

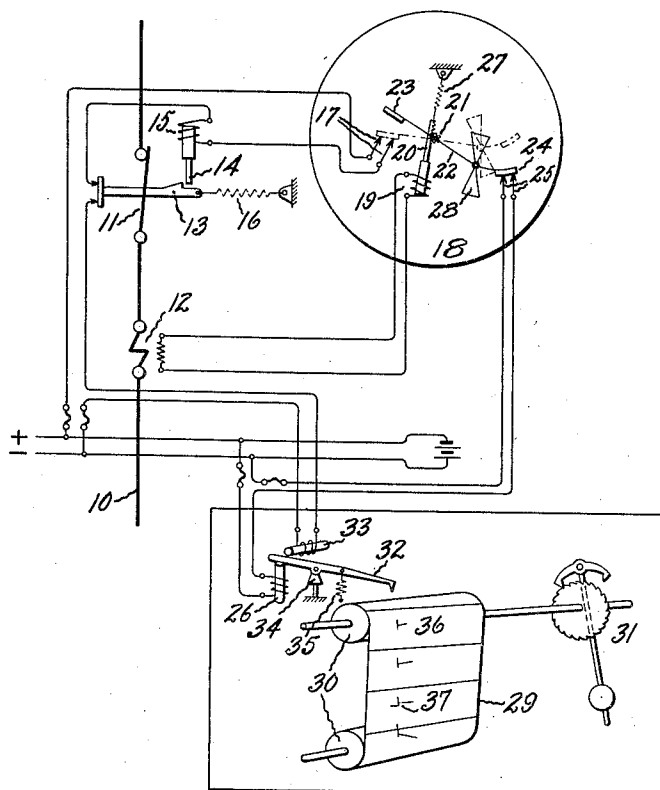
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E. GASIOROWSKI

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RECORDING APPARATUS FOR RELAYS

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Inventor:  
Ernst Gasiorowski,  
by *Myron S. Smith*  
His Attorney.

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# UNITED STATES PATENT OFFICE.

ERNST GASIOROWSKI, OF HERMSDORF, BERLIN, GERMANY, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

## RECORDING APPARATUS FOR RELAYS.

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My invention relates to recording apparatus and is particularly adapted to record the various conditions and operations of relays such as time delay relays used to protect electrical apparatus from overloads. A time delay relay generally has two periods of operation; first a time delay period during which some sort of timing means delays the final operation of the relay; and second, the final operation of the relay subsequent to the time delay period. If the overload or other condition to which the relay is responsive does not last longer than the time delay period, the relay does not perform its final operation but is restored to its initial condition. Conditions which start the operation of such a relay but which do not last a sufficient length of time to cause the complete operation of the relay generally pass unnoticed. It is desirable however that these conditions be brought to the attention of the operating engineer in order that he may determine if the relay is functioning properly and in order that he may adjust load conditions so as to maintain the best service without interruption and without overloading electrical apparatus. A record of the final operations of the relay is also desirable. It is the primary object of my invention to provide recording apparatus for time delay relays and similar devices which will record the initial operation of the relay the time delay period and the final operation, if that occurs.

In carrying my invention into effect I prefer to use a single recording stylus for each such relay and arrange it so that it has distinct movements for each period of operation of the relay whereby a complete record of the various conditions of the relay is made.

The features of my invention which are believed to be novel and patentable will be pointed out in the claims appended hereto. For a better understanding of my invention, reference is made in the following description to the accompanying drawing which represents one diagrammatic embodiment of my invention for recording the operations of a time delay overload relay.

In the drawing, 10 represents an electric power line containing a main switch 11 and a current transformer 12. The switch 11 is provided with an operating member 13 which is normally held in the closed position by means of the catch at 14. When this catch

is released by a relay 15, a spring 16 causes the switch to open. Relay 15 is normally de-energized, thus holding the main switch 11 closed. When an overload occurs and continues for a sufficient length of time the circuit of relay 15 is closed at contacts 17, due to the operation of the time delay relay represented at 18. The time delay relay here represented has a solenoid 19 energized from the current transformer 12. This solenoid is secured to a rack 20 which meshes with a gear wheel 21. Secured to the shaft of gear wheel 21 is a double-ended lever 22 carrying contactors 23 and 24, the former cooperating with contacts 17 in the circuit of release relay 15, and the latter cooperating with contacts 25 in the circuit of the recording relay 26. The action of solenoid 19 is opposed by a spring 27 and the movement of lever 22 is retarded by a suitable fan brake diagrammatically indicated at 28.

The recording apparatus comprises a recording chart 29 with suitable supporting rollers 30, clockwork 31 for advancing the chart at a desired constant rate, a recording stylus lever 32 and relays 26 and 33 for operating the stylus. The last mentioned relay is connected in circuit with relay 15 and contacts 17. The stylus arm 32 is mounted on a ball and socket pivot 34 so that it may be moved toward and away from the chart and at right angles to the chart. Relay 26, which is normally energized through contacts 24 and 25, moves the stylus lever away from the chart and out of recording position. Relay 33, which is energized through contacts 17 and 23 upon the final operation of the relay, moves the stylus arm in a horizontal direction. When neither of these relays is energized, a suitable spring 35 holds the stylus against the chart upon the line of the record 36.

The operation of the apparatus is as follows: Assuming the parts to be in the condition indicated in the drawing; so long as no overload occurs the spring 27 maintains contacts 24, 25 closed and contacts 17, 23 open and relay 26 maintains the stylus away from the chart. When an overload occurs, the pull of solenoid 19 overcomes that of spring 27 and starts to turn lever 22 in a counterclockwise direction. Contacts 24, 25 are opened, relay 26 is deenergized and the stylus records on the chart as indicated by the records 36. The length of these records shows the duration of the overload condition. If the over-

load continues for the time delay period, which generally varies with the magnitude of the overload, lever 22 moves into the position shown in dotted lines and closes contacts 17, 23. Relays 15 and 33 are energized. The circuit breaker 11, 13 is released and spring 16 opens the main switch at the same time relay 33 pulls the stylus lever in a horizontal direction and causes a corresponding record, such as is indicated at 37, to be made on the chart. In this way indications corresponding to the partial and complete functioning of the relay, the duration of overloads and the times of occurrence of the partial and complete overloads are recorded. The chart will preferably be provided with time indications such as the horizontal lines represented.

The direction of movement of the chart is upward as here represented but it has been pulled back to show the records. In practice, additional records of other relays will generally be recorded on the same chart.

In accordance with the provisions of the patent statutes, I have described the principle of operation of my invention together with the apparatus which I now consider to represent the best embodiment thereof, but I desire to have it understood that the apparatus shown and described is only illustrative and that the invention may be carried out by other means.

What I claim as new and desire to secure by Letters Patent of the United States, is,—

1. Recording apparatus comprising a continuously moving record sheet, a recording stylus cooperating therewith, means for normally holding said stylus out of recording position, means responsive to one condition to be recorded for releasing said stylus and allowing it to move into recording position, and means responsive to a different condition to be recorded for moving said stylus in an angular direction with respect to the movement of said record sheet.

2. Recording apparatus comprising a time advanced record sheet, a recording stylus cooperating with said record sheet, means responsive to one condition to be recorded for moving said stylus into recording position on said record sheet whereby a record is produced due to the advance of said record sheet with respect to said stylus, and means responsive to another condition to be recorded for producing a record due to the movement of said stylus across said record sheet.

3. Recording apparatus comprising a record sheet, a recording arm provided with a stylus cooperating with said record sheet, said

recording arm being mounted on a ball and socket pivot whereby it may be moved toward and away from said record sheet and parallel to said record sheet, and means responsive to different conditions to be recorded for respectively producing such movements of said recording arm.

4. In combination, a time delay electric protective device, a recording mechanism associated therewith, and means responsive to the operation of said protective device for causing said recording mechanism to commence recording with the commencement of the time delay operation of said protective device to produce a record of the duration of the time delay period thereof, and to produce a different record upon the final operation of said protective device.

5. A time delay relay, and means for recording the different operations of said relay, comprising a record sheet, a recording stylus cooperating therewith, means responsive to the time delay periods of operation of said relay for causing marks of corresponding length to be made on said record sheet, and means responsive to the final operation of said relay for causing a mark to be made on said record sheet at an angle to said first mentioned marks.

6. A relay having a time delay operation and a final operation, and recording means responsive to said operations for producing timed records of said operations.

7. In combination, a time delay protective device, means for recording the operation of said device comprising a recording mechanism, a pair of electric relays for operating said recording mechanism, and contacts controlled by said time delay protective device for energizing and deenergizing said relays, one of said relays causing the recording apparatus to produce a record of the time delay period of operation of said device, and the other relay causing the recording apparatus to produce a record of the final operation of said device.

8. A relay having a plurality of operating functions, electrically operated recording means, and contacts controlled by said relay during its operation for energizing and deenergizing said electrically operated recording means, and thereby causing the operation of said recording means to produce records corresponding to the different operating functions of said relay.

In witness whereof, I have hereunto set my hand this 11th day of October, 1926.

ERNST GASIOROWSKI.