CURRENT-VOLTAGE DYNAMO REGULATION

PART 8. Simms Series EM36 and JQ Control Boards

by W. C. Stoddart, M.I.Mech.E., F.I.M.I. M.S.A.E.

"Motor Trader" Electrical Consultant

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IN Simms nomenclature, current-voltage control is referred to as "current limiting voltage control," and abbreviated to "C.L.V.C. system."

Basic types of control board employing this system are the Type EM36/1 and the Type JQ50B illustrated in Fig. 27. They are designed for light to medium and medium to heavy duty respectively on commercial and passenger service vehicles. Both types have $\frac{3}{16}$in thick cast aluminium exteriors finished in crackle black. The exterior of the Type EM36/1 consists of a rectangular box housing with base corner fixing flanges at its upper end, a centre fixing flange at its lower end and a cover secured by four screws, whereas that of the Type JQ50B consists of a rectangular base with a recessed underside, a full-length flange at the upper end, and two covers. Of the two last mentioned covers, the larger and upper one is secured by four screws and encloses the control units, the smaller and lower one being secured by two screws and enclosing the main fuse, ammeter shunt and terminals.

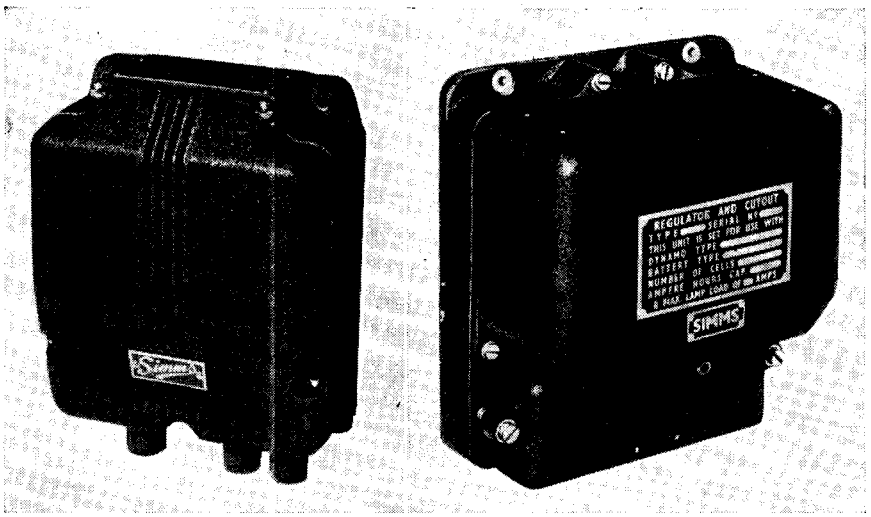

Fig. 27. Basic types of Simms control board for the C.L.V.C. system of regulation. Left: The Type EM36/1. Right: The Type JQ50B

The Type EM36/1 Control Board

This type has three cable-guide entries. They are very substantial, located at the lower end, 1in long and, together with the height of the control board housing, make the overall height $8\frac{7}{8}$in (225.4mm). The remaining overall dimensions are width, $6\frac{1}{2}$in (152.4mm); depth, $3\frac{3}{4}$in (76.2mm). Total weight is 9lb 2oz (4.59kgm).

It is well protected against road shocks, the fixing holes being provided with metal lined thick rubber bushes.

Integral with its housing and arranged therein as upper and lower pairs are four short pillar-shaped lugs. The lower pair occupy the respective lower corners of the housing, the upper pair, positions somewhat inward from the respective upper corners thereof. All four extend from the bottom of the housing, and their end surfaces, all machined to common level, serve as a foundation of an ebonite assembly board. This board is $\frac{3}{8}$in thick (9.52mm), secured to the lugs by four respective screws and spring washers and carries, on its outer side, a bus-bar, two Q type regulators, an M type contactor with attached pilot relay, a main face, an ammeter shunt, and the connecting terminals. On its underseal, it carries the resistances and the inter-connections between the control units.

A spare fuse clip is located on the inside of the cover.

The Q Type C.L.V.C. Regulators

Except for the windings, both regulators are of the same design as that of the Simms Type Q regulator, the latest type of medium duty compensated voltage control regulator Fig. 28. This design is of the semi-closed, single-contact variety, the bobbin being almost entirely enclosed by the yoke-frame, and only the contacts, which are a single pair serving as resistance contacts, being fully exposed. The semi-closed structure of the yoke-frame provides all the advantages of the closed type frame without any of the attending disadvantages of the latter; that is to say, a highly efficient magnetic circuit and ample protection of the bobbin are provided in a manner permitting freedom of access to the contacts for servicing operations.

Referring to Fig. 28 it will be seen that the Q type regulator employs a clapper type armature and a compression type control spring. Its armature, contacts and adjustment assemblies are mounted upon an assembly of simple brass stampings attached by screws to the end of a cylindrical yoke-frame or "barrel." The latter is *not completely* cylindrical, in that throughout its length, it has a flat machined on its exterior surface. and a slot on one side—the remote side as seen in the illustration. The flat is uppermost and serves as a

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Servicing Information for the Motor Vehicle Technician

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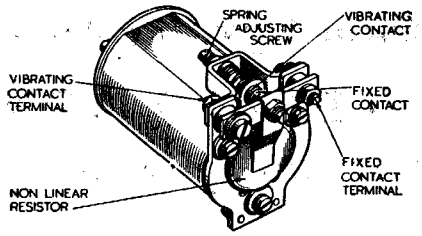


Fig. 28

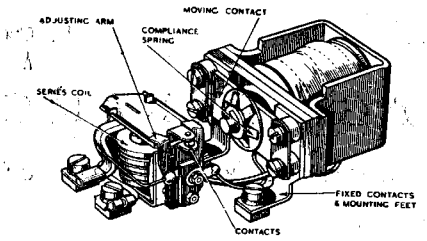


Fig. 29

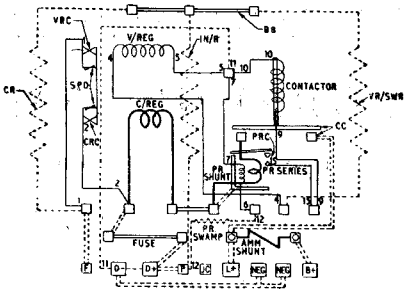


Fig. 30A

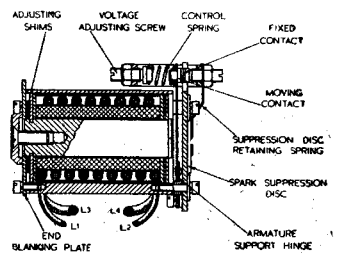


Fig. 28. Perspective and sectional views of the Simms Type Q single-contact regulator as employed for compensated voltage control. For the C.L.V.C. system (current limit voltage control) two such regulators are employed, one being a voltage regulator and having only a shunt or voltage coil, the other being a current regulator and having only a current or series coil. Q type regulators for the C.L.V.C. system have only two coil leads, whereas those for the compensated voltage system have four coil leads L1, L2, L3 and L4 as shown. Hence, the regulators of the C.L.V.C. system can be readily identified by the gauge of their coil-leads, the gauge of the voltage regulator being smaller than that of the current regulator

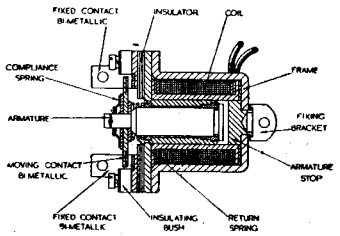


Fig. 29. Perspective view of the Simms Type M contactor and attached pilot relay, and sectional view of the contactor

Fig. 30A. Semi-practical diagram of the Simms Type EM36/1 control board. AMM shunt, ammeter shunt. CC, contactor contacts. CRC, current regulator contacts. PRC, pilot relay contacts. PR SERIES, pilot relay series coil. PRS SHUNT, pilot relay shunt coil. PR SWAMP, pilot relay swamping resistance lead. SPD, spark suppression discs. VRC, voltage regulator contacts. The numerals are assembly connection numbers. Remaining symbols same as Fig. 30. Dotted lines indicate resistance and strip connections on the underside of the board

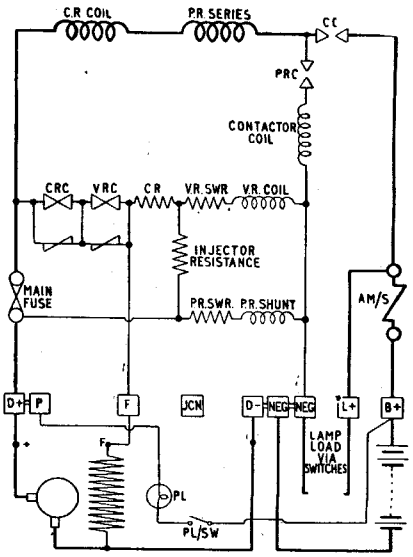
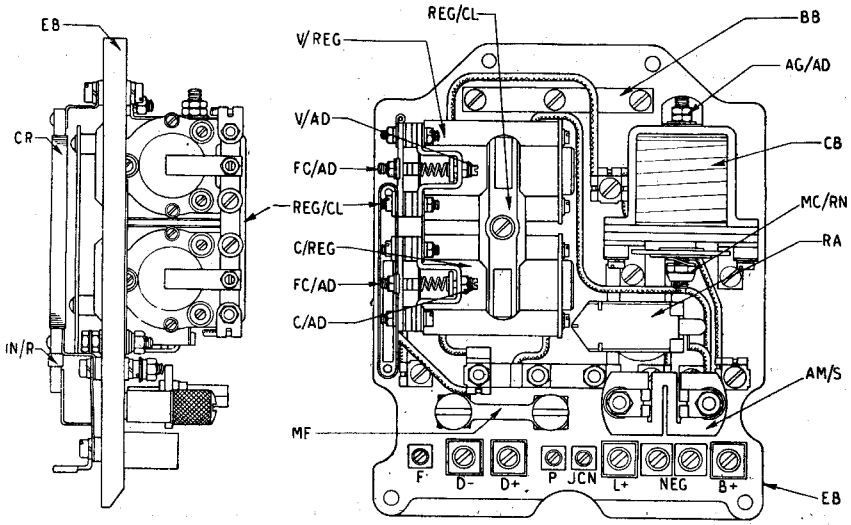
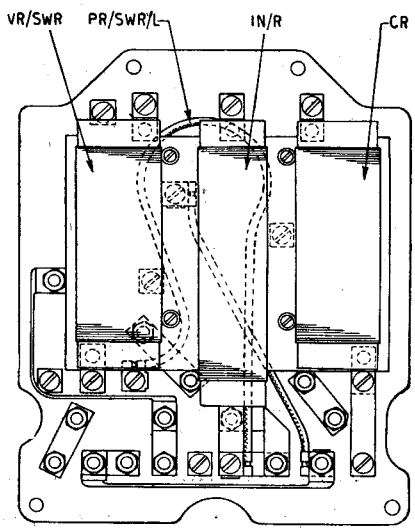


Fig. 30B. Technical diagram of the Simms Type EM36/1 control board in use. AM/S, ammeter shunt. CR. COIL, current regulator coil. PL, pilot lamp. PL/SW, pilot-lamp switch. PR.SWR, pilot relay swamping resistance lead. VR. COIL, voltage regulator coil. Remaining symbols same as Fig. 30A





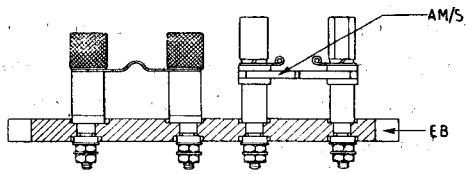


Fig. 30. General arrangement drawings of the Simms Type EM 36/1 control board. AM/S, ammeter shunt. AM/SC, ammeter connecting sockets. BB, bus-bar. C/AD, current adjustment screw. CB, contactor bobbin. CR, contacts resistance. C/REG, current regulator, EB, ebonite assembly board. FC/AD, fixed contact adjustment screws. IN/R, injector resistance. MF, main fuse. PR/SWR/L, pilot relay swamping resistance lead. RA, pilot relay armature. REG/CL, regulator clamp-brace. V/AD, voltage adjustment screw. V/REG, voltage regulator. VR/SWR, voltage regulator swamping resistance

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locating surface for a clamp-brace which secures the two regulators side by side; the slot, arranged at about 5 o'clock, facilitates roll-manufacture of the yoke from mild steel strip and allows ready egress for the coil-leads of the bobbin.

Initial adjustment of the air-gap between the armature and the core is effected by means of two sets of shims, one set being located between the rear end-plate of the yoke-frame and a flange washer engaging with the core, the other set between the armature supports hinge and the main supports plate. Of these two sets, the former is adjusted so as to bring the front end of the core flush with the front end of the yoke-frame, the latter set so as to suit any particular application. Both sets are adjusted at the works, and they should not be modified. For resetting purposes, however, the gap can be varied to give the desired results by adjustment of the fixed contact with respect to the main support plate.

For the rest, as regards mechanical construction it will be seen that the entire regulator can be dismantled with the aid of only a small screwdriver and a BA spanner.

Electrically, the Q type regulator differs from other types of Simms regulator by the addition of a "spark suppression disc."

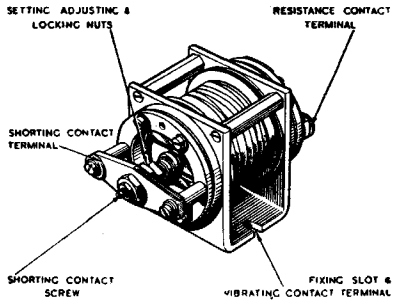


Fig. 31

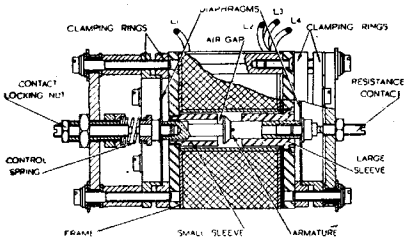


Fig. 31. Perspective and sectional views of the Simms Type C double contact regulator as employed for compensated voltage control. For the C.L.V.C. system (current limit voltage control) two such regulators are employed, one being a voltage regulator and having only a shunt or voltage coil, the other being a current regulator and having two coils serving as current and bucking coils respectively. The current regulator utilizes only one pair of contacts, the resistance contacts. Connected across the latter is a spark suppression disc. C type voltage regulators for the C.L.V.C. system have only two coil-leads, whereas those for the compensated voltage control have four coil-leads L1, L2, L3 and L4 as shown. C type current regulators for the C.L.V.C. system have four coil-leads, of which two are of light gauge and two of heavy gauge. Hence, the regulators of the C.L.V.C. system can be readily identified by the number and gauge of their coil-leads. Moreover, the current regulator can be identified by the spark suppression disc connected across its contacts. The Simms Type G regulator is the same as the type C except for a cover over its contacts end

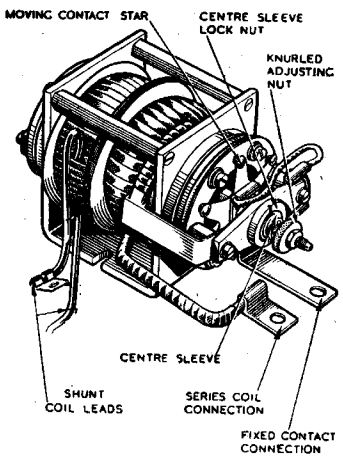
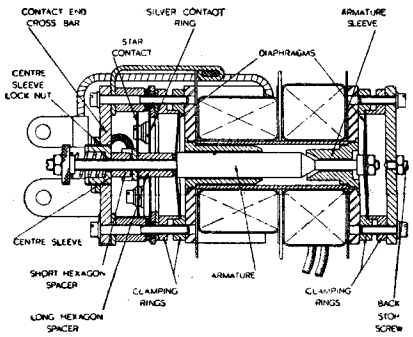


Fig. 32. Perspective and sectional views of the Simms Type C cut-out



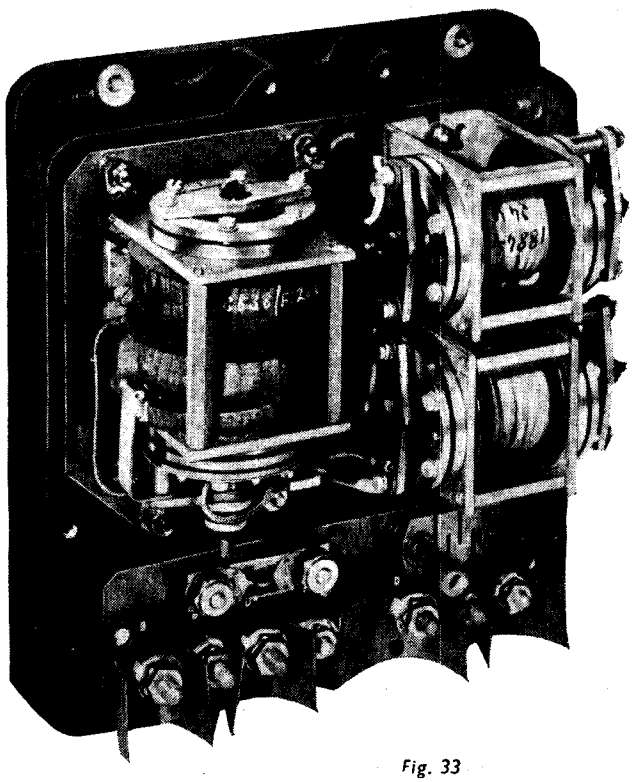
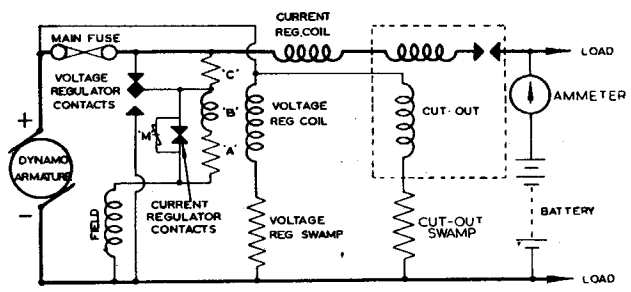


Fig. 33

Fig. 33. The Simms Type JQ50B control board with covers removed. Top left: The Type C cut-out. Top right: The Type C current regulator with the Type C voltage regulator immediately below. Immediately below the cut-out is the strip-type main fuse. Immediately below the voltage regulator is the ammeter shunt and ammeter connecting sockets. Resistances and inter-connections between units are accommodated in a deep recess in the underside of the board

Fig. 34. Technical diagram of the Simms C.L.V.C. system employing Type C cut-out and regulators. A, current regulator contacts resistance. B, current regulator bucking coil. C, voltage regulator contacts resistance. M, current regulator spark suppressor



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To appreciate the merit of the suppression disc, it should first be realized that it is a supplementary resistance to the contacts or points resistance. The latter, usually of pure metal or pure carbon, is a *linear* resistance and, as such, passes current in direct proportion to the applied voltage. The spark suppression disc is a silicon-carbide disc sprayed with metal (brass) on both sides, and is, therefore, a *non-linear* resistance which passes current at a greater ratio than that of direct proportion. For example, the electrical characteristic of the disc used on the Q type regulator is, in terms of amperage and voltage, 150 MA at 30V and 1 amp at 50V, or in terms of resistance and voltage, 200 ohms at 30V and 50 ohms at 50 volts. If, then, such a disc is connected across the resistance contacts (i.e., in parallel with the regular contacts resistance) it will do much to quench any tendency towards sparking at the contacts that may arise as a result of intensive field reactance voltage. In other words, the spark suppression disc offers a lower resistance as the field reactance voltage builds-up and, in this way, the voltage across the contacts and, consequently, the sparking thereat, is reduced to the minimum.

Fig. 28 shows that the disc is arranged across the contacts by being located upon the armature (virtually the moving contact) by a flat-section retaining spring which is secured to the fixed contact and its support by the fixed contact lock-nut.

The contacts are of tungsten, and the only differences between the Q type compensated voltage regulator illustrated and the Q type regulators employed on the EM36/1 control board are those concerning the voltage and current coils as detailed in the caption.

In so far as the resistances operating in conjunction with the regulators are concerned, it should here be noted that in Simms nomenclature the contacts resistance is referred to as the "field resistance," that the latter on the Type EM/36/1 control board, because of the employment of an additional resistance known as the "injector resistance," is connected in a somewhat unorthodox manner and that temperature compensation of the voltage regulator is by swamping resistance. All these resistances are detailed under the sub-title "Control Board Assembly."

The M Type Contactor and Attached Pilot Relay

These two units take the place of what might be otherwise a large cut-out of conventional design.

The pilot relay takes the form of a comparatively small orthodox cut-out. It has 1-amp contacts which are connected in series with the operating coil of the contactor, the frame of the relay and the remaining end of the operating coil being in connection with the control board D+ and D− terminals respectively. A swamping resistance is arranged in series with the shunt coil of the relay, the remaining ends of the resistance and the coil finding respective connection to the said terminals.

The relay series coil is of heavy gauge copper strip. It is coarse pitch wound and superimposed on the shunt coil for ventilation. Of its two ends, one, through the medium of the current regulator coil, is in connection with the control board D+ terminal, the other, directly with one of the fixed contacts of the contactor.

There are two fixed contacts on the contactor; and both are insulated. They are of the bi-metallic plate-type (silver-faced copper) and arranged astride the outer end of the armature and behind a bi-metallic plate-type moving contact. The latter fits freely upon an armature extension to which, through the medium of a compliance spring and seating washer, it is secured by a split-pin. Immediately behind the moving contact is a seating washer for a compression-type armature return spring, the inner end of the spring finding location on the face of an armature guide-bush. Hence, the return spring serves both initially to align the moving contact and, finally, to return the armature to the inactive position.

A spun-in guide-bush in the inner reaches of the contactor core serves both to complete the alignment and to limit the outward movement of the armature. The latter, at its inner end, has two diameters, the larger of which is innermost. When, therefore, the armature moves into its inactive position the outer face of its larger diameter comes to rest against the inner end of the bush. Further, it will be seen that in this way the setting of the non-energized air gap is fixed during manufacture, and thus the contactor requires no servicing adjustment. As, however, the contactor is now used on a variety of systems whose characteristics differ considerably, it has been modified to permit of air-gap adjustment. This modification takes the form of a rearward armature extension which slides in a steel bush secured in the rear of the frame, and carries a nut for adjustment contact with the rear end of the bush when the armature is in its inactive position. Where this modification is found, it will also be found that the front end of the armature has been modified to carry a large diameter coarse pitch double spring-washer and a suitable seating nut instead of the compliance spring and split-pin as illustrated.

In the inner end of the coil spool surmounting the core of the original type, and rivet secured to the contactor frame thereof, is a brass plug. This serves as the armature stop for the active position and completes the assembly. In the modified type, it is the forward end of the rear bush in the frame that serves as the armature stop for the active position.

The insulating bushes of the fixed contacts stand well proud of the contact surfaces, so as to serve as guides for the ends of the moving contact, which have ample working clearance. Of the two fixed contacts, the opposite one to which the relay series coil is connected, finds connection to the control board B+ terminal through the medium of the ammeter shunt.

Overall design of the contactor is such that the contactor pulls in at 90 per cent of the system's nominal voltage. Consequently, when the pilot relay closes, the contactor follows and instantaneously closes the main circuit. Conversely, as the main circuit includes the pilot relay series coil (in series with the contactor contacts and the coil of the current regulator) this coil, when subjected to reverse current, causes the relay contacts to open, whereupon the contactor follows immediately and breaks the main circuit accordingly.

Control Board Assembly

From Fig. 30 it will be seen that the clamp-brace REG/CL that secures the regulator is held by a centrally disposed screw, that the spools for the contact resistance CR, injector resistance IN/R and voltage regulator swamping resistance VR/SWR are of the card-type, that the pilot relay swamping resistance PR/SWR/L is a special resistance *lead*, and that all inter connections behind the ebonite assembly board EB are of heavy gauge brass strip. The clamp-brace is a zinc-alloy die-casting and holds the regulator in cradle extensions from the board, or in arc-shaped depressions therein. The spools are of stiff asbestos material, 1¼in wide × ¼in thick. The pilot relay swamping resistance lead is of asbestos-like cord overwound with nickel-chrome wire and covered with varnished woven glass sleeving. All flexible connections on the front of the board are of heavy duty neoprene insulated stranded cable. The contactor shown in Fig. 30 is of the modified type with air-gap adjustment nuts AG/AD and moving contact retainer nut and spring washer MC/RN.

Reference to Figs. 30A and B will convey that the contacts resistance CR is in series with the contacts CRC and VRC of both regulators and that it is fed from a terminal point which also feeds the voltage regulator coil through the voltage regulator swamping resistance. This point is fed, through the injector resistance, from the dynamo side of the main fuse. When, therefore, either pair of regulator contacts is open, the injector resistance becomes part of the contacts resistance, and in carrying the additional current (i.e. in carrying the weak field current in addition to the operating current of the voltage regulator) is subjected to additional voltage drop which reduces the voltage regulator operating current accordingly. The sudden reduction of the voltage regulator operating current reduces the energization of the regulator and thus the regulator armature returns instantly to the closed contact position. In other words, the injector resistance serves both to augment the weakening of the field current and to increase the frequency of the regulator armature.

The Type JQ 50B Control Board

This board employs a standard Simms Type C cut-out and modified versions of the Simms Type C regulator. The modifications are detailed in Fig. 31 to 34.

With regard to the current regulation Fig 31, it should be noted that what, in the case of a voltage regulator, would be the field short circuiting contact, is merely an armature stop screw for energized air-gap adjustment. This screw, of course, is provided with a lock-nut. Further, it is only the current regulator that employs a spark suppression disc and a bucking coil. The spark suppression disc is located in the base of the regulator frame to which it is secured by a compliance spring, a fibre washer, a spring washer and a nut—a terminal tag intervening. The bucking coil, of course, serves the same purpose as the injector resistance on Type EM36/1 board, but in a very different way.

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