Oct. 13, 1959 C. F. STRANDBERG 2,908,778

IMPULSE SWITCH FOR RANDOM INFORMATION COUNTERS

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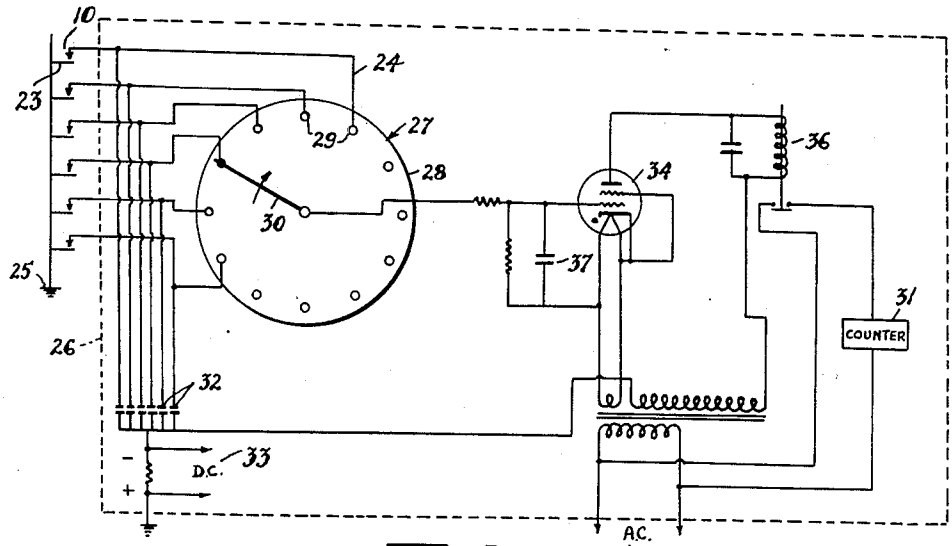

FIG. 1.

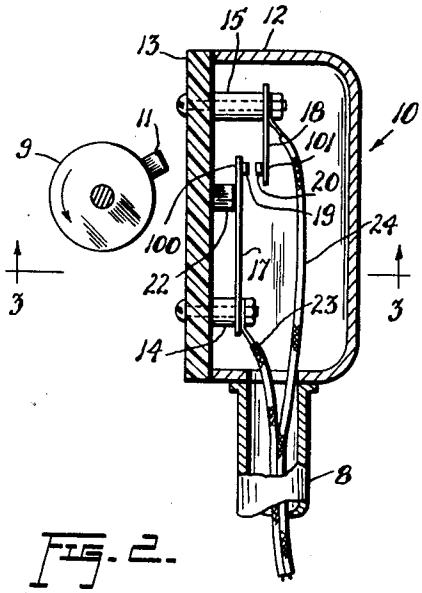

FIG. 2.

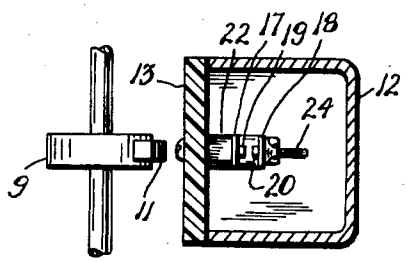

FIG. 3.

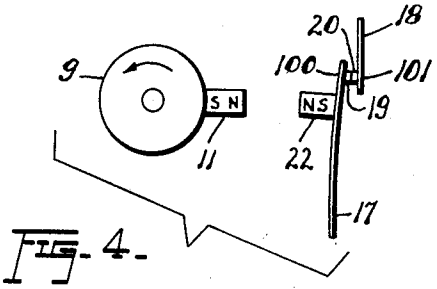

FIG. 4.

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IMPULSE SWITCH FOR RANDOM INFORMATION COUNTERS

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1 Claim. (Cl. 200—19)

This invention relates to an improved impulse switch suitable for use with the random information counting apparatus disclosed in my application S.N. 572,902 filed March 21, 1956, and intended to be substituted for the impulse switch disclosed therein.

The new switch is magnetically operated and does not require attachment to the machine shaft, the revolutions of which are to be counted. A small rectangular magnet is mounted on the machine shaft. A second magnet is attached to one resilient reed blade of the switch. The switch is mounted adjacent the machine shaft so that the magnet on the shaft will repel the magnet on the switch during the portion of the shaft revolution when the magnets are closest to each other. The spacing between the magnet and the strength of the magnets are such that the switch blades will remain open while the shaft is stationary. One of the important features of this invention is that the contacts do not engage unless the shaft is revolving at some nominal speed. This is necessary in the special instance of counting so as to prevent registration of counts while the shaft is idle and the magnets are at opposition. The revolving shaft causes the contact blade to move at a velocity dependent upon the speed of the revolving shaft. The product of the weight of the blade, including its magnet, and the velocity of the blade provides sufficient momentum to cause the contacts to strike.

The electric impulse generated when the switch contacts close is of extremely short duration. This is another desirable feature in consideration of the error that would be introduced should the duration be greater than the period during which the line sampling switch contained in the random information counter is in any contact position.

The new switch provides other important advantages: (1) installation is simplified in that no physical connection to the shaft is required; (2) the entire switch assembly can be sealed in an enclosure having a non-magnetic face, such as plastic, thus preventing exposure of the switch contacts and parts; (3) inasmuch as the switch is not directly driven or attached to the machine shaft, the life expectancy is increased substantially; and, (4) the cost of fabricating the new switch is lower.

The invention will be more readily understood by reference to the accompanying drawings and the following detailed description in which a specific embodiment of the invention is set forth by way of illustration rather than by way of limitation.

In the drawings:

Figure 1 is a diagrammatic view disclosing my improved switch used in conjunction with my random information counting apparatus.

Figure 2 is a vertical sectional view through the switch assembly and shaft disclosing the switch blade in normally open position.

Figure 3 is a horizontal sectional view taken along line 3—3 of Figure 2.

Figure 4 is a fragmentary vertical sectional view of the switch and shaft disclosing the switch contacts in closed position when the shaft and switch leaf magnets are in magnetic opposition and the shaft is rotating at a normal speed.

Referring particularly to Figure 2 of the drawings, the magnetic switch assembly **10** is shown mounted upon a supporting conduit **8** adjacent a rotating machine shaft **9** to which is attached a rectangular magnet **11**.

The switch assembly **10** consists of a box housing **12** fastened to supporting conduit **8** by suitable means and closed by a face plate **13** of non-magnetic material such as Plexiglas. Insulating posts **14** and **15** attached to the face plate **13** and inclosed within the box **12** support resilient switch reed blades **17** and **18** respectively in parallel planes so that their unsupported ends **100**, **101** overlie each other. Contacts **19** and **20** are fastened to the overlying ends of the switch blades **17** and **18** facing each other in non-contacting relation when the switch is in normal inoperative position. Electrical conductors **23** and **24** are attached to switch blades **17** and **18** respectively at the supported ends thereof, and pass through aperture **21** in box **12** and through conduit **8** to connect with suitable impulse receiving apparatus.

Switch blade **17** supports near its unsupported end **100** rectangular magnet **22** adjacent face plate **13** and on its side opposite from contact **19**. Magnets **11** and **22** are mounted to magnetically repel each other when shaft **9** is rotated to position the magnets in facing relation to each other, as shown in Fig. 4. The force of magnetic repulsion tends to flex switch blade **17** toward switch blade **18**. This force alone is not enough to keep the switch contacts closed when the shaft is stationary with magnets opposing each other. However, when the shaft is rotating at normal speed, the momentum given to the switch blade **17** when the force of magnetic repulsion flexes it about its support is enough to cause the switch contacts to close once for each revolution of the shaft. The resilience of reed blade **17** rapidly returns it to normal inoperative position after contact is made since the shaft magnet has rotated out of the field of influence on the switch magnet. The switch contacts will remain open until the shaft magnet is again rotated opposite the switch magnet.

The short duration impulse produced by closing of the switch contacts is suitable for reception by my random counter apparatus shown in Figure 1 and disclosed in detail in my prior application S.N. 572,902 filed March 21, 1956.

The structure of the improved impulse switch having been described, the operation thereof in conjunction with my random counting apparatus for counting, by way of example, the number of picks made by looms in a textile works will now be discussed.

In the textile industry a particular worker supervises the operation of several looms. His pay is based on the number of picks which the looms under his supervision make during a pay period. It is therefore desirable to have apparatus which will count the picks made by each machine and will transmit that count to apparatus which totalizes the picks made by all of the looms.

In accordance with this need each of several looms attended by a particular worker is provided with an impulse switch **10** such as is shown in Figure 2. The switch may be made to count the picks produced by a single loom by operatively connecting shaft **9** to the loom pick producing mechanism so that the shaft rotates once each time a pick is made. As has been described above the switch closes and generates one electric impulse every time shaft **9** makes one revolution. This impulse representing one pick is detected by my Ran-

dom Counter Apparatus which will now be discussed in detail, referring to Fig. 1 of the drawings.

Conductor 23 of the several switches 10 of the respective looms are connected to a common ground 25.

The conductors 24 of the several switches of the respective looms attended by one particular worker are taken to a remote, central point such as a control panel 26, at which there is provided a rotary sampling switch 27. The latter comprises a plate 28 having a plurality of circumferentially spaced contacts or segments 29 thereon, the number of these contacts or segments corresponding to the number of looms attended by the worker. The plate 28 also carries a rotor arm 30 which is suitably driven at a fixed rate so as to successively engage the contacts 29, each once during a certain period of time.

The wires or conductors 24 from the several switches 10 are connected to the respective contacts 29 of the sampling switch 27, it being noted that for simplicity of illustration in the accompanying Figure 1, only a few of such connections have been shown.

The sampling switch 27 is adapted so as to retain an electrical impulse on any one of the contacts 29 until such impulse is picked up by the rotor arm 30 and transmitted by means hereinafter described to a suitable counter 31. Moreover, after the impulse is picked up by the rotor arm, the segment of contact 29 must be free of the impulse. Finally, the rotor arm 30 must make contact with all the segments 29 in less time than can possibly exist between two successive impulses applied to any particular segment.

In order to satisfy the above conditions, a plurality of capacitors 32 are provided between the respective conductors 24 leading to the respective segments 29 and a common direct current supply 33. The polarity of the current supply 33 is such that the capacitors are charged when the respective switches 10 are momentarily closed, thereby making the segments 29 positive with respect to the cathode of a suitable gas control tube 34.

The freeing of impulses from the respective segments 29 is effected by making the time constant of the circuit connected to the rotor arm 30 extremely short whereby to essentially discharge the capacitor when contact of the rotor arm with the segment is made, the current of discharge being employed to actuate the counter circuit.

Finally, the contact of the rotor arm 30 with all the segments 29 in less time than exists between two successive impulses to any given segment is effected by rotating the rotor arm at a speed greater than the rate of occurrence of the impulses.

When the rotor arm 30 picks up an impulse from any one of the segments 29, the grid of the tube 34 is rendered positive, causing the tube to conduct. The counter 31 is in circuit with a source of alternating current 35 and with the tube 34 through a relay 36, the closing of the latter being arranged to actuate the counter each time positive potential is delivered to the grid of the tube.

As will be also noted, the circuit includes a capacitor 37 which absorbs the charge left on each of the segments 29 and reduces the positive potential thereof to a value which is too low to cause the tube 34 to conduct for a second time.

The operation of the invention will be apparent from the following example:

Let it be assumed that one particular operator attends 60 looms and that it is desired to count the total production in terms of number of picks of these looms. Each loom is provided with one of the switches 10 and the sampling switch 27 is equipped with 60 of the segments 29, connected to the wires 24 of the respective

switches 10. Moreover, 60 of the capacitors 32 are connected to the respective wires 24.

Let it be assumed further that each loom is operating at the rate of 173 picks per minute which is represented by 173 impulses per minute which will be fed by each loom to the sampling switch 27 while the loom is actually running.

Under such circumstances the rotor arm 30 is arranged to rotate at a fixed speed of, let us say, 200 revolutions per minute, which is sufficiently fast to prevent more than one impulse being applied to any one of the segments 29 at one time.

The apparatus will thus receive the impulses occurring at random and arrange them sequentially through the medium of the switch 27, so that each time the tube 34 is rendered conductive the counter 31 will be actuated and, during a specified pay period, the counter will indicate the number of picks made by all the looms attended by the same operator.

The arrangement of the control panel 26 is duplicated, of course, for each operator whose work is to be counted, all such panels being located at a common control point, remote from the looms themselves, where the several counters may be conveniently read.

In some cases it may be desirable to have the counter indicate a given ratio of the product being counted. To accomplish this a conventional electronic scaler may be incorporated in the counter circuit. The scaler simply receives the impulses at the full machine rate and scales down to the exact ratio desired.

The invention has been described in detail for the purpose of illustration but it will be obvious that numerous modifications and variations may be resorted to within the scope of the appended claim.

I claim:

In a magnetically energized and momentum operated momentary contact switch, the combination of a leaf spring anchored at one end thereof and having a free other end portion normally retained in an initial position by its inherent resiliency, said free end portion of the spring being deflectable laterally to one side of its initial position to a partially deflected intermediate position and to a fully deflected ultimate position, a switch contact carried by the free end portion of the spring at the side thereof facing its direction of deflection, a stationary switch contact disposed adjacent the spring and electrically engageable by the first mentioned contact only when the spring is deflected to its ultimate position, a magnet carried by the free end portion of the spring at the side thereof opposite the first contact and its direction of deflection, a rotatable shaft disposed adjacent the spring, and a coacting magnet carried by said shaft in inductive relation to the first magnet, said magnets having mutually repelling polarities capable of producing a field of force sufficient to deflect said spring only to its intermediate position and the deflection of the spring to its intermediate position producing momentum to cause deflection thereof to its ultimate position by momentum alone, whereby the spring may remain in its ultimate position only momentarily and return therefrom as soon as its momentum is dissipated.

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