

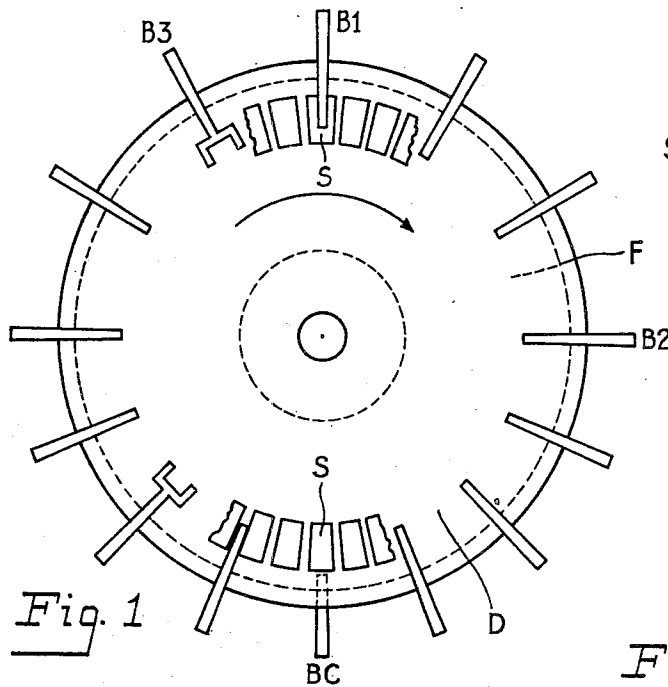
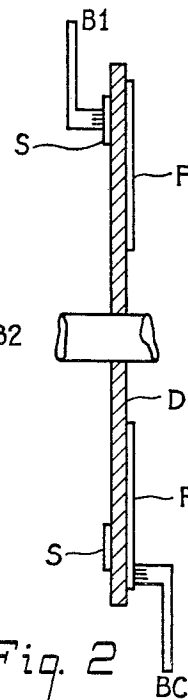
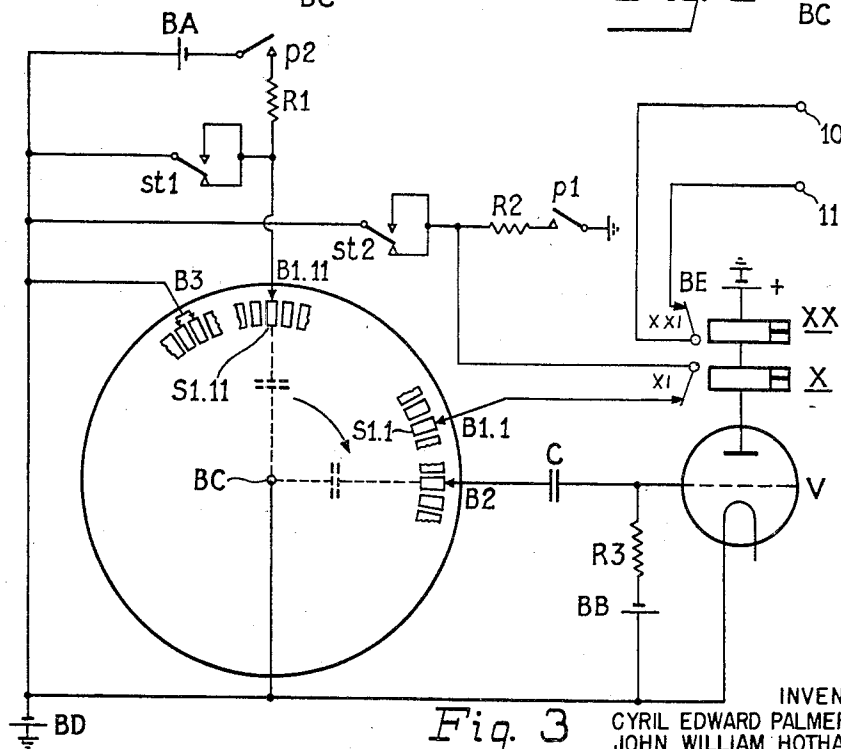
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ELECTRICAL TIMING ARRANGEMENT

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ELECTRICAL TIMING ARRANGEMENT

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The present invention relates to electrical timing arrangements and has for its object to provide an electrical timing device which in response to the application of an electrical stimulus will effect a desired operation or desired operations at any predetermined later time or times. Such a timing device may be used for a variety of purposes and finds one particular application in the automatic telephone art where its use permits timing functions to be performed economically and/or accurately. It may also be used for effecting precision timing to almost any desired degree of accuracy where a suitable alternating current or other accurate timing source is available.

According to the invention, in a timing arrangement suitable for accurately determining or generating intervals of time, a plurality of condensers are connected to a set of corresponding contact segments arranged in a ring so as to be engaged successively by a brush, relative movement between the segments and the brush being effected at constant speed and the brush being arranged to impress a characteristic charge on the appropriate condenser which serves to operate control equipment when the associated segment engages a further brush a predetermined time later dependent on the speed of relative movement and the angular spacing of the brushes.

The invention will be better understood from the following description of a number of methods of carrying it into effect which should be taken in conjunction with the accompanying drawing, comprising Figs. 1-3. Of these Figs. 1 and 2 show in elemental form front and side views of one possible construction of the rotary multi-step condenser storage mechanism employed together with the "stimulus application" brush or brushes, the resultant condenser charge "pick-off" brush or brushes and the "wipe out" brush or brushes for discharging the condensers after they have performed their appropriate function. Fig. 3 shows how this apparatus may be connected up in order to produce an electrical pulse of predetermined length after the lapse of a predetermined interval of time following receipt of a stimulus.

Considering first the construction illustrated in Figs. 1 and 2, the continuously operating rotary condenser storage device as shown is in the form of a disc D of insulating material substantially covered on one side with metallic foil F. The other side carries insulated metallic segments S similar to those used on electrical influence ma-

chines while brushes B1, B2 and B3 are suitably arranged to make contact with the segments individually as they pass predetermined positions. The B1 brush usually serves to apply the stimulus and the B2 brush to pick up the resultant condenser charge on the device after the requisite time interval has elapsed. The B3 brush serves for discharge or wipe-out purposes and brush BC makes contact with the metallic foil F on the back of the disc to provide a return path for the condenser charging circuit. It will be appreciated that the number of brushes employed and their spacing will be determined by the particular use which is being made of the invention and that the number of brushes indicated will generally not be required. In some circumstances it may be convenient for the brushes to be mounted on a rotatable carrier so that they can be moved as a whole relatively to the disc and/or arrangements may be made for moving the brushes individually. A further possibility is to provide more brushes than are likely to be required and to obtain different operating characteristics by connecting up only selected brushes.

The construction shown serves to illustrate clearly the principles involved but certain modifications may be found more desirable in practice. It is not of course essential that the segments should be regularly spaced, though this will generally be a convenient arrangement. Since constancy of speed is fundamental to the arrangement if accurate timing as to be achieved, it will probably be desirable to provide the rotating system with sufficient flywheel effect to damp out speed variations which might otherwise occur.

The general method of operation is that an electrical stimulus is applied to one of the brushes, say B1, whereupon the condenser associated with the segment then engaged by the brush is suitably charged. After the lapse of a predetermined time dependent on the speed of rotation of the disc, the condenser bearing this charge will have moved to the position where it is engaged by brush B2. This brush is assumed to connect with a suitable device capable of being operated by the charge, preferably a thermionic relay device, as this permits of reliable operation with charges of very small magnitude. Moreover, the use of such a device will permit multiple operation to be employed if desired, that is to say the charge may be effective over a brush subsequently encountered to produce a second or further switching operation. After the last pick-off brush

in the desired sequence has been passed, it is arranged that the condenser is completely discharged, in readiness for response to further stimuli, by means of the brush B3 which is arranged to connect the two plates of the condenser together. This brush may be of the bridging type as shown if this is found desirable to prolong the discharging period and ensure that no charge remains. It will be understood that the dimensions of the segments and the brushes will generally be such that bridging does not take place for most purposes for which the device is used but clearly the use of a bridging type for any of the brushes is not excluded where its employment is likely to be advantageous.

Considering now the arrangement of Fig. 3 which shows in more detail how the invention may be applied to the production of an electrical pulse of predetermined length after the lapse of a predetermined interval of time following the receipt of a stimulus, it is assumed that the disc is rotating at constant speed and that the equipment has already been conditioned for use by the closure of the preparatory contacts *p1* and *p2* for instance by a relay operation. The stimulus is comprised in the changing over of the contacts *st1* and *st2* and this particular illustration serves to indicate that the duration of the stimulus need only be extremely small. During the transit period of the ST relay contacts negative potential will be applied from battery BA by way of resistance R1 to the segment S1.11 engaged at that instant by the brush B1.11 while a positive (earth) potential will be applied by way of resistance R2 to the segment S1.1 engaged by the brush B1.1. Brush B2 connects via condenser C to the control grid of a thermionic tube V which is permanently biased by battery BB through high resistance R3. The tube V is assumed to be of the gas-filled type preferably employing mercury vapour or argon. The biasing of the tube is such that the ionisation condition is in unstable equilibrium so that the tube will remain ionised or deionised in response to the conditions momentarily imposed by the potential acquired by the grid as determined by brush B2. It will be noted that the cathode of the tube V connects to brush BC the potential of which is regarded as zero. The anode circuit of the tube V includes two relays of the high speed type designated X and XX and the contacts of the latter when in normal position complete a loop across the terminals 10 and 11 extending to an external circuit.

When the segment S1.1 which has acquired a positive charge from the brush B1.1 has rotated through an angle sufficient to bring it under brush B2, the stored positive charge is communicated via condenser C to the grid of tube V. This tube thereupon ionises and as it is in unstable equilibrium, this condition persists after segment S1.1 has passed beyond B2. Relays X and XX are accordingly now operated and the loop across terminals 10 and 11 is opened at contacts *xx1*, while contacts *x1* are opened to prevent any further effect on segments passing brush B1.1, especially segment S1.11. Accordingly, when segment S1.11 reaches brush B2, the stored negative potential is transferred to the grid of the thermionic tube which thereupon de-ionises. Relays X and XX now release and the loop across terminals 10 and 11 is reclosed by contacts *xx1*. These contacts thus provide the required period of interruption, which will have a duration corresponding to the arc between brushes B1.1 and B1.11 in relation

to the speed of rotation of the disc. The generation of this pulse will furthermore be delayed after receipt of the stimulus by a time interval corresponding to the arc between brushes B1.1 and B2 on a similar basis. This delay before the commencement of the pulse in response to the applied stimulus may clearly if desired be made zero by combining the connections shown to brushes B1.1 and B2 or by using a single brush to perform the dual function. The segments which have been charged are completely discharged when they pass brush B3 and are then ready to store further charges of either polarity.

When contacts *st1* and *st2* restore to their original position assuming contacts *p1* and *p2* are then still closed, a further pulse of similar characteristics will be transmitted over the circuit connected to terminals 10 and 11.

It will be noted that in Fig. 3 no details are shown of the heating arrangements for the cathode of the thermionic tube and it is assumed that these follow normal practice.

It will be understood that this arrangement though not specially suitable for use on a portable basis can be used for a large variety of timing operations where a suitable source of electric energy is available and the condenser disc can readily be driven at a known constant speed. One application where it offers particular advantage is to viscometry and it may also be applied to races, to the timing of telephone calls where a plurality of discs, one for each connection, may be used to time the connection, and to other uses where the time to be measured is not so small that the reaction time of the human operator becomes important.

What we claim as new and desire to secure by Letters Patent is:

1. In a timing arrangement, a plurality of condensers each having one terminal thereof connected to one of a plurality of contacts, a series of brushes, means for causing said contacts to be successively engaged by said brushes at a constant speed, means for causing a characteristic charge to be applied to a condenser when its associated contact is engaged by one of said brushes, and for causing said charge to be effective over another brush when said contact is engaged thereby to control equipment connected to said other brush, said equipment controlled at a predetermined time after engagement by said one brush as determined by the spacing of said brushes and the speed of relative movement of the contacts and brushes.

2. A timing arrangement including a disc of insulating material having a plurality of contact segments, a series of condensers each having one terminal thereof connected to one of said segments, a pair of brushes, means for causing relative movement of the brushes and disc to cause successive engagement of each contact by said brushes, means connected to one brush effective to charge a condenser when a contact is engaged thereby, and means connected to the other brush responsive to the charge on said condenser when its contact is later engaged by said other brush to perform a switching operation, the elapsed time determined by the speed of said movement and the spacing of said brushes.

3. A timing arrangement such as claimed in claim 2 in which there is a third brush engaging each contact after it has engaged said other brush to remove any charge remaining on the condenser connected to the contact.

4. A timing arrangement comprising an element rotating at a constant speed, a series of condenser units carried by said element, a series of contacts on the element each connected to one of said units, a series of brushes engaging said contacts successively as the element rotates, means connected to one of said brushes for charging any one of the condensers as the contact thereof engages said one brush, and means connected to another of said brushes responsive to the charge of the charged condenser when said other brush engages the contact of said charged condenser.

5. A timing arrangement as claimed in claim 4, in which said last means comprises a relay for controlling a work circuit.

6. A timing arrangement as claimed in claim 4, in which said last means includes a grid controlled discharge tube and a relay responsive to said charge to control a work circuit.

7. A timing arrangement including an element having contacts and a plurality of brushes with means for causing relative movement between the contacts and brushes to cause successive engagement of the brushes and contacts, a series of condensers each having a common terminal and another terminal connected to one of said contacts, means controlled over one of the brushes for charging any of said condensers when one brush engages the contacts connected thereto, a gas discharge tube connected to another of said brushes and a relay controlled by said tube when the brush connected thereto engages the contact of a charged condenser.

8. A timing arrangement as claimed in claim 7 in which the means connected to said one brush causes a positive charging of the condenser to later affect the tube in one manner and in which there is means connected to a third brush for negatively charging a condenser to affect the tube in another manner when the brush connected to the tube engages the contacts of the charged condensers.

9. In a timing arrangement, a constantly ro-

tating disc, a series of segments on the periphery of said disc, a condenser connected to each segment, a series of brushes successively engaged by said contacts, means connected to one of said brushes to initiate a timing interval by connecting a potential to said one brush to thereby establish a charge on the condenser engaged at that time by said one brush, a responsive device connected to another brush engaged at a predetermined time thereafter determined by the speed of rotation of the disc and the spacing of the brushes, said responsive device energized by the charge on said charged condenser when said other brush engages the contact connected thereto.

10. A timing arrangement as claimed in claim 9 in which there is means connected to a third of said brushes for establishing a different charge on another of said condensers to nullify the effect on the responsive device of the first charged condenser, and means connected to a fourth of said brushes for discharging all charged condensers when the contacts thereof engage the said fourth brush.

11. In a timing arrangement, an element rotating at constant speed having contacts on the periphery thereof, a plurality of condensers each having a common terminal and another terminal connected to one of said contacts, a series of brushes arranged to successively engage each of said contacts, means associated with one of said brushes for charging the associated condenser when in engagement with one of said contacts at one point in the rotation of said element, a responsive device including a discharge tube connected to another brush engaging the contact of the charged condenser at a later point in the rotation of said element, said device responsive to the charge on the condenser to perform a switching operation, and means controlled at a still later point in the rotation of the element for causing said device to discontinue said switching operation.

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