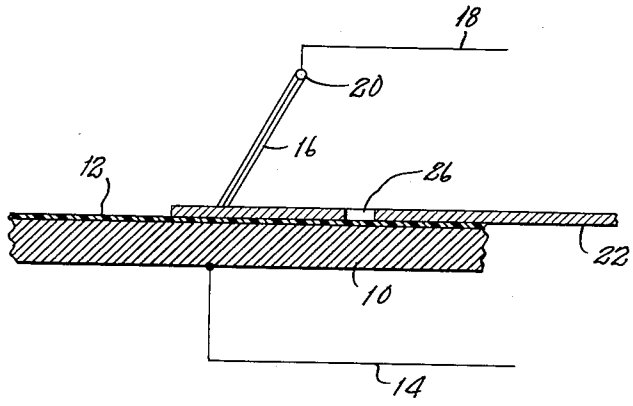
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DATA SENSING CIRCUIT

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INVENTOR.
EDGAR A. BROWN
BY Darby & Darby.
ATTORNEYS

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DATA SENSING CIRCUIT

Edgar A. Brown, Owego, N.Y., assignor to International Business Machines Corporation, New York, N.Y., a corporation of New York

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This device effects capacitance change in a signal generating electric circuit. The circuit contains a micro-capacitor composed of a metal platform connected to a circuit wire. The platform has a dielectric layer on one face, and a contact finger is connected to the other circuit wire. The contact finger has a support for positioning the finger so that an apertured data carrier, such as a perforated card or tape, can be fed between it and the coated side of the platform. The layer determines a fixed minimum spacing between the platform and finger, when the finger enters an aperture in the carrier, and the carrier, in the absence of an aperture, determines their maximum spacing. When a carrier aperture aligns with the finger, it moves into contact with the layer, reducing the separation between the finger and the platform from a maximum to a minimum, causing a capacitance increase in the circuit.

The general object of this invention is to provide a data processing machine control device, actuated by a data carrier, for effecting capacitance changes in the input circuit of the machine.

Another object of the invention is to provide a device of this nature for sensing the presence of data on a carrier, particularly in the form of an aperture, and indicating such sensing in the form of capacitance changes in a circuit connected to the device.

Another object of the invention is to provide a data sensing device in which the data carrier effects a mechanical change in the spacing between the members of a micro-capacitor to thereby change the capacitance of a control circuit in which it is connected.

Other objects of the invention will be pointed out in the following description and claims and illustrated in the accompanying drawings, which disclose, by way of examples, the principle of the invention and the best mode, which has been contemplated, of applying that principle.

In the drawing the single figure is a vertical, cross-sectional view of the elements of the device illustrating its construction and manner of operation.

There are many forms of devices for controlling the operation of data processing systems actuated by movement of a data carrier, such as a card or a tape, therethrough. These devices include combinations which cooperate with such a carrier to produce capacitance change in the input control circuit for such systems.

The prior art devices of this type generally comprise a pair of members forming the plates of a micro-condenser between which the carrier moves, but in which such plates are fixed so that changes in the dielectric capacity of the carrier with its data effect capacitance change in the circuit.

The device of this invention is based on a different principle, namely a change in the spacing between the plates of the micro-capacitor effected by the data carrying carrier which in this case is in the form of a perforated carrier such as a card or tape.

Referring to the single figure, which illustrates in a broad sense the nature of this device, there is illustrated at **10** a metal platform having an insulating layer **12** on the upper face thereof of suitable material, thickness, insulating and dielectric characteristics. By way of example, this coating can consist of a thin film of Teflon or Mylar, which can be applied either in liquid form or as a

film adhered to the platform. Teflon is a commercially available plastic consisting of a tetrafluoro ethylene polymer. Mylar is likewise a plastic comprising polyethylene terephthalate resin. Both are products of E. I. du Pont de Nemours. They have excellent strength, wear resistance, and electric properties, and are highly inert chemically. They likewise have good heat stability and while given here only in an exemplary sense, they are very suitable for the purposes of this invention.

At **20** there is diagrammatically illustrated a support of any suitable kind for a spring contact finger **16** for relatively fixing the position of the finger above the insulated face of the platform. At **22** is a data bearing card. In this case the data is in the form of a number of series of perforations **26** arranged thereon in accordance with well known practices and principles suitable to the purpose and nature of data recording and processing systems. The carrier, in the case of a card, is made of a more or less standardized paper stock, carefully prepared so that the card has for all intents and purposes substantially uniform dielectric properties and thickness. The carrier if in the form of a tape, will be made of any one of many available plastic materials well known in this art for these purposes.

The circuit comprises a wire **14** connected to the platform **10** and a wire **18** connected to the contact finger **16**.

As is apparent from the figure, when the carrier **22** is moved across the coated face of the platform **10**, so as to pass between it and the contact finger **16**, preferably for example from left to right in the figure, the contact finger **16** will be spaced from the platform **10** by a distance represented by the thickness of the insulating layer **12** and the thickness of the carrier **22** at its imperforate areas.

It is clear, however, that when the card moves to a point where data representing aperture **26** aligns with the end of the finger **16**, that the finger will drop into the hole into contact with the coating **12**. It will be understood, of course, that the finger **16** is mounted for such movement, or is a spring finger which is displaced out of a normal position in the imperforate areas of the carrier. In other words, the normal position of the finger **16**, in the absence of the carrier or in the presence of an aperture, is in contact with the layer **12**.

In accordance with well known principles of electric circuits the dielectric capacity of a micro-capacitor, all other relevant factors being fixed, represented by the platform **10** and its layer **12** and the contact finger **16** is determined by the spacing between them. Thus at maximum spacing, determined by the combined thickness of the coating **12** and carrier **22**, the capacity of this micro-capacitor is at a minimum. On the other hand, when the contact finger projects through an aperture in the carrier into contact with the layer **12**, the spacing will be at a minimum, and the capacitance of the micro-capacitor will have increased to a maximum.

This relationship can be well illustrated mathematically based on the well known mathematical relationship:

$$\text{Capacitance}=C=0.224K\frac{A}{d}$$

where

A=area in square inches of the plates

d=separation of the plates of the micro-capacitor in inches

C=capacitance in micromicrofarads

K=dielectric coefficient of the material between the plates of the micro-capacitor

The following assumptions are made:

The thickness of the insulating coating **12** is 0.001".

The thickness of the carrier **22** is 0.0065".

The dielectric coefficient of the carrier in the case of cards of standard card stock and of Mylar for example, is approximately the same, that is 2.5.

Therefore, in the case of an imperforate portion of the carrier lying between the plates of the micro-capacitor as illustrated in the drawing

$$C=0.224\times 2.5\times\frac{(0.125\times 0.57\times 0.8)}{d}$$

The factor 0.8 is based upon tests which indicate that the area of the end of a finger which can move freely through a hole of given size should be 0.8 of the area of the hole.

$$C=\frac{0.0035}{d}=\frac{0.0035}{0.0075}=0.45 \text{ micromicrofarads}$$

When a hole aligns with the finger **16**,

$$C=\frac{0.0035}{0.001}=3.5 \text{ micromicrofarads}$$

Thus the capacitance ratio of these conditions, that is of no hole to hole equals the ratio of 0.0075 to 0.001 which is a ratio of 7.5 to 1.

While there have been shown and described and pointed out the fundamental novel features of the invention as applied to a preferred embodiment, it will be understood that various omissions and substitutions and changes in the form and details of the device illustrated and in its operation may be made by those skilled in the art, without departing from the spirit of the invention. It is the intention, therefore, to be limited only as indicated by the scope of the following claims.

What is claimed is:

1. A data sensing combination comprising an electric circuit including a micro-capacitor having a fixed and a relatively movable plate, an insulating layer on one of said plates and a data carrier movable between said plates to vary the spacing between said plates by and in accordance with the presence or absence of a data bearing area of said carrier, said layer determining the minimum spacing between said plates.

2. In the combination of claim 1, a respective data bearing area being in the form of an aperture.

3. A device of the type described comprising a signal generator circuit, a micro-capacitor connected to said circuit comprising an insulated metallic platform for a first plate, a second metallic plate supported so as to be displaced from normal engagement with said first plate, and a data carrying member movable on said insulated platform between said plates to vary their spacing in accordance with the data recorded on said member.

4. In the combination of claim 3, said second plate being in the form of a finger.

5. In the combination of claim 3, said second plate being in the form of a resilient finger.

6. In the combination of claim 3, said data carrier being perforated at the points of data recording.

7. In a combination as described, a signal generator comprising a circuit and a two-plate micro-capacitor connected therein, one of said plates having an insulating coating and the other plate being supported for relative movement with respect to the first plate, a data carrier of dielectric material movable between said plates to vary the spacing between the plates as data bearing portions of the carrier move into and out of the superposed areas of the plates, said coating preventing conductive contact between said plates.

8. In the combination of claim 7, said data bearing portions comprising apertures.

9. In the combination of claim 7, said data bearing portions comprising apertures and one of said plates comprising a finger positioned to enter said aperture when aligned therewith so as to move into contact with said insulating coating.

10. A micro-capacitor for use with a device for sensing data stored in the form of apertures on an insulated data carrier, said micro-capacitor comprising a fixed capacitor plate, an insulating coating on said fixed plate, a resiliently mounted metallic finger for the other plate of said capacitor, said data carrier moving on the insulating coating of said fixed plate and said finger riding on the data carrier to vary the spacing between the finger and the fixed plate in accordance with the characteristics of the data carrier, said finger contacting the insulating coating when moving into the area of an aperture on said data carrier thereby producing the maximum value of capacitance for said capacitor.

11. A micro-capacitor for use with a device for sensing data stored in the form of apertures on an insulated data carrier, said micro-capacitor comprising a fixed capacitor plate, an insulating coating on said fixed plate, a resiliently mounted metallic finger for the other plate of said capacitor, said data carrier moving on the insulating coating of said fixed plate and said finger riding on the data carrier to vary the spacing between the finger and the fixed plate in accordance with the characteristics of the data carrier, said finger being shaped to be smaller in size than an aperture and to move into an aperture and make contact with insulating coating thereby producing the maximum value of capacitance for said capacitor.

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