DETACHABLE ELECTRICAL CONNECTORS

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My invention relates in general to electrical
connectors, and in particular to detachable elec-
trical connectors of the type whereby a plurality
of external circuit conductors can be simulta-
neously connected with, or disconnected from,
the terminal posts of electrical devices such, for
example, as the electrical relays employed in
railway signaling systems.

As is well known, the relays employed in rail-
way signaling systems are generally provided
with a relatively large number of contacts for
controlling complicated circuit networks upon
the proper operation of which the safety of train
movements depends. It occasionally becomes
necessary to replace these relays for one rea-
on or another, and it will be apparent that if
the external circuit wires are connected directly
to the relay terminal posts, as is now the gen-
eral practice, the time required to disconnect
these wires from the one relay and to connect
these wires to the other relay is likely to cause
an undesirable interruption in the operation
of the system. Furthermore, there is always the
danger that in connecting the wires to the re-
placement relay a mix-up will occur which will
cause a dangerous condition to exist.

One object of my present invention is to pro-
vide a detachable electrical connector of the
type described which will enable a reliable low
resistance connection to be made between the
terminal posts of an electrical relay and the exter-
cal circuit wires that are to be connected
therewith, and which will preclude any possi-
bility of improper circuit connections being
made.

Another object of my invention is to pro-
vide a detachable electrical connector which can
be applied to relays which are already in serv-
ice without the necessity for making any changes
in the construction of the relays, and which
connector includes means to facilitate its attac-
hment to, and its detachment from the relay.

According to my invention the external cir-
cuit conductors, instead of being secured directly
to the relay terminal posts, are secured to other
terminal posts mounted on a detachable ter-

minal plate adapted to be secured to the relay
top plate. These other terminal posts are so
arranged on the detachable terminal plate that
when the detachable terminal plate is secured
in place on the relay top plate, each terminal
post on the detachable terminal plate will align
vertically with a corresponding one of the ter-

minal posts on the relay top plate, and each ter-

minal post on the detachable terminal plate is
secured to suitable spring members for fric-
tionally engaging the corresponding relay ter-

minal post to make good electrical contact ther-

with. The detachable terminal plate is further
provided with one or more rotatable members
which are anchored against axial movement
and which are adapted to cooperate with other mem-
bers anchored in insulating brackets secured to
certain ones of the terminal posts on the relay
top plate, whereby by rotating the rotatable
members in the proper direction, the detachable
terminal plate will be pulled toward or shoved
away from the relay top plate to connect or dis-
connect the two sets of terminal posts.

I shall describe one form of electrical connec-
tor embodying my invention, and shall then
point out the novel features thereof in claims.

In the accompanying drawing, Fig. 1 is a top
plan view showing a detachable electrical con-
ector embodying my invention applied to an
electrical relay. Figs. 2 and 3 are sectional
views taken substantially on the lines II—II and
III—III, respectively, of Fig. 1. Figs. 4 and 5
are isometric views showing certain of the detail
parts of the connector illustrated in Figs. 1, 2 and
3.

Similar reference characters refer to similar
parts in each of the several views.

Referring to the drawing, the electrical device
to which I have shown my electrical connector
applied is an electrical relay of the type com-
monly employed in railway signaling systems,
but it should be distinctly understood at the out-
set that my electrical connector is not limited
to this particular application. The relay in the
form illustrated comprises the usual top plate A
provided with a pair of windings 2 which are
adapted to be energized to cause operation of
the relay and with a plurality of terminal posts
3 of the type which has been adopted as standard
by the Association of American Railroads for
railway signaling purposes. The terminal posts
3 are disposed in front of the windings 2, and in
order to facilitate convenient access thereto are
arranged in stepped rows.

The electrical connector is designated as a
whole by the reference character B, and in the
particular form illustrated comprises a terminal
plate 4 of moulded in insulating material such as
"Bakelite." The terminal plate is generally of
a shape which will permit it to be secured to
the top plate A in the position to substantially en-
close the upper ends of the relay terminal posts,
and formed in the under side of the terminal
plate are a plurality of rectangular recesses 5
each of which is adapted to receive the upper end of one of the relay terminal posts when the connector is in place on the relay. The recesses 5 communicate at their upper ends with vertical holes 6, and secured within each recess by means of a terminal post 7 mounted in the associated hole 6 is a guide member 8 and two oppositely disposed contact fingers 9.

Each of the guide members 8 in the form shown (see Fig. 5) comprises a flat strip of metal bent into a rectangular shape of such size that it will fit snugly within the recesses 5. The upper end wall of each guide member is formed by the confronting ends of the strip, and each of these ends is provided with a semicircular recess 8a for receiving the shank of the associated terminal post. The bottom wall of each side member is pierced by a hole 8b, the marginal wall of which is rounded upwardly for a purpose which will be made clear presently. Each contact finger 9 comprises a horizontal-slotted portion 9a which straddles the shank of the associated terminal post 7, and is clamped between the head 7a of the terminal post and the top wall of the associated guide member. Each contact finger 9 also comprises a vertical portion 9b which lies flat against the adjacent side wall of the guide member, and an integral return bend 9c of substantially V-shape.

The parts are so proportioned that when the connector is disconnected from the relay, the V-shaped portions of the two contact fingers which are supported in each recess 5 will be spaced apart at their closest portions a distance that is less than the diameter of the relay terminal posts, and it will be apparent, therefore, that when the connector is placed on the relay, the two fingers in each recess will fractionally engage the opposite sides of one of the relay terminal posts to make electrical contact therewith. The parts are further so proportioned that when the fingers are engaging a terminal post, the free ends of the return bends will bear against the sides walls of the fingers to thereby permit the desired contact pressure to be obtained with a lighter gauge material. One advantage of the use of a lighter gauge material is that there is less likelihood that it will take a permanent set, and the life of the contact is accordingly prolonged.

Each terminal post 7 is provided at its upper end with a washer 10a, a nut 11 which secures the terminal post to the terminal plate, two washers 12 between which the curved end of a circuit conductor is adapted to be clamped, and an insulating nut 13 for clamping the circuit conductor between the washers 12. The head 7a of each terminal post 7 is made square and is of such size that it prevents the terminal post from turning relative to the terminal plate.

In assembling each contact assembly, the slot portions of the two oppositely disposed fingers are placed under the head of the associated terminal post in superimposed relation before the head of the terminal post has entered the associated recess 5, and the guide member 8 is then placed on the post by springing its side walls apart through which the guide member and fingers are slid upwardly into the recess. It will be seen, therefore, that the construction of the fingers and guide members greatly facilitate assembly of the parts.

It will be noted from an inspection of Fig. 2 that none of the contact assemblies are turned 90° from other ones of these assemblies. This construction facilitates aligning the relay terminal posts with the contact members of the connector when the connector is to be attached to the relay.

It should be pointed out that without the guide members it would be possible in attempting to attach the connector to the relay to cause the ends of the relay terminal posts to engage the lower ends of the guide members, and if enough force were applied with the parts in these positions, it would be possible to bend the contact fingers out of shape. However, with the guide members constructed in the manner shown it is impossible for the relay terminal posts to engage the fingers except in their properly centered positions, whereby damage to the fingers is effectively prevented.

With the connector constructed in the manner thus far described it will be apparent that due to the large number of contact members which are provided, and the fact that relatively high contact pressures are used, an appreciable amount of force is required to engage the connector with, and disengage it from the relay. To facilitate engagement of the connector with, and its disengagement from, the relay I provide means embodying my present invention, which means I shall now describe.

As here shown, these means comprise two brackets 15 and 16, preferably of moulded insulating material, secured to the relay top plate at its opposite sides by means of the terminal posts 3 of the middle row of terminal posts in a manner which will be apparent from an inspection of the drawing. The outer end of each bracket 15 or 16 extends outwardly beyond the associated terminal post, and is provided with a threaded metal insert 17. The inserts 17 cooperate with the screw-threaded lower ends of studs 18 and 19, the upper ends of which extend upwardly with clearance through holes 20 formed in the terminal plate and have pinned thereto on the upper side of the terminal plate hexagonal nuts 21, whereby the stud may be rotated. Formed on the studs 18 and 19 directly above their screw-threaded lower ends are enlarged shank portions 23 which form shoulders 24 and disposed on each stud between the shoulders 24 and the adjacent under side of terminal plate is a thrust washer 25. The inserts 17 are mounted on the stud between the associated nut 21 and the top of the terminal plate to limit movement of the studs in an axial direction. It will be apparent, therefore, that while the studs are free to rotate relative to the terminal plate, they are prevented from moving longitudinally relative to the terminal plate. It will also be apparent that rotation of the studs in one direction will cause them to pull the connector towards the top plate; whereas rotation of the studs in the opposite direction will cause them to push the connector away from the relay.

The lengths of the enlarged shank portions 23 of the studs are such that when the shoulders formed at their lower ends are engaging the tops of the brackets 15 and 16, the connector will occupy the proper vertical position for the contact assembly carried by the opposite sides of the relay terminal posts in the desired manner. As designated by this position of the connector is reached, any additional force exerted on the studs will jam the threads of the studs into tight engagement with the threads of the inserts 17, but will not cause any force to be exerted on the parts of the connector. If desired, the upper ends of the studs may be provided with saw kerfs for the re-
ception of a screw driver, whereby the connector may be attached or removed either by a screw driver or a wrench.

In applying a connector of the type described to a relay for the first time, the excess nuts and washers are first removed from the terminal posts of the relay, and if the relay has already been in service, all circuit wires are also removed from the terminal posts. The brackets 15 and 16 are then secured to the top plate by means of the terminal posts of the middle row after which each circuit wire is attached to the terminal post 7 of the detachable connector corresponding to the terminal post of the relay to which such wire was previously connected or would be connected if the detachable terminal plate were not provided. The connector is then placed in the proper vertical alignment with the terminal posts of the relay and is pulled downwardly into its proper engaging position by rotating the studs 18 and 19 in the proper directions.

When a relay has been provided with a connector of the type described, and it is subsequently desired to remove the relay from service, the studs 18 and 19 are rotated in the proper direction to disengage the contact fingers of the connector from the relay terminal posts. The connector is then lifted bodily off of the top plate of the relay and placed on the top plate of the replacement relay, after which the connector is again pulled downwardly to the position shown in the drawing by means of the studs 18 and 19.

One advantage of an electrical connector embodying my invention is that it can be applied to relays which are already in service without disturbing any parts of the relay.

Although I have herein shown and described only one form of electrical connector embodying my invention, it is understood that various changes and modifications may be made therein within the scope of the appended claims without departing from the spirit and scope of my invention.

Having thus described my invention, what I claim is:

1. The combination with an electrical device having a plurality of projecting terminal posts for establishing external circuit connections with the device and a detachable electrical connector comprising a terminal plate carrying members for engaging said terminal posts to establish electrical connection therewith, of an insulating member secured to said device by means of certain ones of said terminal posts, and means secured to said terminal plate and cooperating with said member to facilitate the engagement of the contact members of said connector with, or their disengagement from, said terminal posts.

2. The combination with an electrical device having a plurality of projecting terminal posts for establishing external circuit connections with the device and a detachable electrical connector comprising a terminal plate carrying contact members for frictionally engaging said terminal posts to establish electrical connection therewith, of two insulating members secured to said device at its opposite sides by means of certain ones of said terminal posts and each provided with a threaded member, and two studs rotatably mounted in said terminal plate and one cooperating with each of said threaded members for moving said connector toward or away from said device to effect the engagement of said contact members with or their disengagement from said terminal posts.

3. The combination with an electrical device having a plurality of projecting terminal posts for establishing external circuit connections with the device and a detachable electrical connector comprising a terminal plate carrying contact members for frictionally engaging said terminal posts to establish electrical connection therewith, of two moulded insulating members secured to said device at its opposite sides by means of certain ones of said terminal posts and each provided with a threaded opening, two studs rotatably mounted intermediate their ends in openings formed in said terminal plate and each provided on the outer side of said terminal plate with means for engaging the stud to rotate it and on the under side of the plate with a threaded end for cooperation with a different one of the threaded openings in said insulating member and with an enlarged shank portion forming a shoulder which cooperates with the associated insulating member to position said connector relative to said device when said studs are screwed into said threaded openings, the parts being so proportioned that when said shoulders are engaging said insulating members said contact members will occupy the proper positions relative to said terminal posts to establish electrical contact therewith.

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