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PRESSURE SWITCHING

Original Filed May 4, 1938

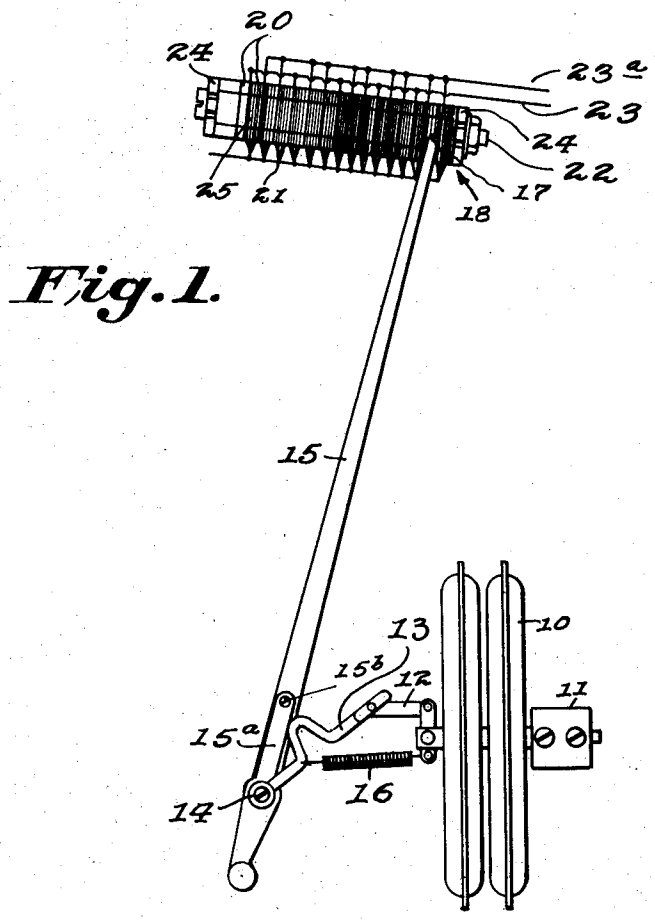
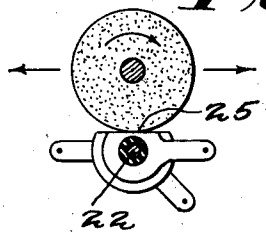


Fig. 1.

Fig. 2.



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PRESSURE SWITCHING

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Original application May 4, 1938, Serial No. 206,086. Divided and this application November 22, 1941, Serial No. 420,153

10 Claims. (Cl. 200—83)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

The invention described herein may be made and used by and for the Government of the United States for governmental purposes without the payment to us of any royalty therefor.

This invention relates to the radiometeorograph pressure switching art and aims generally to improve the same, and the present application is a division of our application Serial Number 206,086, filed May 4, 1938 (Patent No. 2,283,919, granted May 26, 1942).

Among the objects of this invention are the provision of an improved construction of commutator switch increasing the accuracy of the pressure switching.

Sub-objects consist, severally and collectively, in so forming the commutator switch as to obtain more accurate and uniform construction, and in constructing it of an improved combination of substances yielding more accurate and uniform operation.

In the preferred embodiments these cooperating provisions mutually coact, i. e., the substance combination eliminates condensation drag thus rendering it possible to obtain uniform results with the transversely polished commutator, which in turn provides true linear joints and equi-length commutator segmentation without which drag elimination would be only partially effective for increased accuracy.

In the accompanying drawing of preferred embodiments of apparatus in accordance with and illustrative of the structure and method of this invention;

Fig. 1 illustrates a preferred form of pressure responsive switching means,

Fig. 2 illustrates the preferred manner of forming and polishing the commutator switching segments therefor.

Most former radiometeorographs used clockworks, fans, electric motor, or some similar extraneous means for switching the radio transmitter, usually involving interruption or shift of radio frequency of the carrier, rendering it, for practical purposes, nearly useless for direction finding and difficult to maintain continuous reception of the signals.

In the illustrative embodiment shown in the drawing advantage is taken of the fact that the barometeric pressure element deflects continuously in one direction as the balloon ascends. A pointer actuated by the pressure diaphragm moves over a simple switching element which consists of alternating conducting and insulating segments. As the arm moves over these segments it performs the necessary switching operations. The face of the switching element is polished so that friction opposing the arm movement is negligible. Hence, the sequence of switching operations also serves to mark definite values of pressure on an absoluate scale. Selected members, as successive fifth conducting segments of the switching element, for example, provide positive identification of the portion of the pressure range which is being indicated. How these identifying contacts function and also the manner in which the temperature and humidity indications are given are hereinafter described.

The pressure-switching method and arrangement of this invention affords several important advantages over other types of meteorographs: (1) It provides absolute readings of that meteorological element which requires the greatest precision of measurement, i. e., the barometric pressure; (2) by dispensing with the need for auxiliary motive power for switching it makes possible a very simple and inexpensive meteorograph unit, a most desirable feature if the radio meteorograph is to replace the use of airplanes in this service; (3) the number of observations obtained during an ascent becomes independent of the rate of ascent of the balloon. Hence, a high rate of ascent may be used in order to reduce the total time required for taking a complete set of observations.

An illustrative form of switching element is shown in Fig. 1. In this form the meteorological factor responsive device which operates the switching means comprises a pressure responsive means shown as an expansible bellows or "Sylphon" **10** adjustably mounted on a support **11** and connected by an adjustable link **12** to input arm **13** of a bell crank pivoted at **14** and having an output arm comprising a light lamination **15**.

Slack takeup means is preferably provided, herein shown as a light tension spring **16** bridging the linkage interconnecting arm **13** and the "Sylphon" **10**, arm **13** being offset as shown for clearance and to enable adjusting of its effective length by bending.

The light lamination **15** of the output arm carries a contact point **17** at its outer end, engaging the commutator or switching element **18**. Means is preferably provided for adjusting the contact tension, herein shown as a heavy lamination **15***a* comprised in the output arm, provided with an adjustable set screw **15***b* threaded through it and engaged against the face of the light lamination.

The commutator means comprises alternate

insulating segments **20** and conducting segments **21** suitably assembled, as for example, on a central rod or bolt **22**, from which the conducting segments are electrically isolated. A particularly satisfactory embodiment which has been successfully used comprises conducting segments 0.003 inch thick, and insulating segments of Bakelite 0.015 inch thick. Double or triple segments **23**, **23***a* are used for special purposes, as for index contacts, as desired.

After the insulating and the conducting segments, the latter preferably provided with soldering lugs, as shown, are assembled and rigidly clamped together, and preferably to a supporting base (arms **24** of a generally U-shaped supporting base are shown for illustration) a face **25**, preferably flat, is formed on one side of the stacked segments, preferably by planing or milling, and polishing the same in a direction transverse to the axis of the commutator, as shown in Fig. 2, so that no chipping or drawing over of the edges of the segments will occur, as might be the case if the forming operation were performed longitudinally of the commutator and thus from segment to segment. The transversely polished condition of the edge sections is, of course, a characteristic of the structure which is easily identified by an expert by simple inspection, aided if necessary by a magnifying glass or microscope. It makes itself evident not only by the true linearity of the joints between the thin conductive and non-conductive segments and the absence of chipping and drawing over of the one into the zone of the other, but also by the direction of the tiny tool marks left even in the most nearly perfect ground and polished surface.

In view of the extreme delicacy and sharpness of response desired, and of the weather conditions in which the instruments may be used, it is particularly desirable to reduce friction between the contact point and commutator and eliminate drag on the contact arm due to condensation of moisture on the commutator.

To this end many experiments with various materials have been resorted to and while combination No. 1 following has been relatively satisfactory, the best combinations have been found to be Nos. 2 and 3 following:

	Comb. #1	Comb. #2	Comb. #3
Insulating segments.	Bakelite	Bakelite	Bakelite.
Conductive segments.	Coin silver	German silver	Beryllium copper.
Contact point	Platinum	Stainless steel	Phosphor bronze.

The contact point **17** is of course smoothly rounded and polished to give a fine, smooth, rounded point.

In radiometeorograph practice, as above mentioned, the pressure decreases substantially constantly with ascent. Thus the pressure responsive device **10** will move the arm **15**, starting at atmospheric pressure at the earth's surface, continuously from one end of the commutator to the other, save for possible reversals due to down drafts. The continuity of motion, or reversal thereof, may easily be determined by the order of receipt of the several reference signals mentioned hereinafter. Now contact of the pressure arm with any given insulating or conducting segment of the commutator C corresponds to a definite pressure on the diaphragm **10** easily determined by initial calibration thereof. Thus, by identifying the particular segment contacted, an absolute pressure scale may be secured. The method and means of this invention accomplishes this in simple fashion by means of reference contacts corresponding to selected ones, as every fifth one, of the conducting segments, which may be arranged either of greater width than the others, as above mentioned, or to give a reference signal of predetermined modulation, or both, as in the preferred forms shown in our application Ser. No. 206,086, in which a combination of two identifying frequencies together with varying widths of the index contacts gives positive identification of the portion of the pressure scale involved.

Having established identification of the index contacts, contact of the pressure arm with any conducting strip lying intermediate to the index contacts may now be identified by the sequence of its occurrence with relation to the index contacts preceding and following it. The indication that a contact has occurred is provided; for example, by causing it to produce a change in frequency of the audio oscillator. The magnitude of the frequency change for these intermediate contacts, which may be used for indicating other meteorological factors, has no significance in the form shown as regards pressure indication. The occurrence of an incremental change of pressure is identified by the fact of making or breaking of contacts, which actions serve as pressure indications.

This method of securing a positive and absolute pressure scale affords the important advantage of freeing the intermediate contacts for use in switching between other factors such as temperature and humidity readings indicated on a frequency basis, as described in application Serial Number 206,086.

The pressure scale may be made approximately linear with either pressure or altitude by design of the pressure arm linkage. The linear pressure scale is employed in the embodiment shown, since it affords a greater number of readings at the lower altitudes for a given number of contact segments in the pressure-switching element. In one embodiment of switching element, 75 contact segments have been used. This provides pressure readings at increments in the altitude of less than 500 feet during the first 15,000 feet of an ascent. These increments may be further reduced, if desired, by increasing the number of segments in the switching element. In any case the readings of these factors may be made between or on the contacts as described in application Serial Number 206,086.

From the foregoing detailed description and the articles to which reference has been made in application Serial Number 206,086, it will be seen that various modifications, adaptations, and applications may be made without departing from the scope of the present invention.

We claim:

1. In a radiometeorological switching means, a switch arm comprising a contact point, a switch element comprising a multiplicity of thin conductive segments and thin non-conductive segments of Bakelite rigidly stacked in interposition and having edge sections thereof lying in a common plane polished transversely of said stack and parallel to the linear joints between the segments thereof so that said element presents in said plane, over which said contact point moves, true linear joints between the thin conductive and non-conductive segments and great constancy of

thickness of the polished edges of like segments, said contact point and said conductive edge sections consisting, to minimize frictional condensation drag, of one of the group of paired materials consisting of platinum sliding against coin silver, German silver sliding against stainless steel, and beryllium copper sliding against phosphor bronze.

2. In a radiometeorological switching means, a switch arm comprising a contact point, a switch element comprising a multiplicity of thin conductive segments and thin non-conductive segments of Bakelite rigidly associated in interposition and having edge sections thereof lying in a common plane over which said contact point moves, said contact point and said conductive edge sections consisting, to minimize frictional condensation drag, of one of the group of paired materials comprising platinum sliding against coin silver, German silver sliding against stainless steel, and beryllium copper sliding against phosphor bronze.

3. In a radiometeorological switching means, a switch arm comprising a contact point, a switch element comprising a multiplicity of thin conductive segments and thin non-conductive segments of Bakelite rigidly associated in interposition and having edge sections thereof lying in a common plane over which said contact point moves, said contact point and said conductive edge sections consisting, the one of platinum, and the other of coin silver.

4. In a radiometerological switching means, a switch arm comprising a contact point, a switch element comprising a multiplicity of thin conductive segments and thin non-conductive segments of Bakelite rigidly associated in interposition and having edge sections thereof lying in a common plane over which said contact point moves, said contact point and said conductive edge sections consisting, the one of German silver, and the other of stainless steel.

5. In a radiometerological switching means, a switch arm comprising a contact point, a switch element comprising a multiplicity of thin conductive segments and thin non-conductive segments of Bakelite rigidly associated in interposition and having edge sections thereof lying in a common plane over which said contact point moves, said contact point and said conductive edge sections consisting, the one of beryllium copper, and the other of phosphor bronze.

6. In a radiometerological switching means, a switch element consisting of a multiplicity of thin conductive segments and thin non-conductive segments, said segments rigidly stacked in interposed relation and having edge sections thereof lying in a common plane polished transversely of said stack and parallel to the linear joints between segments, said element thus presenting in said plane true linear joints between the thin conductive and non-conductive segments and great constancy of thickness of the polished edges of like segments.

7. The method of maintaining true linear joints between and great constancy of thickness of polished edges of a rigidly associated stack of very thin conducting and non-conducting segments, which consists in forming a polished edge-exposing face on the side of said stack by moving abrading particles transversely of the axis of the stack and parallel to the linear joints between segments.

8. A radiometeorological switching means according to claim 1, in which selected ones of said segments differ in thickness from other like segments and thus constitute index segments.

9. A radiometeorological switching means according to claim 2, in which selected ones of said segments differ in thickness from other like segments and thus constitute index segments.

10. A radiometeorological switching means according to claim 6, in which selected ones of said segments differ in thickness from other like segments and thus constitute index segments.

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