear changes in the signal produced by the pick-off as its arm pivots relative to the drum. The construction embodied in my invention eliminates this source of non-linear response of a system which employs this type of pick-off contact. It is this parallel sliding motion of contactor 25 which produces a linear signal effect when the contactor is moved from its neutral position in either direction as illustrated in Fig. 1.

Fig. 3 illustrates the swivel action of the mounting for contactor 25 which allows the contactor to maintain an even pressure over its entire width, which is in contact with the surface of drum 11. It will be noted that the width of contactor 25 is in this instance equal to the width of the insulating strip 23 as measured parallel to the longitudinal axis of the drum 11. If desired, the width of contactor 25 might be greater or less than that of the strip 23. Any such difference in width of contactor 25 will of course produce either an overlap in the alternate contacting of surface areas 19 and 21 on the contactor drum 11, or a time lag between the alternate contacting. That is, if contactor 25 is wider than strip 23, then when the contactor 25 is in its neutral position and the drum 11 is rotating, the periods of alternate contacting of areas 19 and 21 will overlap such that both areas 19 and 21 will be contacted simultaneously for very short periods each cycle. On the other hand, if contactor 25 is narrower than strip 23, then, with contactor 25 at neutral, there will be short periods between the alternate contacting of areas 19 and 21 when neither area 19 nor 21 will be contacted. It will now be evident that the action of the pick-off unit is such that by maintaining a continuous rotation of drum 11, the two circuits (not shown) connected to surface areas 19 and 21 will be alternately connected to contactor 25 and its supporting structure for producing an alternate energization of the two circuits. The time duration of alternate energizations in each cycle may be varied by pivoting the pick-off arm 35 in either direction from its neutral position (illustrated in Fig. 1).

Fig. 4 illustrates the configuration of the insulating strip 23 which has a zig-zag shape when viewed (as illustrated in Fig. 4) by unrolling the surface of drum 11. It will be observed that by means of this configuration, two complete cycles of alternate contacting of the two surface areas 19 and 21 may be had for each revolution of the drum 11. In this way, the speed of revolving drum 11 may be reduced one-half while the same frequency of alternate contacting of the two surface areas is maintained. For this reason, a greatly reduced brush travel speed of the contactor 25 over the surface of the drum 11 will be accomplished, and, consequently, much less wear of the contactor 25 and also of the surface of the drum 11 will take place. This means that undesirable grooving of the surface of drum 11 will be reduced to a minimum.

It will be clear that the configuration of strip 23 may be made with additional changes in direction or zig-zags, in order to increase the number of additional cycles per revolution of the drum 11 and thus further reduce the speed of travel of the surface of drum 11 relative to the contractor 25 while maintaining the same frequency.

The details of a specific embodiment of the invention have been illustrated in accordance with the applicable statutes; but this is to be taken as illustrative only and in no way as limiting my invention.

I claim:

1. In an electrical pick-off device having a contact drum, the surface of which is divided into two separate areas being separated by an insulating strip with a predetermined shape, and a sliding contactor riding on the surface of said drum, said contactor being movable over the surface of said drum carried by an arm pivoted about a point fixed relative to the rotational axis of said drum, the improvement comprising swivel mounting means for said contactor to maintain even contact pressure over the entire contacting surface of the contactor, and means mounting said contactor for contact movement along the surface of said drum parallel to the rotational axis of the drum.

2. In an electrical pick-off device having a contact drum, the surface of which is divided into two separate areas being separated by an insulating strip with a predetermined shape, and a sliding contactor riding on the surface of said drum, said contactor being movable over the surface of said drum carried by an arm pivoted about a point fixed relative to the rotational axis of said drum, the improvement comprising swivel mounting means for said contactor to maintain even contact pressure over the entire contacting surface of the contactor, a bracket attached to said arm, and spring means for applying contact pressure to said contactor, said arm, said bracket and said swivel mounting means all supporting said contactor for movement over the surface of said drum parallel to the axis of the drum.

3. In combination a contact drum, means for continuously rotating said drum about its longitudinal axis, a sliding contactor spring biased into contact with the surface of said drum, swivel mounting means for said contactor to maintain even pressure over the whole contacting surface of the contactor, means for positioning said sliding contactor to cause it to move over the surface of the drum parallel to the longitudinal axis

of the drum, and insulation means on the surface of said drum for separating said surface into two sections insulated from one another, said insulation means being of a configuration such that said contactor will complete a plurality of cycles of contacting one of said drum sections and then the other.

4. In combination a contact drum, means for continuously rotating said drum about its longitudinal axis, a sliding contactor spring biased into contact with the surface of said drum, an arm supporting said sliding contactor, said arm having a bearing for pivoting the arm about an axis at right angles to the longitudinal axis of said drum, a swivel mounting on said arm for said sliding contactor to maintain even contact between the full width of the contactor and the drum, said arm being positioned relative to said drum so that said contactor slides in a path parallel to the longitudinal axis of the drum, and an insulation strip on the surface of said drum for dividing the surface of the drum into separate areas, said strip having a configuration such that a plurality of cycles are completed in one revolution of the drum when the contactor is over the insulation strip.

5. In combination a contact drum, means for continuously rotating said drum about its longitudinal axis, a sliding contactor spring biased into contact with the surface of said drum, an arm supporting said sliding contactor, said arm having a bearing for pivoting the arm about an axis at right angles to the longitudinal axis of said drum, a cross arm swiveled near the end of said first mentioned arm, a swivel mounting on said cross arm for said sliding contactor to maintain even contact between the full width of the contactor and the drum, a bracket on said first mentioned arm for supporting the spring that biases said sliding contactor into contact with the drum, said first mentioned arm being positioned relative to said drum so that said contactor slides in a path parallel to the longitudinal axis of the drum, and a zig-zag shaped insulation strip having parallel sides, said strip dividing the surface of the drum into separate areas for alternate contacting by said contactor, said zig-zag strip being configured to produce two complete cycles of alternate contacting in one revolution of the drum.

No references cited.