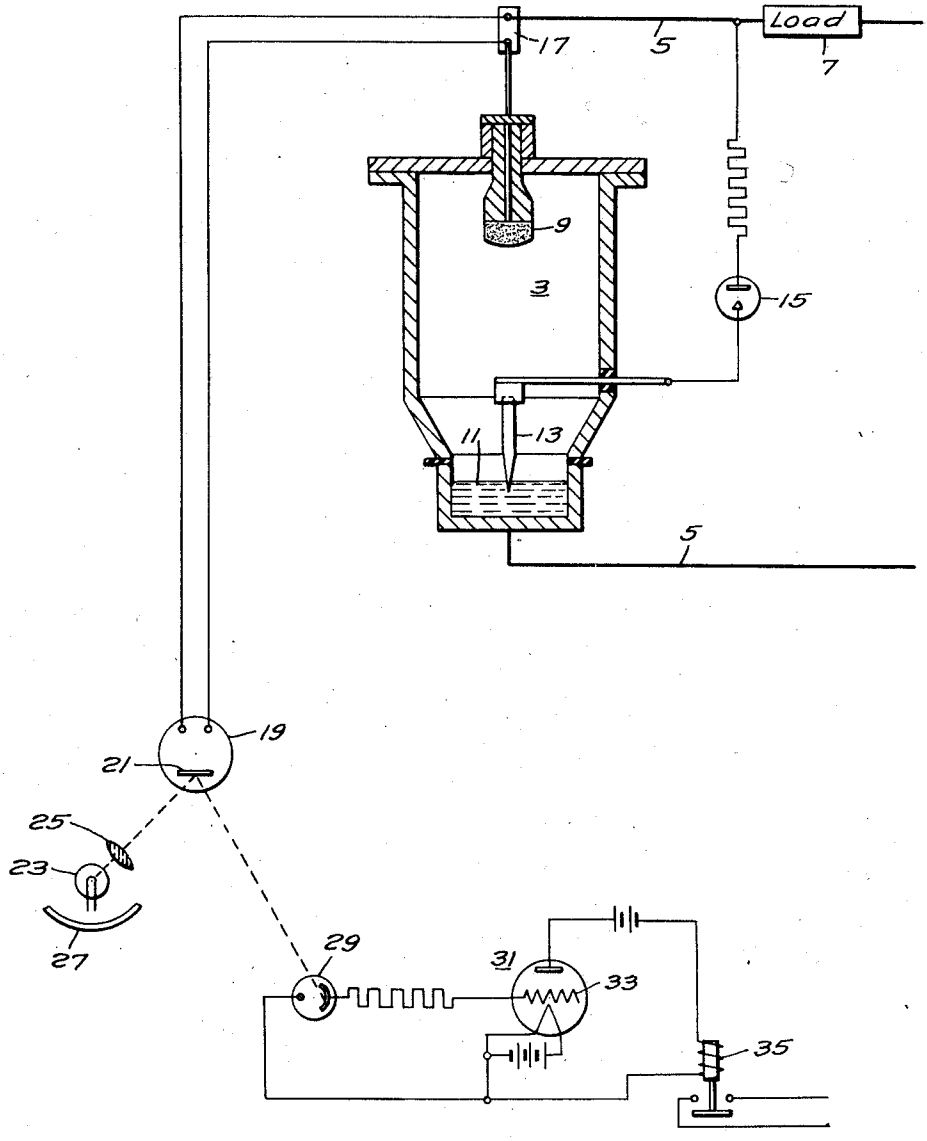
Oct. 8, 1940. L. R. LUDWIG 2,217,446

ARC-BACK INDICATOR

Filed March 31, 1938



WITNESSES:

E. A. McCloskey

J. Thoben Dachs

INVENTOR

Leon R. Ludwig.

BY O. B. Buchanan

ATTORNEY

Patented Oct. 8, 1940 2,217,446

UNITED STATES PATENT OFFICE

2,217,446

ARC-BACK INDICATOR

Leon R. Ludwig, Wilkinsburg, Pa., assignor to Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., a corporation of Pennsylvania

Application March 31, 1938, Serial No. 199,275

2 Claims. (Cl. 177—311)

My invention relates to a fault-responsive device and more particularly to a relay responsive to inverse currents in a vapor-electric converter.

In the operation of vapor-electric converters of the type used for transferring energy between alternating-current and direct-current systems, there is the disadvantage in that such converters are subject to temporary reverse currents known in the art as arc-backs. Means and methods for disconnecting the converter or detecting arc-backs is not unknown in the art. Prior art devices, of which I am aware, are of the inductive type; that is, their operation is dependent upon the rate of rise of current. Moreover, previous arc-back responsive devices have an inherent disadvantage in that they respond to load conditions and transients in the circuit which might give false indications.

According to my invention, I have found it preferable to rely on an arc-back responsive device which may be called one of the electronic type in that such a device is free of transients and is more likely to give a faithful indication of operating conditions in the converter.

Briefly, I use an oscillographic element which is operatively connected in parallel with a millivolt shunt placed in the direct-current circuit of the converter through which current normally flows in one direction. A beam of light is directed upon a mirror forming part of the oscillographic element which is normally reflected in a direction away from some light-sensitive device, such as a photo-electric cell. However, upon the occurrence of a reverse current in the direct-current circuit, the oscillographic element turns the mirror so that a light beam is thrown upon the photo-electric cell, which in turn transforms the light received into electrical impulses. A suitable valve, such as a grid-controlled discharge device, breaks down and consequently operates a suitable relay device.

It is, therefore, an object of my invention to provide an arc-back responsive device which is itself free from transients that might give false indications.

Another object of my invention is to provide an automatically operated arc-back responsive device which is reliable and noiseless in operation.

It is a further object of my invention to provide an arc-back responsive device which can be operated only when a reverse current flows in a unidirectional conductor attached to the vapor-electric converter.

Other objects and advantages of my invention will be apparent from the following detailed description taken in conjunction with the accompanying drawing, in which the single figure is a diagrammatic illustration of an arc-back responsive device embodying my invention.

The apparatus according to my invention comprises a current rectifying device 3, such as a mercury arc converter, having a circuit 5, supplying direct current to a load 7. The converter 3 comprises an anode 9, a mercury pool cathode 11, and a make-alive electrode 13 for establishing the cathode spots. The make-alive electrode 13 is connected to the anode 9 through a suitable unidirectional conductor 15, such as a half wave rectifier. In series with the anode 9 is placed a millivolt shunt 17 which normally carries current in one direction. In parallel with the shunt 17 is attached a suitable magnetically operated light reflector 19, such as an oscillograph, including a light reflecting element 21, such as a mirror. A source of light from an incandescent lamp 23 provides a beam of light which is focused by the lens 25 to produce a narrow beam on the mirror 21 of the oscillograph 19. A suitable shield 27 prevents light from spreading in all but the desired direction.

A light-responsive device 29, such as a photo-electric cell, is suitably placed in the vicinity of the oscillograph 19 to pick up light that may be reflected from the reflecting element 21 when the latter is moved into a certain position. A suitable control device 31, such as a grid-controlled discharge device, is connected in series with the photo-electric cell 29. The auxiliary discharge device 31 has a voltage characteristic such that under normal operating conditions the grid 33 of the discharge device 31 is sufficiently negative to prevent a breakdown. Associated with the auxiliary discharge device 31 is an actuating coil 35 of a circuit breaker or annunciator or any such similar device may be attached.

In the operation of my device 3, current normally flows in the shunt 17 in one direction so that the oscillograph 19 will cause the mirror 21 to deflect the projected light beam in a direction away from the photo-electric cell 29. However, if a reverse current flows in the shunt 17, the oscillograph 19 will swing the light reflecting element 21 through an angle, thereby reflecting the incident light from the source 23 towards the photo-electric cell 29, thus energizing it. Simultaneously, with the pickup of the reflected light, the photo-electric cell 29 produces an electrical impulse which is impressed on the grid 33 of the auxiliary discharge device 31, permitting the same to break down, and thus actuating a coil

35 of a relay, or possibly an actuating coil of a circuit breaker.

While I have shown and described certain specific embodiments of my invention, it is apparent that changes and modifications can be made therein without departing from the true spirit of my invention or the scope of the appended claims.

I claim as my invention:

1. An inverse current responsive relay comprising a conductor normally carrying current in only one direction, a shunt in said conductor, an oscillograph element connected in parallel to said shunt, a light reflecting element actuated by said oscillograph element, a light source cooperating with said light reflecting element, said light reflecting element reflecting light in one direction during normal direction of current flow through said shunt and in another direction during abnormal direction of current flow therein, a light responsive means energized by the light during inverse current flow in said shunt and circuit means operatively connected to said light responsive means.

2. An arc-back responsive relay for a vapor electric device comprising a conductor connected to said device, said conductor carrying current in one direction during normal operation of the device and in an inverse direction during an arc-back, a shunt in said conductor, an oscillograph element connected in parallel with said shunt, said oscillograph element being movable in one direction in response to normal current direction in said shunt and in the opposite direction in response to inverse current, a light reflecting element carried by said oscillograph element, a light source for said light reflecting element, a photo-electric device positioned to be energized by the light from said light reflecting element during the occurrence of inverse current in said shunt.

LEON R. LUDWIG.