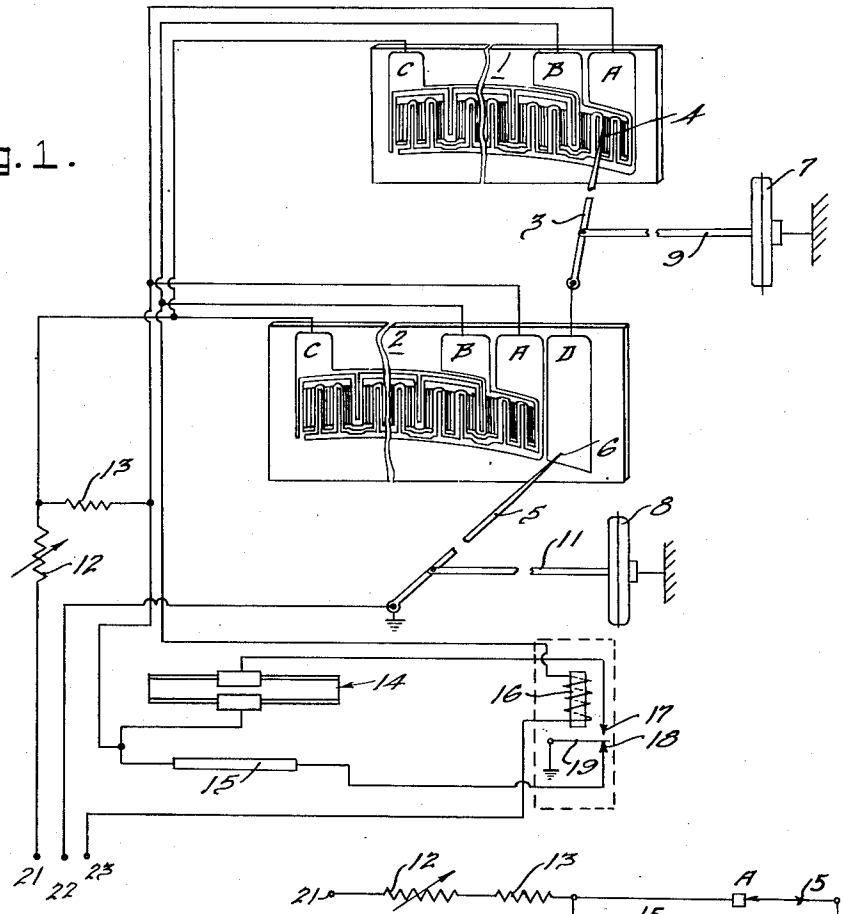
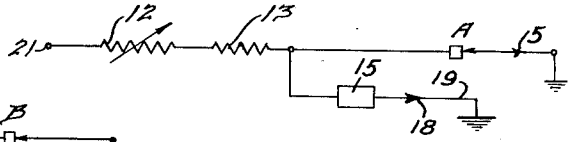
Sept. 14, 1954 P. R. GOUDY 2,689,342

PRESSURE OPERATED SWITCHING DEVICE

Filed Sept. 8, 1950

Fig. 1.





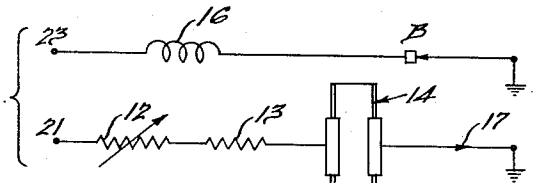


Fig. 2.

Fig. 3.

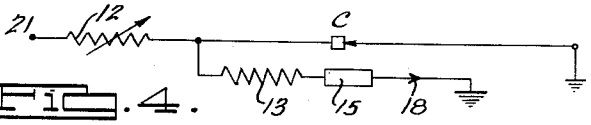


Fig. 4.

Fig. 5.

INVENTOR.
Paul R. Goudy.
BY
Myron J. Seibold
ATTORNEY.

Patented Sept. 14, 1954

2,689,342

UNITED STATES PATENT OFFICE

2,689,342

PRESSURE OPERATED SWITCHING DEVICE

Paul R. Goudy, Milwaukee, Wis., assignor, by mesne assignments, to Kollsman Instrument Corporation, Elmhurst, N. Y., a corporation of New York

Application September 8, 1950, Serial No. 183,690

4 Claims. (Cl. 340—345)

1

This invention relates to a radiosonde modulator system, and more particularly to a pressure actuated switching means for selectively connecting various circuits elements into the modulation circuit of a radiosonde transmitter, and to a means whereby a plurality of pressure responsive devices having individual pressure response ranges may be utilized through their most sensitive range.

The object of the present invention is to provide a modulator for a radiosonde transmitter in which pressure actuated switching means are utilized to select the channels for a transmitter modulator circuit.

Another object of the present invention in accordance with the previous object is the provision of the means whereby the accuracy of the radiosonde modulator device may be extended over a greater pressure range.

A more specific object of the present invention is the provision of a pair of pressure sensitive devices designed so as to motivate a pair of brushes across a pair of commutators whereby the movement of the brushes will connect a plurality of sensitive elements individually with a transmitter input circuit, and an arrangement whereby one pressure sensitive device will operate through a first pressure range while the second will operate through another pressure range which is a continuation of the first and will thereby provide not only a means for accurately presenting a response of the sensitive elements, but will also provide means for accurately determining pressure through a wide range of pressures.

Figure 1 is a schematic representation of the pressure switched channel selecting means of the radiosonde modulator.

Figures 2, 3 and 4 are schematic showings of the circuits of channels A, B and C respectively of Figure 1.

Figure 5 is a schematic showing of the circuit with a brush on the insulating segment of the commutators of Figure 1.

In the schematic representation of Figure 1, two commutators are shown at 1 and 2, both commutators having channels A, B and C. Arms 3 and 5 carrying brushes 4 and 6 are pivotally mounted so as to be movable across commutators 1 and 2 respectively to contact repeating conducting segments of channels A, B and C on the commutators. Commutator 2 has, in addition to channels A, B and C, a conducting tab D through which arm 5 and brush 6 are connected to arm 3 carrying brush 4. (Pivoted arm 5 with brush

2

6 connects commutator 2 to a common return, here shown as ground, and to the transmitter input as shown in Figure 1 at 21, 22 and 23.) Aneroid capsules 7 and 8 are operatively connected through links 9 and 11 to the arms 3 and 5 respectively to effect movement of the arms. Aneroid capsules 7 and 8 have different pressure ranges such that one, for instance 8, will become operative when the other has passed through its most sensitive range.

The commutators 1 and 2 may be constructed of polystyrene, or some similar material, which has been etched and then coated with a conducting material, such as silver, to produce the construction of the channels as shown in Figure 1. The channels may have any order of repetition, but as shown in Figure 1, the order of repetition is channel A, four channels B with that order repeating twice and then followed by a channel C. This order of repetition is continued across the entire commutator.

Through the channels A, B and C of commutators 1 and 2, and the channel of the insulating segments of the commutators, a variable resistor 12 and a fixed resistor 13, a humidity sensitive element 14, a temperature responsive element 15, and a relay 16 are variously connected. Relay 16 has contacts at 17 and 18 and a movable contact carrying armature 19. These responsive element circuits are connected so that when the active brush 4 or 6 is on a conducting segment of one of channels A, B, C or on an insulating segment of the commutator, the circuit through the commutator will be as is shown in Figures 2 through 5.

In Figure 2 is shown the circuit when the active conducting brush is on a segment of channel A. Here, the circuit is completed from terminal 21 through variable resistor 12 and fixed resistor 13 and then through the conducting segment and brush to ground.

In Figure 3 is shown the circuit when the active conducting brush is on a conducting segment of channel B, the brush and conducting segment completing a circuit from terminal 23 through the coil of relay 16 to ground. This effects closing of contact 17 and completes the circuit from terminal 21 through variable resistor 12 and fixed resistor 13 and the humidity sensitive element 14 to ground.

In Figure 4 is shown schematically the circuit when the active conducting brush is on a conducting segment of channel C. Here the circuit is completed from terminal 21 through vari-

able resistor 12 and the conducting segment and brush to ground.

In Figure 5 is shown schematically the circuit when the active conducting brush rests upon an insulating segment of either commutator 1 or 2. Here a circuit is completed from terminal 21 through variable resistor 12, fixed resistor 13, the temperature sensitive element 15 and contact 18 to ground.

The operation of the radiosonde modulator system specifically illustrated in Figure 1 is as follows:

The package enclosing the modulator system and its radiosonde transmitter is designed to be either dropped from a high altitude with a small parachute controlling its rate of descent or is lifted from a low altitude through the aid of a gas filled balloon. In the description of the operation herein, the balloon lifted type radiosonde will be used although it will be readily apparent that the operation of a descending radiosonde will be similar with only a change in the aneroid and commutator first actuated.

As the radiosonde rises into regions of lower pressure, aneroid capsule 7 will begin to expand and through link 9 and arm 3 will cause brush 4 to move across commutator 1 so as to connect into the radiosonde transmitter input circuit, the various elements connected through channels A, B and C. Channel A presents the circuit of Figure 2 and is a reference circuit. Channel B presents the circuit of Figure 3 wherein the relay 16 is energized, causing its contact carrying armature to move so as to engage contact 17 and present the humidity responsive element 14 into the radiosonde transmitter input. Channel C presents the circuit of Figure 4 into the radiosonde transmitter input and is another reference circuit. In Figure 5 is shown the circuit arrangement when either brush 4 or 6, depending upon which is presently controlling the modulation, is on an insulating segment. In this circuit, relay 16 is not energized and the contact carrying armature 19 is in the position shown in Figure 1 and the temperature responsive element 15 is presented into the input circuit of the radiosonde transmitter.

As the pressure continues to decrease, and aneroid capsule 7 continues to expand, the brush 4 is moved further across commutator 1 to contact the repeating channels A, B and C. When the atmospheric pressure has decreased to the point at which the low pressure aneroid capsule 8 begins to expand, brush 6 through link 11 and arm 5 will be moved across commutator 2; brush 6 will first be moved to leave conducting tab D to disconnect arm 3 from the circuit. When this occurs, the high pressure section of the radiosonde modulator is no longer controlling the circuit and all channel selection will be done by the low pressure section of the device as brush 6 is moved across commutator 2. The channels provided by commutator 2 are the same as those provided by commutator 1, being electrically common therewith, and the transmitter is modulated again in accordance with high and low reference circuits and the humidity and temperature sensitive elements. The selection of the resistances in variable resistor 12, fixed resistor 13 and the impedances 14 and 15 are such that the radiosonde transmitter output will be modulated in accordance with the changes in not only pressure as the contact arms are moved to present the resistances and impedances into the circuit but also temperature and humidity as there aerological factors change. The use of a low pressure aneroid greatly increases the accuracy of the radiosonde modulator by providing a pressure responsive device which gives greater movement at the very low pressures encountered in high altitudes. In this manner, pressure responsive devices having individual sensitive ranges may be used to provide an improved overall accuracy in the radiosonde modulator.

From the foregoing explanation, it will be apparent that the atmospheric pressure at which the temperature and humidity will be as is indicated on a chart produced by a suitable receiver is determined at the beginning of each of the traces. The reference circuits will produce on the receiver's chart a trace by which the calibration of the receiver may be checked or adjusted and the spacing of the two reference traces on the chart will provide an aid in the determination of the contact number engaged by the brush by providing a means for counting the consecutive traces in groups such as fives or tens depending upon the construction of the commutator in use. The initiation pressure for each commutator segment will be previously determined by test calibration.

It is to be understood that applicant is not restricting himself to only two commutators and their associated pressure responsive devices as shown, as any desired number of repeating units may be employed to develop the desired accuracy in various sections of the atmosphere, nor is he restricting himself with the choice of sensitive elements as shown in the figures of the drawings, for it will be obvious that any sensitive element may be employed with the disclosure and any order of sensitive elements may be selected without changing the spirit of applicant's invention, and, while certain preferred embodiments of the invention have been specifically disclosed, it is understood that the invention is not limited thereto, as many variations will be readily apparent to those skilled in the art and the invention is to be given its broadest possible interpretation within the terms of the following claims.

What is claimed is:

1. A pressure operated switching device comprising a pair of commutators, brush carrying contact arms movable across said commutators, a pair of aneroid capsules operative to move said brush carrying contact arms across said commutators, said commutators and aneroid capsules being designed so that each has an individual response range while the device has a continuous pressure response characteristic, and means whereby one of said aneroid capsules and contact arms electrically disconnects the other of said pair of aneroid capsules and contact arms when said one aneroid capsule has entered its pressure responsive range, said one contact arm being continuously connected to ground, utilization circuits, relay means connected to said commutators and operable at positions of said contact arms on said commutators for successively connecting said utilization circuits to said commutators.

2. A pressure operated switching device comprising a plurality of commutators providing repeating circuit selecting conductor segments, temperature, humidity and reference circuits connected to individual repeating segments of said commutator's repeating segments, a brush carrying contact arm movable across each of said commutators providing means for selectively connecting said temperature, humidity and reference

circuits into the modulator circuit of a radiosonde transmitter, one of said contact arms being continuously connected to ground, pressure responsive means operative upon said brush carrying contact arms to move said arms across said commutators, said pressure responsive means being individually operative in separate pressure ranges yet collectively operative over a continuous range of pressure, said commutators providing means for successively connecting each alone in the selection circuit as their associated pressure responsive means enter their separate pressure ranges.

3. A pressure operated switching device comprising a first and a second commutator having a plurality of channels therethrough, a plurality of sensitive elements responsive to changes in atmospheric conditions connected to said plurality of channels, a first and a second brush carrying contact arms movable across said first and second commutators respectively, said second commutator having a separate channel thereon at its upper end through which the brush carrying contact arm of said first commutator is connected to the brush carrying contact arm of said second commutator, a first and a second pressure responsive device operative individually on said first and second brush carrying contact arms so as to move said brushes across said commutators, the range of said second pressure responsive device being a continuation of the range of said first pressure responsive device into a range of lower pressure, said second pressure responsive device operating to disconnect said first pressure responsive device from circuit control by moving the brush carrying contact arm associated with said second commutator out of contact with said separate channel whereby said brush carrying contact arm associated with said first commutator is disconnected from said switching device, the said contact arm of said second pressure responsive device being continuously connected to ground, utilization circuits, relay means connected to said commutators and operable at positions of said contact arms on said commutators for successively connecting said utilization circuits to said commutators.

4. A pressure operated switching device comprising a first and a second commutator having a plurality of channels therethrough a plurality of sensitive elements responsive to changes in atmospheric conditions connected to said plurality of channels, a first and a second brush carrying contact arms movable across said first and second commutators respectively, said second

commutator having a separate channel thereon at its upper end through which the brush carrying contact arm of said first commutator is connected to the brush carrying contact arm of said second commutator, a first and a second pressure responsive device operative individually on said first and second brush carrying contact arms so as to move said brushes across said commutators, the range of said second pressure responsive device being a continuation of the range of said first pressure responsive device into a range of lower pressure, said second pressure responsive device operating to disconnect said first pressure responsive device from circuit control by moving the brush carrying contact arm associated with said second commutator out of contact with said separate channel whereby said brush carrying contact arm associated with said first commutator is disconnected from said switching device, the contact arm of said second pressure responsive device being continuously connected to ground, utilization circuits, relay means connected to said commutators and operable at positions of said contact arms on said commutators for successively connecting said utilization circuits to said commutators, said first and second brush, upon moving across said first and second channel, sequentially connecting and disconnecting said plurality of sensitive elements, one of said sensitive elements being energized when said first or second brush touches a conducting portion of said first or second channel and a second of said sensitive elements being energized when said first or second brush does not make contact with a conducting portion of said first or second channel.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
2,405,689	De Giers	Aug. 13, 1946

OTHER REFERENCES

"Sensitive Aneroid Diaphragm Capsule With No Deflection Above a Selected Pressure," by W. G. Brombacher et al., January 1940.

An Improved Radio Sonde and Its Performance, by Harry Diamond et al. (September 1940).

Research Paper RP 1329, Journal of Research of the National Bureau of Standards, vol. 25 (p. 333 relied on).

Research Paper RP 1270, Journal of Research of the National Bureau of Standards, vol. 24 (pages 31 and 32 relied on). (Copy available in Division 42.)