Aug. 11, 1959 A. SCHÜLER 2,899,515

CENTRIFUGAL CONTACT-BREAKERS

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FIG. 1

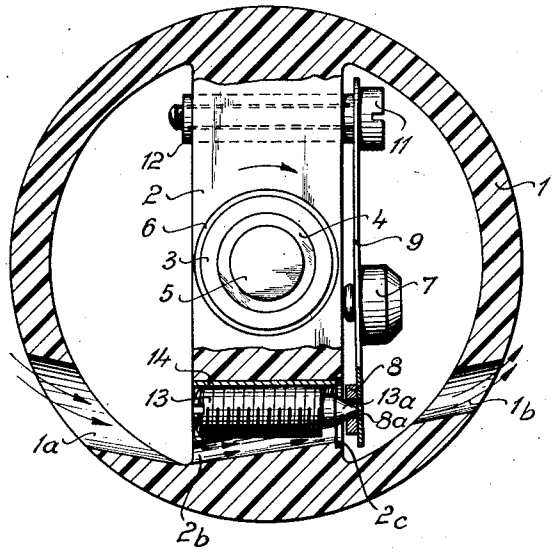
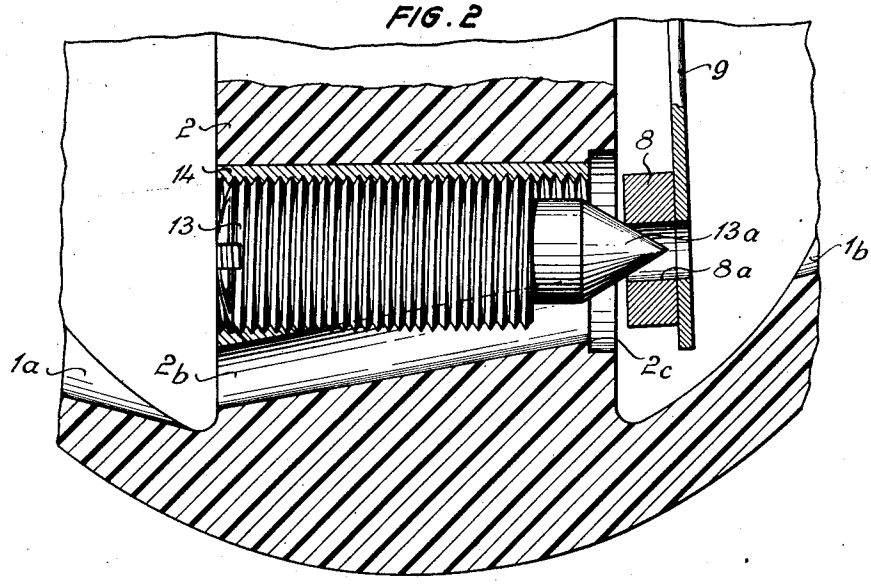


FIG. 2



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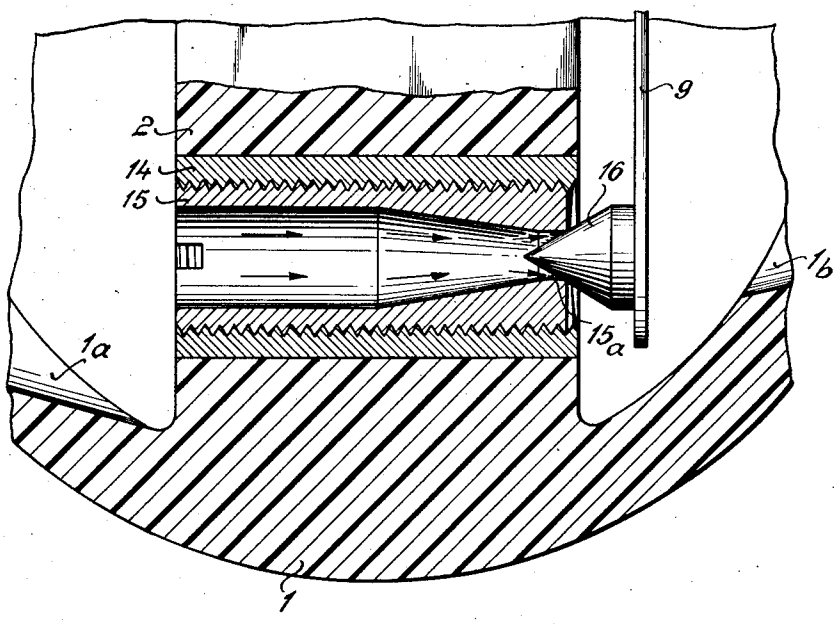
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FIG. 3



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CENTRIFUGAL CONTACT-BREAKERS

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Claims priority, application Germany November 12, 1956

5 Claims. (Cl. 200—80)

The invention relates to a centrifugal contact-breaker for regulating the speed of the motors in an electro-mechanical driving gear, more especially of the kind used in magnetic wire or tape recorders, comprising a centrifugally deflectable contact element cooperating with a fixed contact element.

Such centrifugal contact-breakers may be incorporated, for instance, in the electrical circuit of a motor for the purpose of breaking the circuit whenever the speed of the motor exceeds a desirable maximum. The maintenance of constant speed is a matter of considerable importance in the driving gear of magnetic sound recorders because fluctuations in the speed of the wire or tape when the record is made or played back give rise to distortion. In other kinds of equipment, such as in electro-mechanical control gear, constant speed is likewise a factor that is often of material significance.

The difficulties experienced in making provision for the generation of the necessary centrifugal forces naturally rise in proportion with every reduction in the overall size of the contact-breaker. Moreover, high operational frequency causes the contact points to be burnt, and they will then cease to make contact reliably and tend to stick. Burning of the contacting surfaces is due chiefly to sparking. It is a well known fact that a spark discharge will occur at the point of maximum electrical field strength. If the contact-breaker comprises a point contact cooperating with a flat contact surface, the surface area where the two contacts touch will be the region chiefly exposed to deterioration. The discharge is initiated by a glow discharge which ionises the air in the immediate vicinity of the contacting surfaces. Moreover, the relative movement between the contacting elements when they separate produces a region of reduced pressure precisely where the strength of the electrical field is a maximum, so that the reduced air density in the region of pronounced ionisation will encourage a repetition of the discharge.

The present invention is based on the idea that repetitive discharges and the consequent deterioration of the contact points can be prevented by the continuous removal of the ionised air from the vicinity of the contacting surfaces. To this end the invention proposes to mount the contact elements which cooperate substantially in a plane normal to the axis of revolution upon a rotating beam or the like disposed transversely to the axis of revolution of the contact breaker, to embody one of the elements in a point contact and the other element in an annular contact and to fan the contacting surfaces of the two contacts by exposing them to a unidirectional current of air flowing substantially in the axis of relative motion of the said contacts. Owing to the peculiar conformation of the two contact elements and the possibility they afford of conducting the air current over the annular contacting surfaces, the ionised air in the vicinity of the contacting surfaces will be continuously blown away and the formation of highly ionised air layers between the two contacts prevented. Glow discharges leading to flash-over cannot therefore develop in a centrifugal contact-breaker constructed as proposed by the present invention until the contact points have moved very closely together or unless very high voltages are applied. If the working voltage remains the same a centrifugal contact-breaker constructed according to the invention will operate with a substantially reduced number of repeated spark discharges per working cycle and the life of the contact points will be greatly prolonged. The proposed centrifugal contact-breaker is therefore greatly superior in reliability and safety of operation to equivalent centrifugal contact-breakers of known type.

For ducting the air current the beam which carries the centrifugally operated contact system may be enclosed within a cylindrical casing divided into two compartments by the beam. On one side the casing may be provided with an air inlet and on the opposite side with an air outlet opening. If the fixed contact is embodied in a threaded pin with a tapering point and the cooperating movable contact is a ring, then an annular recess may be cut into the beam around the fixed point and the air entering on one side of the casing conducted through a duct below the said threaded pin into the annular recess and over the annular contacting surfaces of the two contacts. To accelerate the velocity of the air current the said duct is preferably of smaller cross section than that of the air inlet and outlet openings. Alternatively, the moving contact may be a point contact and the fixed contact a small tube with a tapering bore to form a convergent duct of which one end provides the annular contact surface for cooperation with the moving point contact. In this case the air will flow with increasing velocity through the tube and over the annular contact surface towards the movable point contact.

In either form of construction the apex angle of the cone-shaped point contact is appropriately chosen to determine the exact position of the annular contacting surface between the two contacts. The movable contact may otherwise be constructed in the conventional manner and consist of a leaf spring secured at one end and deflected by the centrifugal action of a weight.

Two illustrative embodiments of the invention are shown in the accompanying drawings, in which the contact breaker assembly is represented on an enlarged scale. In the drawings

Fig. 1 is a horizontal section through a centrifugal contact-breaker with an adjustable point contact acting as the fixed contact element. The bearings of the beam which carries the contacts are not shown in section but in plan.

Fig. 2 is a section similar to that of Fig. 1 but showing only the two contact elements on a somewhat larger scale, and

Fig. 3 is another section, similar to that of Fig. 2, of a form of construction in which the point contact is movable and the annular contact is fixed.

The centrifugal contact-breaker illustrated in Figs. 1 and 2 is entirely enclosed within a plastic casing 1. A beam 2 divides the interior of said casing 1 into two compartments. Hub 3 of the beam is fitted with a metal bush 4 for mounting the contact-breaker on a drive shaft 5. Insulated from the metal bush 4 the face of hub 3 carries a slip-ring 6 for cooperation with a sliding contact in the conventional manner. A spring arm 9 which carries the centrifugal weight 7 and the centrifugally operated contact element 8 is secured to the upper end in the drawing of beam 2 by means of a screw 11 which is held in a metal sleeve 12 with an internal thread. Sleeve 12 is electrically connected with the slip ring (the connection not being shown in the drawing) on hub 3. The fixed contact element 13 is arranged at the end of beam 2 opposite the end to which spring

arm 9 is secured. The fixed contact consists of a threaded pin adjustably held in a threaded sleeve 14 and provided with a reduced forward end terminating in a cone-shaped taper point 13 with an apex angle arranged to fit a central hole 8*a* in the movable contact element 8. Sleeve 14 is likewise electrically connected with a second slip-ring on bush 3 (ring and connection not shown in the drawing).

An air inlet channel 1*a* is drilled obliquely through the peripheral wall of casing 1 and a second similar obliquely drilled channel 1*b* provides an air outlet, communication being established by a transverse duct 2*b* in beam 2 through which the air can pass. An annular recess 2*c* encircling point 13*a* of the fixed contact in beam 2 serves to conduct the air concentrically around the cooperating surfaces of the two contacts 13 and 8. The diameter of the transverse duct 2*b* is smaller than the diameter of either of the oblique channels 1*a* and 1*b* so that the air current flowing through duct 2*b* will be accelerated. The centrifugal contact-breaker revolves clockwise as shown by the arrow, so that in course of its rotation air will be scooped through opening 1*a* and enter the interior of the casing in the manner likewise indicated in Fig. 1 by arrows. This current of air is forced through transverse duct 2*b* into the circular recess 2*c* and sweeps over the contacting surfaces of contacts 13 and 8, preventing an accumulation of ionized air in their vicinity. Finally, the air leaves casing 1 through the oblique outlet channel 1*b*.

In Fig. 3 the arrangement of the contact elements is reversed inasmuch as the fixed contact element is of annular and the movable contact element of pointed shape. To this end a metal tube 15 is inserted into sleeve 14 in beam 2, the mouth of said metal tube at its right-hand end in the drawing forming an annular contacting surface 15*a*. At the same time tube 15 provides the transverse duct for the passage therethrough of air from one side of the beam to the other and, for accelerating the flow of air through the tube towards the annular contact surface 15*a*, the cross section of the tube is narrowed in the manner of a convergent duct. The centrifugally controlled contact on spring arm 9 which cooperates with annular contact 15*a* is a point contact 16. Otherwise the construction of the contact-breaker conforms with that of the contact breaker illustrated in Figs. 1 and 2.

Moreover, the manner of operation of the contact-breaker according to Fig. 3 is entirely similar to that of the contact-breaker according to Figs. 1 and 2. Owing to the rotation of the contact-breaker air enters casing 1 through inlet channel 1*a*, passes through tube 15 with increasing velocity, impinges upon the contacting surfaces, entrains the ionised air, and finally escapes through outlet channel 1*b*.

I claim:

1. Centrifugal contact-breaker for controlling the speed of electro-mechanical drive means, more particularly for the speed control of magnetic sound recorders employing a magnetised wire or tape as a record carrier, comprising a movable contact element deflectable by centrifugal force and a fixed cooperating contact element, one of said elements being a point contact and the cooperating element an annular contact, and a rotating beam mounted transversely on the drive shaft, said beam supporting said contacts for cooperation in a plane substantially perpendicular to the axis of rotation thereof, a current of air sweeping unidirectionally over the contacting surfaces of said contacts substantially in their axis of relative motion, a cylindrical casing entirely enclosing said beam and the centrifugal contact system, said casing rotating together with said beam which divides said casing into two compartments, one of said compartments having an inlet opening for air and the other an outlet opening for said air and the said two compartments communicating through a channel which traverses said beam approximately in the axis of relative motion of said contacts, and which has a narrowing cross section in the direction of air flow to form a convergent duct.

2. Centrifugal contact-breaker for controlling the speed of electro-mechanical drive means, more particularly for the speed control of magnetic sound recorders employing a magnetised wire or tape as a record carrier, comprising a movable contact element deflectable by centrifugal force and a fixed cooperating contact element, one of said elements being a point contact and the cooperating element an annular contact, and a rotating beam mounted transversely on the drive shaft, said beam supporting said contacts for cooperation in a plane substantially perpendicular to the axis of rotation thereof, a current of air sweeping unidirectionally over the contacting surfaces of said contacts substantially in their axis of relative motion, a cylindrical casing entirely enclosing said beam and the centrifugal contact system, said casing rotating together with said beam which divides said casing into two compartments, one of said compartments having an inlet opening for air and the other an outlet opening for said air and the said two compartments communicating through a channel which traverses said beam approximately in the axis of relative motion of said contacts, and which has a narrowing cross section in the direction of air flow to form a convergent duct, a fixed contact embodied in a threaded pin screwed into said beam and having a cone-shaped tapering point cooperating with an annular deflectably movable contact and surrounded by an annular recess cut into said beam, a communicating channel traversing said beam below said threaded pin and having a cross section smaller than that of said air inlet and air outlet openings and directing the air current which passes therethrough on to the contacting surfaces of said cooperating contacts.

3. Centrifugal contact-breaker for controlling the speed of electro-mechanical drive means, more particularly for the speed control of magnetic sound recorders employing a magnetised wire or tape as a record carrier, comprising a movable contact element deflectable by centrifugal force and a fixed cooperating contact element, one of said elements being a point contact and the cooperating element an annular contact, and a rotating beam mounted transversely on the drive shaft, said beam supporting said contacts for cooperation in a plane substantially perpendicular to the axis of rotation thereof, a current of air sweeping unidirectionally over the contacting surfaces of said contacts substantially in their axis of relative motion, a cylindrical casing entirely enclosing said beam and the centrifugal contact system, said casing rotating together with said beam which divides said casing into two compartments, one of said compartments having an inlet opening for air and the other an outlet opening for said air and the said two compartments communicating through a channel which traverses said beam approximately in the axis of relative motion of said contacts, and which has a narrowing cross section in the direction of air flow to form a convergent duct, a fixed contact embodied in a tubular member adjustably located in said beam, one end of said tubular member providing an annular contact surface for cooperation with a deflectably movable contact embodied in a contact element with a cone-shaped tapering point, and a communicating channel traversing the beam embodied in said tubular member for the passage of air therethrough and over the contacting surfaces of said cooperating contacts.

4. Centrifugal speed governor with breaking contact for electro-mechanical drive-means in which the contacts are swept by a current of air, particularly used in magnetic recorders, comprising an annular contact and a cone-shaped contact, wherein the annular surfaces of the contacts, if the contact is closed, are swept by the current of air which is caused to flow substantially in the direction

of their axis of relative motion by the rotation of the governor.

5. Centrifugal contact-breaker as set forth in claim 4 wherein the apex angle of the cone-shaped point of said pointed contact is arranged to conform with the opening of said annular cooperating contact.

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