No. 714,607. Patented Nov. 25, 1902.

H. N. POTTER.

ELECTRIC CUT-OUT.

(Application filed Mar. 27, 1901.)

(No Model.)

Fig. 1

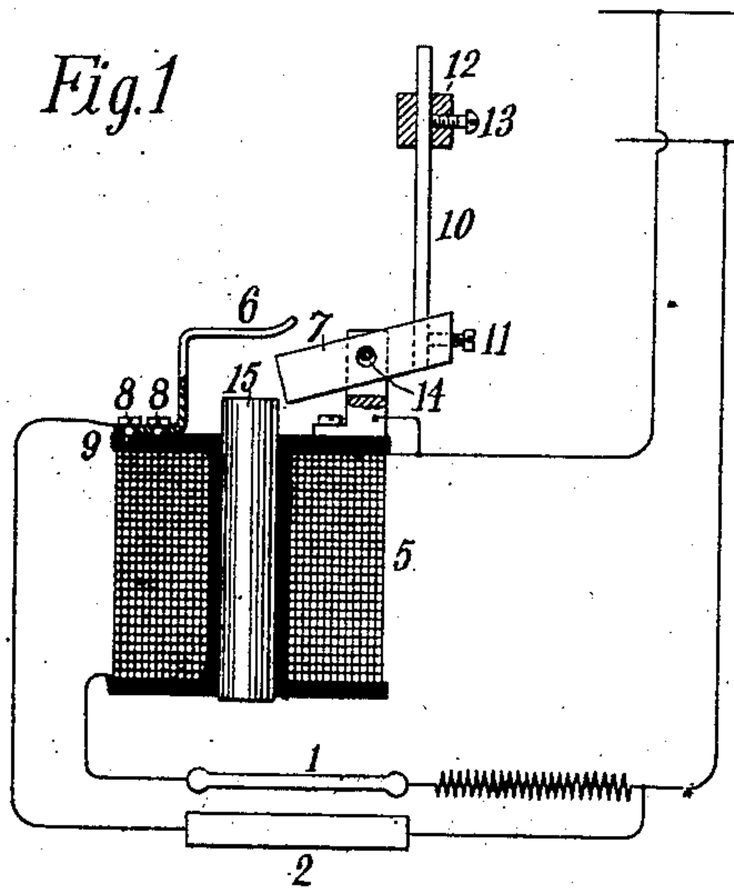


Fig. 2

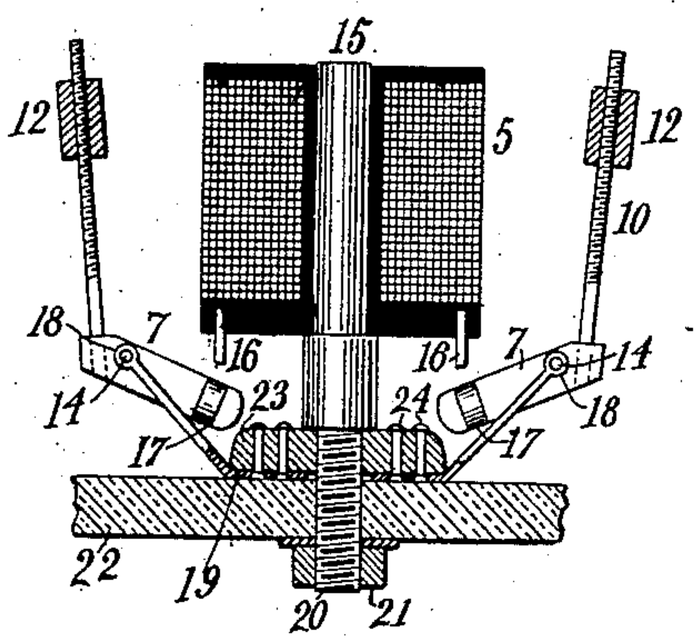


Fig. 3

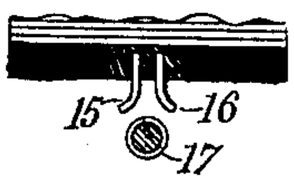


Fig. 4

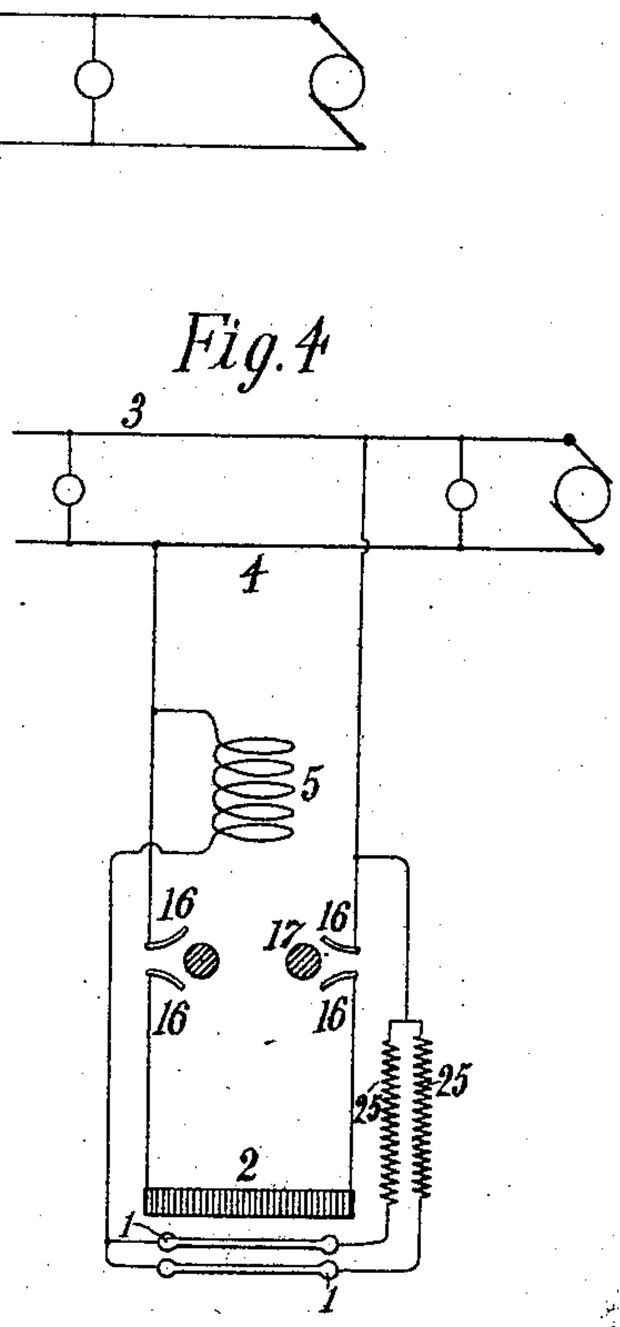
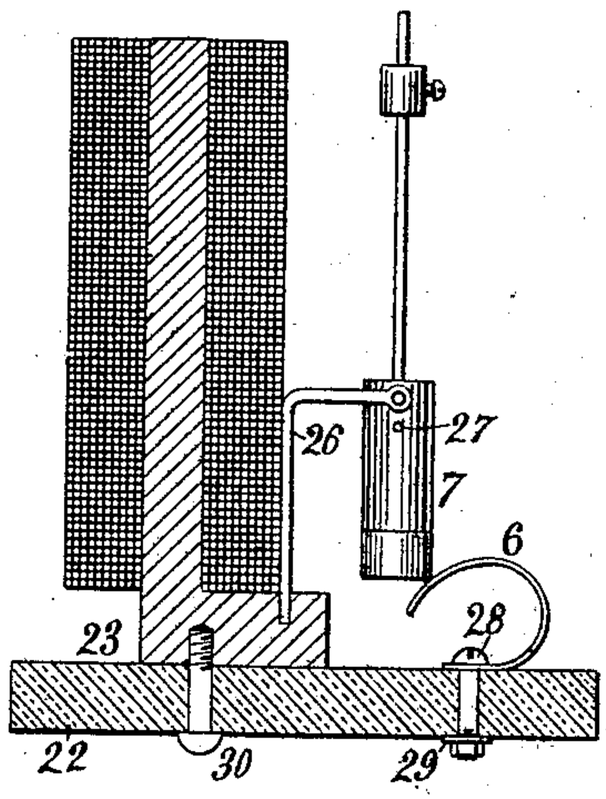


Fig. 5



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UNITED STATES PATENT OFFICE.

HENRY NOEL POTTER, OF PITTSBURG, PENNSYLVANIA, ASSIGNOR TO GEORGE WESTINGHOUSE, OF PITTSBURG, PENNSYLVANIA.

ELECTRIC CUT-OUT.

SPECIFICATION forming part of Letters Patent No. 714,607, dated November 25, 1902.

Application filed March 27, 1901. Serial No. 53,033. (No model.)

To all whom it may concern:

Be it known that I, HENRY NOEL POTTER, a citizen of the United States, and a resident of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Electric Cut-Outs, of which the following is a specification.

My invention relates to improvements in cut-outs designed to be used on alternating-current circuits, and it is applicable to all cut-outs which are subjected to the conditions that obtain in such circuits.

For the sake of convenience I shall describe my invention as applied to a cut-out for Nernst lamps. In operating cut-outs for this class of lamps designed to operate on all frequencies—such, for example, as three thousand alternations per minute—difficulty has been found in preventing a noise being produced by the vibration of parts. Owing to the need of securing great freedom of movement in such cut-outs, the bearing or bearings of the moving part must be very loose. In the case of an immovable pin surrounded by a collar attached to the moving part the opening in the collar is generally made considerably larger than the diameter of the pin. Unless means be provided for preventing it a short diametral motion of the collar relative to the pin during the periods of weak magnetic attraction may take place by reason of the intermittent magnetic pull and gravity being opposed to each other. In other words, if the angle between the line of magnetic attraction and the downward pull of gravity exceeds ninety degrees the intermittent effects of the magnetic force and of gravitation will cause the collar of the moving part to bump up against the pin on one side and then fall away from it and bump against the other side, thereby making a noise. To prevent this, the magnetic force and the gravitational restraining force should have their pulls exerted at an angle with each other of less than ninety degrees—that is to say, as gravity pulls the moving part downward the movement due to the magnet should be slantingly downward. By organizing a cut-out apparatus so as to produce this relation of forces the noise of the cut-out can be prevented.

The invention which I have thus indicated was first suggested to me by a recognition of the fact that all moving parts either have a period of their own, which causes them to be resonant at the frequency employed, or else their natural period is so short in comparison to the duration of one alternation that they are able to execute considerable movement between alternations. It therefore seemed to me to be possible to correct this tendency by giving to the moving part or parts of a cut-out apparatus a natural period, which should be long in comparison to the duration of one alternation. This lengthening of the period of the moving armature can be easily accomplished on the general principle of the metronome—in other words, of an oscillating body having its center of gravity but slightly below the center of support and having a considerable portion of its weight relatively far above the center of support. Even short pendulums so constructed may be made to have very long periods. In the cut-out the slight stable equilibrium of the metronome is not necessarily incorporated; but the combination may be put in unstable relation by placing the center of gravity above the center of rotation and support.

The period of the moving part can readily be made variable by means of an adjustable weight, which can be set at varying distances from the center of oscillation. In this way the natural period of the cut-out can be made incommensurable with any particular frequency on which the lamp may have to operate.

My invention will be fully understood by reference to the accompanying drawings, in which—

Figure 1 is a diagram of a system of Nernst-lamp circuits including my improved cut-out, which is shown in elevation. Fig. 2 is a view, partly in section and partly in elevation, of my improved cut-out adapted to control both sides of the circuit. Fig. 3 is a detail view of the contacts employed with the form of apparatus illustrated in Fig. 2. Fig. 4 is a diagram of the circuits controlled by the cut-out illustrated in Fig. 2; and Fig. 5 is a view, partly in section and partly in elevation, of a cut-out of the same general type constructed strictly on the metronome principle.

Referring to Fig. 1, the elements 1 and 2

are respectively a glower of the Nernst type and an electric heater therefor arranged in proximity to the glower, these elements being connected up in parallel between two main conductors 3 and 4, supplied by any suitable source of alternating current. In series with the glower is arranged the coil of an electromagnetic cut-out, and in series with the heater are arranged the terminals 6 and 7, whose relation is controlled by the electromagnet of the cut-out. The coil referred to is designated by the character 5. The function of the cut-out apparatus in this class of circuits is to break the circuit of the heater when the glower has become conductive through its operation.

The part 6 is in the present instance a stationary terminal in the form of a bent piece of metal secured by screws 8 8 to the insulating-head 9 of the magnet 5. The part 7 is the movable part of the cut-out, and it consists, essentially, of a pivoted bar of iron having a rod 10 secured to it beyond the pivot by means of a screw 11 or some other suitable device. A weight 12 is adjustably secured to the rod 10 by means of a set-screw 13. The parts 7 and 10 may, if found convenient, be made in a single piece, and the weight 12 may be made adjustable upon the rod 10 in any other convenient way besides the one indicated.

The part 7 is pivoted upon a transverse rod or pin 14, the opening in the part 7 being somewhat larger than the pin and constituting a collar loosely surrounding the pin. Before the glower begins to operate the end of the terminal 7 rests against the stationary terminal 6, the heater-circuit being thereby completed. It will be understood that the part 7 is of soft iron and that its end lies within the range of influence of the iron core 15 of the magnet 5.

When the glower becomes conductive and the glower-circuit is thereby brought into operation, causing current to pass through the coil 5, the magnet will be energized and the movable terminal 7 will be drawn down into the position illustrated in Fig. 1, whereby the heater-circuit will be broken.

It will be remembered that the glower-circuit, including the magnet 5, is now traversed by a rapidly-alternating current, tending to energize the magnet at the summit of each alternation and to leave the movable terminal 7 wholly under the influence of gravity between alternations. It will also be noted that with the arrangement shown and described the pull of the magnet-core is slantingly downward, while the action of gravity is directly downward. Accordingly there is no tendency toward a diametral movement of the collar surrounding the pin upon the pin than would be the case if the action of the magnet were in a direction exceeding ninety degrees from a direct downward pull. Should the adjustment prove to be such that there is still a disagreeable vibration, the period of the moving part of the cut-out can be varied by a proper adjustment of the weight 12 upon the rod 10 until such vibration ceases to produce a noise.

The cut-out shown in Fig. 1 is a single-pole cut-out. In Fig. 2 I show a double-pole cut-out adapted to operate on the same general principle. Here the weight 12 is screw-threaded to correspond to the screw-threaded form given to the upper end of the rod 10, and two moving parts are provided, one on each side of the magnet 5. In the lower insulating-head of the said magnet, on opposite sides of the core 15, are mounted two pairs of contact-terminals 16 16, and the part 7 on each side is arranged to bridge one of these pairs. I generally surround the iron portion 7 with a band 17, of silver or platinum, to prevent oxidation at the points where the movable element of the cut-out makes contact with the stationary terminals. The parts 7 in this construction are provided with transverse pins 14 14, which are mounted in suitable eyes 18 18 in the outer ends of suitable yokes 19 of non-magnetic material.

The core 15 is provided with a screw-threaded downward extension 20, which, in conjunction with a suitable nut 21, serves as a means for attaching the core and the magnet to an insulating-base 22. Between the base and the main body of the core 15 the yokes 19 are mounted, and also a soft-iron pole-piece 23, the latter being screwed upon the extension 20. The yokes 19 are secured to the pole-piece 23 by means of screw-bolts 24 24, or they may be held in place between the pole-piece 23 and the base 22 by tightening the nut 21. Normally the movable parts of the cut-out are so held by gravity that the rings 17 17 are in contact with the stationary terminals 16 16. When, however, current traverses the glower-circuit, including the coil 5, and the pole-piece 23 is magnetized, the ends of the parts 7 are drawn down into the position illustrated in Fig. 2, whereby the heater-circuit is broken on both sides. This will be more clearly evidenced from an examination of Fig. 4, which is a diagram of the circuits designed to be used with such a cut-out as has just been described. In this diagram I have shown a plurality of glowers 1 1, each in series with a suitable ballast resistance 25, the coil 5 being in a circuit common to all the glowers. The diagram shows the heater-circuit broken, it being assumed that the heater has already done its work and that the glower-circuit is now in operation.

In Fig. 5 I have illustrated a form of cut-out more nearly corresponding in principle and action to a metronome. Here the movable part is mounted upon a suitable pair of bent insulating-arms 26, the construction of the entire movable part being such that its center of gravity (indicated at 27) is below the center of rotation. The pole-piece 23 is

extended, as shown, far enough so that its sphere of influence embraces the lower end of the part 7, while the stationary terminal 6 of the cut-out is mounted directly upon the base 22 by means of a screw-bolt 28 and a nut 29. The magnet 4 is held to the base by means of a screw 30 entering the base from below and passing up into a screw-threaded opening in the core. The action is obvious.

The invention claimed is—

1. In an electromagnetic cut-out, a movable element, having an adjustable natural period, and so disposed that the force of restraint and the pull of the magnet are at an angle of less than ninety degrees with relation to each other.

2. In an electric circuit, carrying an alternating current of determinate frequency, an electromagnetic cut-out having a pivoted movable element, which has a period incommensurate with such frequency.

3. In an electric circuit adapted to carry, at different times, alternating currents of different frequencies, an electromagnetic cut-out having a pivoted movable element, which has a period incommensurate with a selected one of these frequencies, and means for adjusting the period of such movable element so as to make it incommensurate with any other of the frequencies.

Signed at New York, in the county of New York and State of New York, this 5th day of February, A. D. 1901.

HENRY NOEL POTTER.

Witnesses:
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