Jan. 20, 1942. S. DETTAR 2,270,513

CIRCUIT MAKER AND BREAKER

Filed May 22, 1940 2 Sheets-Sheet 1

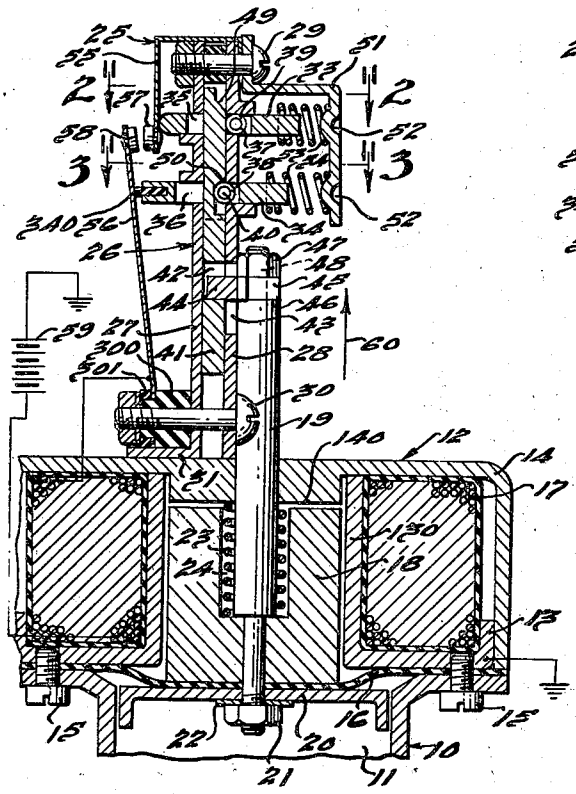


FIG. 1.

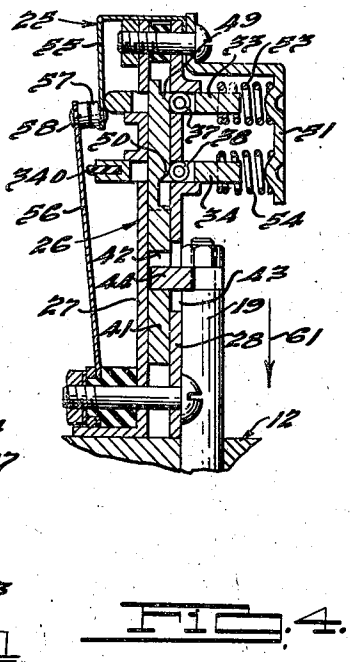


FIG. 4.

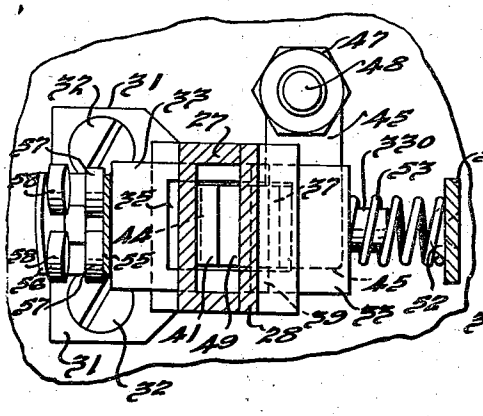


FIG. 2.

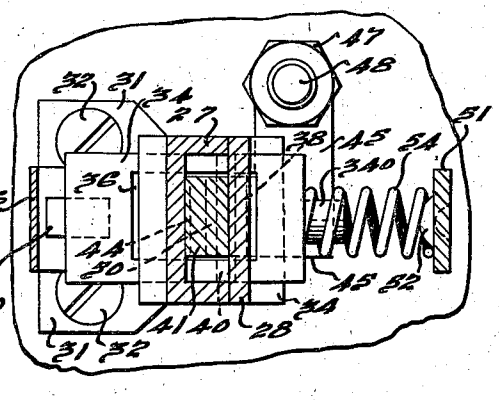


FIG. 3.

INVENTOR
Steve Dettar.
BY
Everett G. Wright,
ATTORNEY

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CIRCUIT MAKER AND BREAKER

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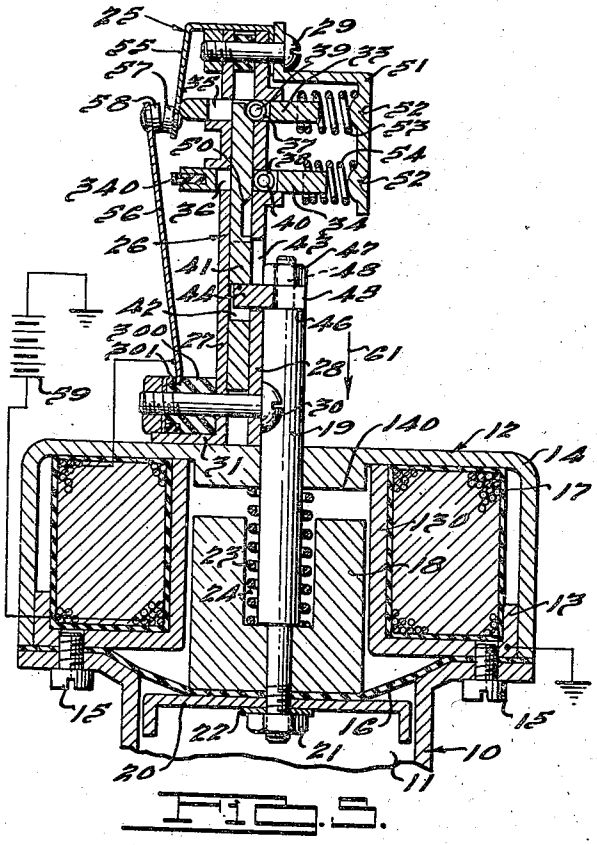


FIG. 5.

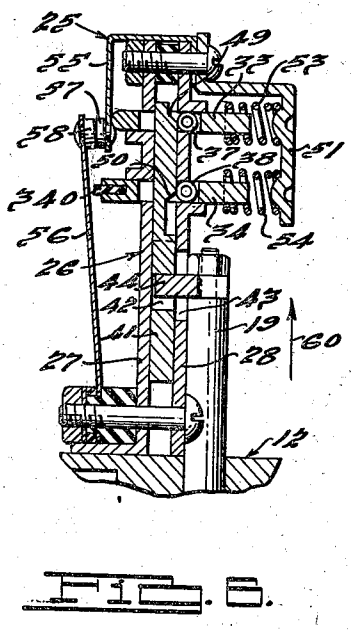


FIG. 6.

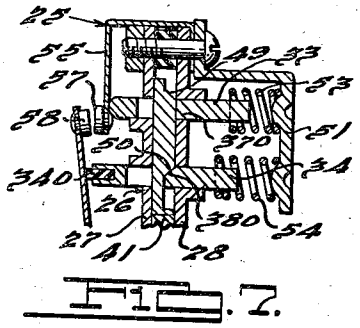


FIG. 7.

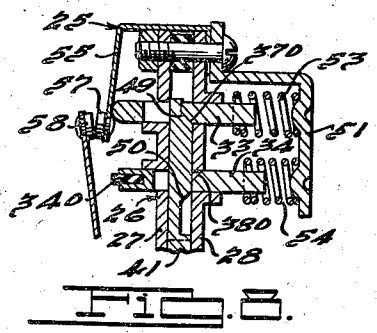


FIG. 8.

INVENTOR
Steve Dettar
BY
Everett Gillright
ATTORNEY

Patented Jan. 20, 1942 2,270,513

UNITED STATES PATENT OFFICE

2,270,513

CIRCUIT MAKER AND BREAKER

Steve Dettar, St. Clair Shores, Mich.

Application May 22, 1940, Serial No. 336,486

4 Claims. (Cl. 200—68)

This invention relates to circuit makers and breakers and in particular to cam action rapid make and break means for electric circuits particularly adapted for use in combination with electric fuel pumps, windshield wipers, and the like.

This invention is an improvement in the circuit breaker disclosed and claimed in Patent No. 2,104,190 issued January 4, 1938, on an application for patent filed by Steve Dettar on January 2, 1936, Serial No. 57,149.

Although applicable to many various types of devices, the invention will be described herein in combination with an electric fuel pump which employs a solenoid to actuate its plunger which in turn serves as the reciprocating element that operates its circuit maker and breaker embodying the invention.

The instant invention has among its objects the provision of a circuit maker and breaker operated by delayed cam action responsive to a reciprocating element which operates freely and accurately under conditions of generous tolerances and which positively makes and positively breaks a circuit with extreme rapidity and with contact wiping action alternately at the limit of the movement of the said reciprocating element.

Other objects of the invention will become apparent by reference to the following detailed description taken in connection with the accompanying drawings, in which:

Fig. 1 is a vertical sectional view of a circuit maker and breaker embodying the invention with its contacts open operatively mounted on an electric fuel pump, only sufficient of the fuel pump being disclosed to indicate the adaptability of the invention thereto.

Fig. 2 is a horizontal sectional view taken on the line 2—2 of Fig. 1 showing the positive rapid circuit making cam and follower.

Fig. 3 is a horizontal sectional view taken on the line 3—3 of Fig. 1 showing the positive rapid circuit breaking cam and follower.

Fig. 4 is a fragmentary sectional view similar to Fig. 1 showing the circuit maker and breaker with its contacts initially closed prior to rapid positive closing thereof.

Fig. 5 is a vertical sectional view similar to Fig. 1 except that the contacts of the circuit breaker are shown positively closed.

Fig. 6 is a fragmentary sectional view similar to Fig. 5 showing the circuit maker and breaker with its contacts still closed prior to rapid positive opening thereof.

Figs. 7 and 8 are fragmentary sectional views similar to Figs. 1 and 5 respectively showing a circuit maker and breaker employing beveled cam followers rather than roller cam followers as disclosed in Figs. 1 and 5.

Referring now to the drawings wherein like numerals refer to like and corresponding parts throughout the several views, the illustrative embodiment of the invention disclosed in Figs. 1 to 6 inclusive is shown in combination with and operatively connected to a solenoid operated electric fuel pump.

The electric fuel pump has a main body member 10 forming a pumping chamber 11 and the customary suitable valved intake and discharge ports, not shown. A solenoid unit 12 having a base casting 13 and cover 14 is secured to the pump body member 10 over the pumping chamber 11 by suitable machine screws 15 with a diaphragm 16 disposed therebetween as best shown in Figs. 1 and 5. The central portion of the solenoid base casting 13 is formed into a sleeve 130 around which the solenoid coil 17 is wound.

The plunger 18 of the solenoid unit 12 is reciprocatingly mounted within the sleeve 130 of the solenoid base casting 13 and is guided to float centrally therein by a shouldered reciprocating element or shaft 19 having its upper end reciprocatingly mounted through a suitable aperture provided in the top of the cover 14 of the solenoid unit 12 and its lower end extending through the lower portion of the solenoid plunger 18, through the center of the diaphragm 16, and through the center of a pump piston 20 located in the pumping chamber 11 of the fuel pump body member 10. A nut 21 having a lock washer 22 threaded on the depending end of the said reciprocating element or shaft 19 secures the said shaft 19, the solenoid plunger 18, the pump diaphragm 16 and the pump piston 20 into a single unit.

A compression spring 23 located around the reciprocating element or shaft 19 in a bore 24 in the top of the solenoid plunger 18 reacts against the bottom 140 of the solenoid unit cover 14 and provides a mechanical pumping stroke for the solenoid plunger 18 and the pump piston 20. The solenoid coil 17 of the solenoid unit 12, when energized, provides an electrical suction stroke for the solenoid plunger 18 and the pump piston 20. Electric current from a suitable source must be supplied to the solenoid coil 17 at the completion of each spring actuated mechanical stroke of the solenoid plunger 18 and such supply of electric current must be shut off at the

completion of each electrical stroke of the solenoid plunger 18. This timed intermittent supply of electric current to the solenoid coil 17 is accomplished by the positive acting delayed cam action quick make and break circuit maker and breaker embodying the invention which now will be described in detail.

The delayed cam action quick make and break circuit maker and breaker embodying the invention disclosed in Figs. 1 to 7 inclusive generally designated by the numeral 25 throughout the drawings comprises a vertically disposed hollow guide member 26 preferably formed from a U-shaped stamping 27 and a rectangular stamping 28 secured together by the bolts 29 and 30. The lower portion of the rectangular stamping is bent at right angles thereto to form a seat 31 which is fixed to the top of the cover 14 of the solenoid unit 12 by short stud screws 32.

The said guide member 26 has a maker push arm 33 and a breaker push arm 34 transversely mounted therethrough in vertically spaced relationship with respect to each other. Each push arm 33 and 34 is provided with a rectangular aperture 35 and 36 respectively across each of which is mounted a roller cam follower 37 and 38 respectively on pins 39 and 40. The maker push arm 34 is provided with a push element 340 of hard fibre or other insulating material to avoid electrical contact between the push arm 34 and the contact arm 56.

A cam slide member 41 having a slotted aperture 42 therein is disposed vertically in said guide member 26 and extends through the rectangular apertures 35 and 36 of each push arm 33 and 34 respectively. The guide member 26 has a vertically disposed slot 43 therein through which extends the tongue 44 of a horizontally disposed L-shaped arm 45 mounted on the reciprocating element or shaft 19 of the solenoid unit 12. The said reciprocating element 19 is shouldered at 46 to provide a seat against which the said arm 45 is secured by threading the nut 47 on the reduced end 48 of the said reciprocating element or shaft 19.

The said cam slide member 41 has oppositely disposed maker and breaker cams 49 and 50 respectively formed thereon which cooperate with the maker cam follower 37 and the breaker cam follower 38 respectively as indicated in Figs. 1 to 6 inclusive and as hereinafter described in detail.

The circuit maker and breaker 25 is provided with a bracket 51 secured to the hollow guide member 26 by the bolt 29 which serves as an abutment for the compression springs 53 and 54 which constantly urge the maker push arm 33 and breaker push arm 34 respectively toward contact arms 55 and 56 which preferably carry pairs of contactors 57 and 58 respectively. The contact arm 55 is grounded with respect to the circuit maker and breaker 25 and is secured thereto by the bolt 29 and is normally disposed parallel and in spaced relationship to the said hollow guide member 26. Contact arm 56 is secured in insulated relationship and normally parallel to the said hollow guide member 26 by the bolt 30 and the insulators 300 and 301 disposed therearound as indicated in Figs. 1, 4, 5 and 6. When assembled and without pressure being applied thereto by either the maker or breaker push arms 33 and 34 respectively, the contact arms 55 and 56 normally urge the contactors 57 and 58 thereon into contact with respect to each other, see Figs. 4 and 6. It will be noted that, by having one of the contact arms 55 or 56 shorter than the other, when the contactors 57 and 58 thereon are moved into and out of contact with respect to each other, a wiping action occurs which maintains the contact surface of the contactors 57 and 58, bright and clean.

To assure smooth working of the delayed cam action circuit maker and breaker 25, the compression springs 53 and 54 are made proportionately as strong as the spring pressure of the contact arms 55 and 56 respectively thereagainst. For example, in the embodiments of the invention disclosed in the drawings, the compression spring 54 is slightly stronger than the compression spring 53. Also, to assure retention of the springs 53 and 54 in their proper place, the bracket 51 is provided with suitable protuberances 52 which center one end of the said springs 53 and 54, and the maker push arm 33 and the breaker push arm 34 are each provided with a tongue 330 and 340 respectively which center the other end of the said springs 53 and 54 respectively.

As diagrammatically illustrated in Figs. 1 and 5, electric current from a suitable source such as the battery 59 runs through the solenoid 17 when the contactors 57 and 58 of the circuit maker and breaker 25 are closed, one side of the battery 59 and the contact arm 55 carrying the contactor 57 being grounded while the other side of the battery 59 is connected through the solenoid 17 to the contact arm 56 carrying the contactor 58.

Fig. 1 shows the open position taken by the contactors 57 and 58 after the solenoid 17 has been energized and has lifted its plunger 18 in the direction indicated by the arrow 60 to the uppermost limit of its electric power stroke, the said plunger 18 having compressed the compression spring 23 ready for the spring actuated mechanical stroke of the solenoid plunger 18. In such position of the solenoid plunger 18 and the reciprocating element or shaft 19 affixed thereto, the breaker cam 50 on the cam slide member 41 has been acted upon by the spring loaded cam follower 38 of the breaker push arm 34 and has caused the cam slide member 41 to jump in the direction of movement 60 of the electric power stroke of the solenoid plunger 18 under the power of the compression spring 54 of the breaker push arm 34. The movement of the breaker push arm 34 when causing the cam slide member 41 to jump opens the contactors 57 and 58 instantaneously to the position indicated in Fig. 1. Now, the spring actuated mechanical stroke of the solenoid plunger 18 in the direction indicated by the arrow 61 in Fig. 4 begins and continues until the slide member 41 arrives at the position indicated in Fig. 4 wherein the contactors 57 and 58 have been initially closed at which position the rapid positive closing of the said contactors 57 and 58 is accomplished by the action of the maker push arm 33 as hereinafter described in detail. The movement of the slide member 41 to the position indicated in Fig. 4 from its position indicated in Fig. 1 causes the cam 50 thereof to act on the cam follower 38 of the maker push arm 34 and move it back to its neutral position shown in Fig. 4.

At the initial closing of the contactors 57 and 58 by the spring actuated stroke of the solenoid plunger 18 and the reciprocating element or shaft 19 affixed thereto in the direction indicated by the arrow 61 in Fig. 4, the spring loaded cam

follower 37 of the maker push arm 33 acts on the cam surface 49 of the cam slide member 41 which causes the said cam slide member 41 to jump rapidly in the direction of movement 61 of the spring actuated stroke of the solenoid plunger 18 but independently thereof, whereby to permit the said maker push arm 33 to positively close the contactors 57 and 58 which had been initially closed the instant before. It will be noted that the slot 42 in the cam slide member 41 is sufficiently long to permit the cam slide member 41 to jump in the direction of movement 61 of the spring actuated power stroke of the solenoid plunger 18 under the influence of the spring loaded cam follower 37 acting on the cam surface 49 of the cam slide member 41, thus providing an extremely rapid positive closing of the contactors 57 and 58; the contactors 57 and 58, the cam slide member 41, and maker push arm 33 moving under the power of the cam slide compression spring 53 from the position shown in Fig. 4 to the position shown in Fig. 5. A wiping action of the contactors 57 and 58 against each other is accomplished during the rapid positive closing thereof by the maker push arm 33.

At the completion of the spring actuated stroke of the solenoid plunger 18 and the reciprocating element or shaft 19 affixed thereto and upon closing the contactors 57 and 58 to the position indicated in Fig. 5, the solenoid 17 becomes energized and the said solenoid plunger 18 and the reciprocating element or shaft 19 affixed thereto is moved in the direction indicated by the arrow 60 in Fig. 6 from the position indicated in Fig. 5 to the position indicated in Fig. 6 whereupon the cam 49 of the cam slide member 41 has moved the maker push arm 33 back to its neutral position and the cam 50 of the cam slide member 41 becomes ready to be acted upon the spring loaded cam follower 38 of the breaker push arm 34 which moves the contactors 57 and 58 instantaneously from the closed position indicated in Fig. 6 to the open position shown in Fig. 1 under the power of the breaker push arm compression spring 54. When the breaker push arm 34 moves from its position shown in Fig. 6 to its position shown in Fig. 1, it causes the cam slide member 41 to jump in the direction of movement 60 of the electric power stroke of the solenoid plunger 18 under power of the compression spring 54 of the said breaker arm 34. A wiping action of the contactors 57 and 58 against each other is accomplished during the rapid breaking thereof by the breaker push arm 34. Thus, the cycle of operation of the delayed cam action circuit maker and breaker is completed.

Figs. 7 and 8 show one alternate construction of delayed cam action rapid make and break means embodying the invention with its contactors 57 and 58 opened and closed respectively, the difference between the construction shown in Figs. 7 and 8 and the embodiment of the invention hereinbefore described in detail being that beveled cam follower surfaces 370 and 380 have been substituted for roller cams 37 and 38 of the maker and breaker push arms 33 and 34 respectively.

Although but two specific embodiments of the invention have been disclosed and described herein, it will be observed that various changes including the size, shape, arrangement and details of the various parts thereof may be made without departing from the spirit of the invention and it is not intended to limit the scope thereof other than by the terms of the appended claims.

I claim:

1. In a circuit maker and breaker, a pair of spring contact arms including contactors thereon oppositely disposed with respect to each other, a guide and a slide reciprocatingly mounted in said guide, a spring loaded maker push arm and a spring loaded breaker push arm reciprocatingly mounted in spaced relationship through said guide and positioned to urge said contactors together and apart respectively, cam followers on said push arms, oppositely disposed spaced cams on said slide engageable by said cam followers alternately during the reciprocation of said slide with respect thereto, means for reciprocating said slide whereby to place said cams alternately in engagement with said cam followers and permit said push arms to make and break said contactors alternately responsive to spring pressure thereagainst, the engagement between said reciprocating means and said slide being sufficiently free to admit of independent movement of the said slide by said spring loaded push arms permitting a more rapid make and break than possible by the rate of movement of the said reciprocating means.

2. In a circuit maker and breaker operable by reciprocating means therefor, a pair of spring contact arms including contactors thereon oppositely disposed with respect to each other, a guide fixed and a slide reciprocatingly mounted in said guide, a spring loaded maker push arm and a spring loaded breaker push arm reciprocatingly mounted through said guide and positioned to urge said contactors together and apart respectively, cam followers on said push arms, oppositely disposed spaced cams on said slide engageable by said cam followers alternately during the reciprocation of said slide with respect thereto, a linkage between the reciprocating means employed and said slide reciprocating said slide whereby to place said cams alternately in engagement with said cam followers and permit said push arms to make and break said contactors alternately responsive to spring pressure thereagainst, said linkage being sufficiently free to admit of independent movement of the said slide by said spring loaded push arms permitting a more rapid make and break than possible by the rate of movement of the said solenoid plunger.

3. In a circuit maker and breaker operable by a reciprocating member, a guide and a slide in said guide having oppositely disposed spaced cam surfaces thereon, a pair of spring contact arms including contactors thereon oppositely disposed with respect to each other mounted parallel to said guide and spaced therefrom, a spring loaded maker push arm and a spring loaded breaker push arm each having cam followers thereon reciprocatingly mounted through said guide normal to said slide in spaced relationship with respect to each other and with the cam followers thereof constantly urged against said slide, said slide being adapted to be moved by the said reciprocating member first in one direction and then the other to bring the said spaced cam surfaces thereon in operating engagement alternately with said cam followers on said maker and breaker push arms whereby said maker and breaker push arms become alternately released against and withdrawn from contact with said spring contact arms causing the contacts carried thereby to be closed and opened alternately, the engagement between said reciprocating member

and said slide being sufficiently free to permit the cam followers on said push arms to contact the cams on said slide and move said slide under spring pressure independent of the movement of said reciprocating member whereby to cause alternate make and break between said contactors more rapid than the movement of the said reciprocating member.

4. In a circuit maker and breaker operable by reciprocating means, a guide and a slide in said guide having oppositely disposed spaced cam surfaces thereon, a pair of spring contact arms including contactors thereon oppositely disposed with respect to each other mounted parallel to said guide and spaced therefrom, a spring loaded maker push arm and a spring loaded breaker push arm each having cam followers thereon reciprocatingly mounted through said guide normal to said slide in spaced relationship with respect to each other and with the cam followers thereof constantly urged against said slide, and a linkage between said reciprocating means and said slide engaging said slide and moving it therewith first in one direction and then the other to bring the said spaced cam surfaces thereon in operating engagement alternately with said cam followers on said maker and breaker push arms whereby said maker and breaker push arms become alternately released against and withdrawn from contact with said spring contact arms causing the contacts carried thereby to be closed and opened alternately, the said linkage being sufficiently free to permit the cam followers on said push arm to contact the cams on said slide and move said slide under spring pressure independent of the movement of said reciprocating means whereby to cause alternate make and break between said contactors more rapid than the movement of the said solenoid plunger.

STEVE DETTAR.