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LATVIJAS REPUBLIKAS
PATENTU VALDE

①1 LV 10542 B

⑤1 Int.Cl. ⁵ H01H9/54
H01H47/18

Latvijas patents uz izgudrojumu
1995.g. 30.marta Latvijas Republikas likums

①2

Īsziņas

②1 Pieteikuma numurs: P-92-540

②2 Pieteikuma datums: 29.12.1992*

④1 Pieteikuma publikācijas datums: 20.02.1995

④5 Patenta publikācijas datums: 20.06.1995

③0 Prioritāte:
884150 19.09.1988 NO

⑧6 PCT pieteikums:
PCT/NO89/00095, 18.09.1989

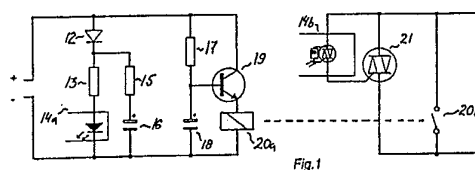
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⑤4 Virsraksts: Pārslēga shēma

⑤7 Kopsavilkums: Piedāvāta elektriskā pārslēgšanas shēma (fig. 1), kas satur elektromagnētisko releju (20a, 20b) un bezkontakta divvirziena pārslēgu (21). Tā spēj pieslēgt un atslēgt kapacitāto, induktīvo vai tīri rezistīvo slodzi (22) bez loka veidošanās un bez būtiskiem siltuma zudumiem. Slodzes pieslēgšana notiek ar sprieguma (11) palīdzību, kuru pievada caur fāzu taisngriešanas optronu (14a, 14b) divvirziena bezkontakta pārslēgam (21), piemēram, simistoram. To pašu spriegumu pievada laika aiztures shēmai (15, 16), piemēram, RC-kontūram, kura noteiktā laika periodā ierosina elektromagnētisko releju (20a, 20b). Slodzi atslēdzot, šī secība ir pretēja.



* pieteikums pieņemts ievērojot LR Ministru Padomes 1992.gada 28.februāra lēmumu Nr.72 (PSRS ir norādītā valsts PCT pieteikumā)

IZGUDROJUMA FORMULA

1. Pārslēgšanas shēma, kas paredzēta elektriskās slodzes (22) pieslēgšanai un atslēgšanai ar magnētisko releju (20a un 20b) un paralēlu divvirzienu bezkontakta vadāmu pārslēgu (21), kur pieslēgšanas gadījumā divvirziena vadības bezkontakta pārslēgs (21) vispirms savienos slodzi (22), un pēc zināma laika perioda elektromagnētiskais relejs (20a) tiks aizvērts, atslēgšanas gadījumā elektromagnētiskais relejs (20a) vispirms tiks atvērts, pēc kā divvirziena vadības bezkontakta pārslēgs (21) atvienos slodzi (22), izejot caur pirmo vai sekojošo nulles spriegumu, raksturīga ar to, ka tiek lietots integrēts fāzi detektējošs optrons (14a, 14b), lai pieslēgtu un atslēgtu divvirzienu vadības bezkontakta pārslēgu (21).

2. Shēma, saskaņā ar punktu 1, raksturīga ar to, ka RC-kontūrs (17,18) paralēli savienots ar releja spoli, lai aizkavētu pieminētās spoles ierosināšanu.

3. Shēma, saskaņā ar punktu 2, raksturīga ar to, ka releja (20a) primārā spole savienota virknē ar tranzistoru (1), kurš pastiprina sprieguma līmeni no pieminētā RC-kontūra (17,18).

4. Shēma, saskaņā ar punktu 1, raksturīga ar to, ka RC-kontūrs (13,15,16) savienots, lai aizkavētu ierosinājuma samazināšanos.

5. Shēms, saskaņā ar punktu 4, raksturīga ar to, ka pieminētā RC-kontūra (13,15,16) laika konstante ir lielāka vai ekvivalenta ar slodzes shēmas (22) darbības pusperiodu.

A switching circuit

The invention relates generally to a switching circuit for making and breaking capacitive, inductive and resistive load in an electrical circuit, as disclosed in the introductory part of Claim 1.

5 Electrical switching devices are known in various embodiments, commonly known by the term "relay". Known electromagnetic relays have been available for several years, but they demand a lot of space, energy, and are besides generating electritical noise at making and
10 breaking. Such devices also require a relatively high controlling power, and are thus precluded for a number of task, e.g. where the controlling is being done from a computer.

A different kind of electrical switching circuits are
15 based only upon electronics, i.e. making and breaking is being effecting without mechanical contacts; on the contrary, semiconductor technology is utilized. These so-called "SSR-relays" ("Solid State Relay") have great heat losses with high loads, especially with inductive loads.
20 They thus need to be cooled, for which reason they are precluded for a number of tasks, in particular for use over a longer period of time.

US Patent specification 4,074,333 discloses a device in which these detrimental features by far are eliminated. Said
25 device operates by means of first making the load using an electronical coupling means, a bidirectionally controlled, contactless switch, whereupon a mechanical relay connects and holds the load circuit. The order of making and breaking is controlled by a dedicated sequence controller. Means are
30 provided for controlling the triac, responsive to signals from the sequence controller through a phase detector. The phase detector is provided to ensure making and breaking at the point in time where the phase angel in the load circuit equals zero (zero-voltage crossing). A signal is fed back
35 from the triac-controller to the sequence controller, which,

through the energizing means, provide closing of the electromagnetical relay.

An advantage of the device disclosed in US 4,074,333 compared to directly using an electromechanical relay, lies in the fact that arcs are avoided in making and breaking the load circuit, as said load circuit previous is made by the contactless switch. This implies utilizing the advantages from both kinds of switches, the "SSR"-technology provides a non-arc making, and the electromagnetical relay provides a permanent connection without substantial heat losses.

A disadvantage with the device disclosed in US 4,074,333 is that it comprises a relatively complex circuit including a plurality of relatively complex circuit elements. If this circuit should be designed according to the description, using existing circuit elements, it would become unreasonably expensive. Furthermore, the device would require a relatively great amount of space, so that the device have to be large and expensive, and thus of less commercial interest.

It is therefore a main object for the present invention to provide switching means for making and breaking various kinds of loads to any AC-circuit, especially in cases where any creation of heat or high-frequency noise in making or breaking is undesired or unacceptable, or where risks exist for explosion. Importance is attached to providing switching means which is compact, simple, reliable and inexpensive in manufacturing. It is a more particular object to improve known switching means, in order to provide switching means being more simple, less expensive, and which require less space.

According to the invention, this can be accomplished with a circuit as stated in the characterizing part of Claim 1. Additional favorable features are disclosed in Claims 2 to 5.

Present invention is in some respect based upon similar principle as the device known from said US Patent specification 4,074,333. However, as opposed to this, the present invention is carried out using a minimum of, and

simple elements, a fact which results in the circuit does require a minimum of space. Furthermore, the tolerances are not critical for the function of the circuit. All these factors contribute to a very low cost for the manufactured
5 circuit.

In the following a best mode of using the invention will be described with reference to the accompanying drawing, showing a circuit diagram of a switching circuit according to present invention.

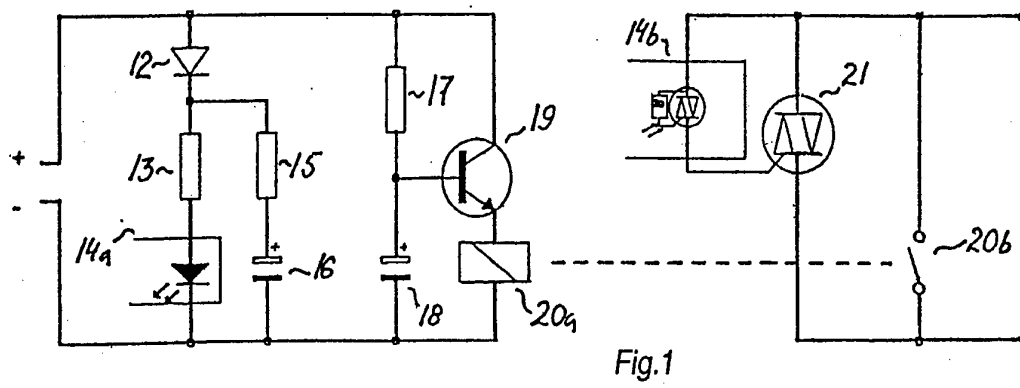
10 The function of this embodiment is that a control voltage 11 is applied, for controlling making and breaking of the circuit. If AC voltage is to be used, it should be rectified (not shown in the figure). In the presence of the control voltage 11 a current will flow through a diode 12, a
15 resistor 13, and a light-emitting section 14a of an optical coupler. This will in its turn provide triggering of the light-sensitive section 14b. The optical coupler 14a, 14b is of the kind being used to control triacs, and is in addition delaying the making until the phase angle being zero.
20 Optically coupler 14b is connected to the control input of a triac 21, which is capable of making a load 22. Said load can be inductive, capacitive or pure resistive. Provision of voltage to the triac, results in connection of the load.

Simoultaneously with the control voltage 11 triggering the
25 triac 20, the same voltage 11 starts generating an electric field in capacitor 18 through a resistor 17. The capacitor 18 will, together with the resistor 17, form a time-delay circuit (RC-network), which will, in a period of time
determined of the selected values of the resistor 17 and
30 capacitor 18, generate a voltage between the base of a transistor 19 and ground, so that the transistor 19 will conduct current through the control coil of a mechanical relay 20a, which shuts a switch 20b of the relay, making the
load 22. In utilizing a transistor 19 for amplifying the
35 voltage level of the RC-network 17 and 18, the development of a high charge in the RC-network is rendered redundant, and the capacitor can consequently be of a considerably less capacity.

As the control voltage is triggering triac 21, and starts charging the capacitor 18, the same control voltage also starts charging capacitor 16 through the resistor 15. Resistor 15 and resistor 13 are, together with capacitor 16
5 forming a time delay circuit. This time delay circuit is utilized in breaking the load connection.

As the control voltage 11 is cut off, the RC-network formed of resistor 15, resistor 13, and capacitor 16, will provide current to optical coupler 14a, 14b in a periode of
10 time determined by said RC-network. On the other hand, the transistor 19 will immediately be turned off, opening the electromagnetic relay 20a, 20b. However, connection to the load will be maintained by means of the triac 21 until the control voltage entirely disappears when the capacitor 16 is
15 sufficiently discharged. To have the triac 21 breaking the circuit in zero-voltage crossing, the time constant for the RC-network fromed by 13, 15 and 16, should correspond to at least half a period of the load 22. Still, it could be larger, as it is the phase detecting optical coupler
20 observing the breaking being exactly in zero-voltage crossing. This fact implies that a narrow tolerance of the components are not crucial, and it is possible to use inexpensive components to obtain the same result as with more accurate and expensive components.

25 By using the optical isolator 14a, 14b to make and break the triac 21, it is in addition obtained a galvanic separation between the control circuit 11 and the load 22.



Claims:

1. A switching circuit for making and breaking an electrical load (22) by means of an electromagnetic relay (20a and 20b) and a parallell bidirectively controlled contactless switch (21), wherein at making, the
- 5 bidirectively controlled contactless switch (21) first will connect the load (22), and after a certain period of time, the electromagnetic relay (20a) will shut; at breaking, electromagnetic relay (20a) will first open, whereupon the bidirectively controlled contactless switch (21) will
- 10 disconnect the load (22) in the first, or a subsequent zero-voltage crossing, c h a r a c t e r i z e d in using an integrated phase detecting optical isolator (14a, 14b) in turning on and off the bidirectively controlled contactless switch (21).
- 15 2. Circuit according to claim 1, c h a r a c t e r i z e d in a RC-network (17, 18) being connected in parallell to the relay coil to delay energizing of said coil.
3. Circuit according to claim 2,
- 20 c h a r a c t e r i z e d in the primary coil of the relay (20a) being connected in series with a transistor (1), which amplifies the voltage level from said RC-network (17,18).
4. Circuit according to claim 1,
- 25 c h a r a c t e r i z e d in a RC-network (13, 15, 16) being connected to delay the de-energizing.
5. Circuit according to claim 4, .
- c h a r a c t e r i z e d by said RC-network (13, 15, 16) has a time constant greater than, or equal to half a period
- 30 of the load circuit (22).