United States Patent

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[45] Patented **Dec. 15, 1970**

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[54] **ELECTROMAGNETIC RELAY STRUCTURE**
5 Claims, 9 Drawing Figs.

[52] **U.S. Cl.** **200/168,** 200/166; 335/135
[51] **Int. Cl.** **H01h 9/02**
[50] **Field of Search** ..... 335/129, 128, 127, 135, 136, 202; 200/168(A), 166.1, 16.1

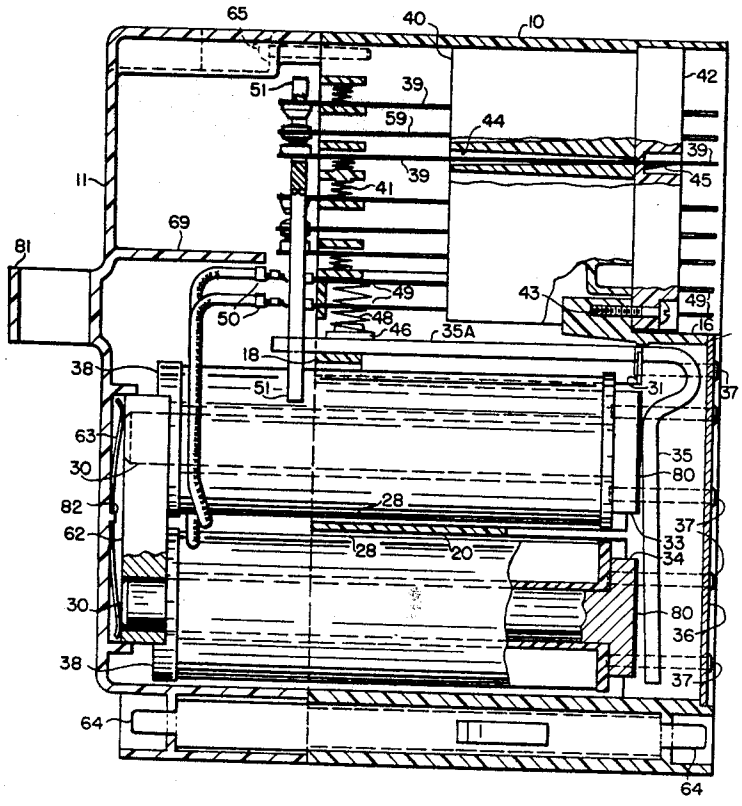
[56] **References Cited**

UNITED STATES PATENTS

2,907,983	10/1959	Boswau	200/166(.1)
3,211,873	10/1965	Vigren	200/166(.1)
3,231,700	1/1966	Hiyane	335/135

Primary Examiner—Harold Broome
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ABSTRACT: This electromagnetic relay is of the safety-type as used by railroads. It has parts molded of black fiber glass plastic material and has other parts formed of metal and constructed to be assembled in such a way as to provide a composite structure requiring no adjustment after initial assembly. The armature is mounted on a knife edge bearing with the working airgap at the rear of the relay and the contact operator at the front of the relay. The plastic cover holds a magnetic back yoke in place for connecting the two magnetic core members, which back yoke is directly removable when the cover is removed so as to be able to replace the coils without further disassembly. The coils have quick detachable connectors which connect to the coil lead fingers at the front of the relay. The contact fingers are pushed into position from the front of the relay with the cover removed and a guide block is permanently provided for assisting the entry of the contact fingers into the rear mounting block into which such fingers automatically lock when they are placed in position.

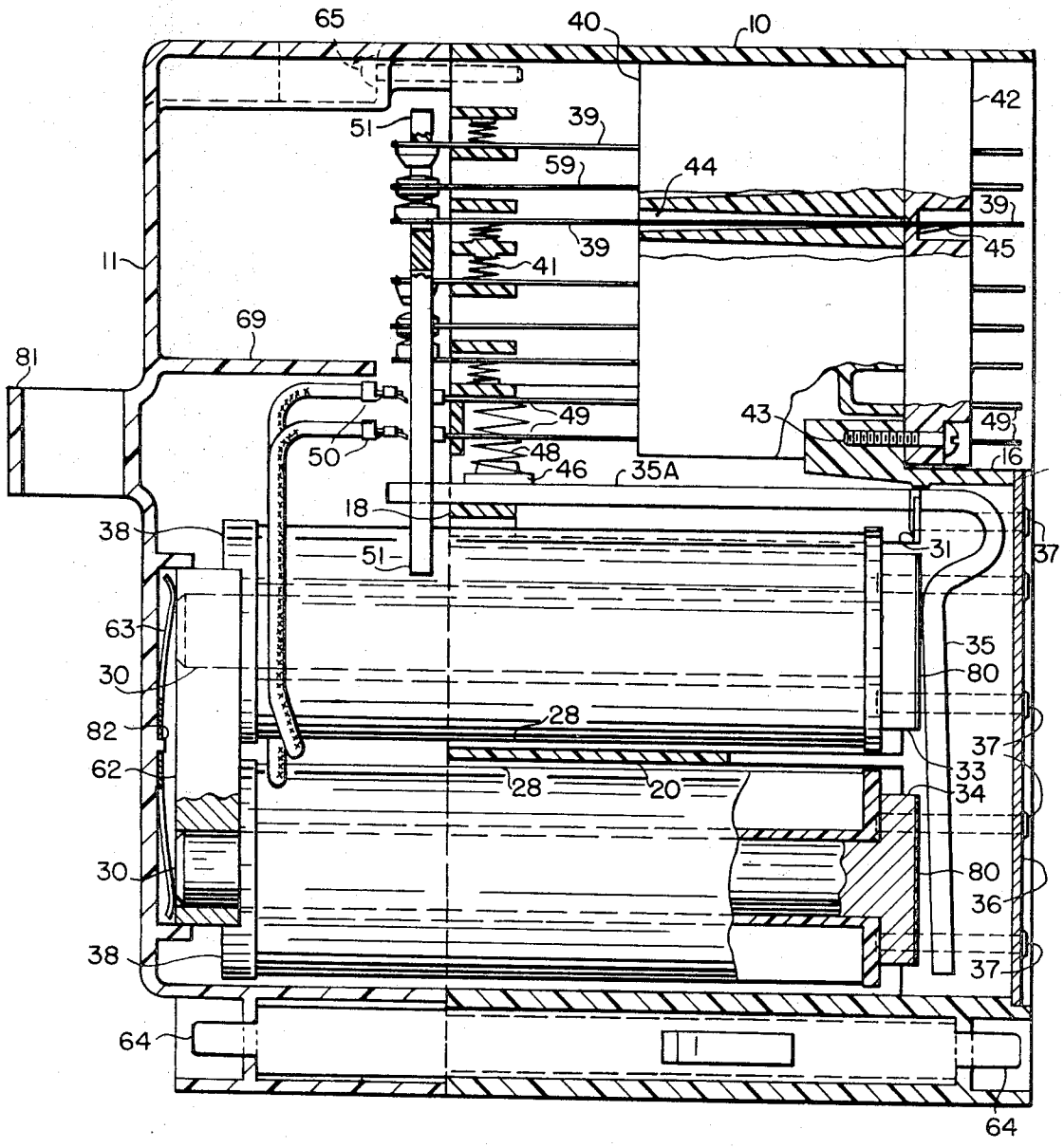


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SHEET 1 OF 4

FIG. 1



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FIG. 2

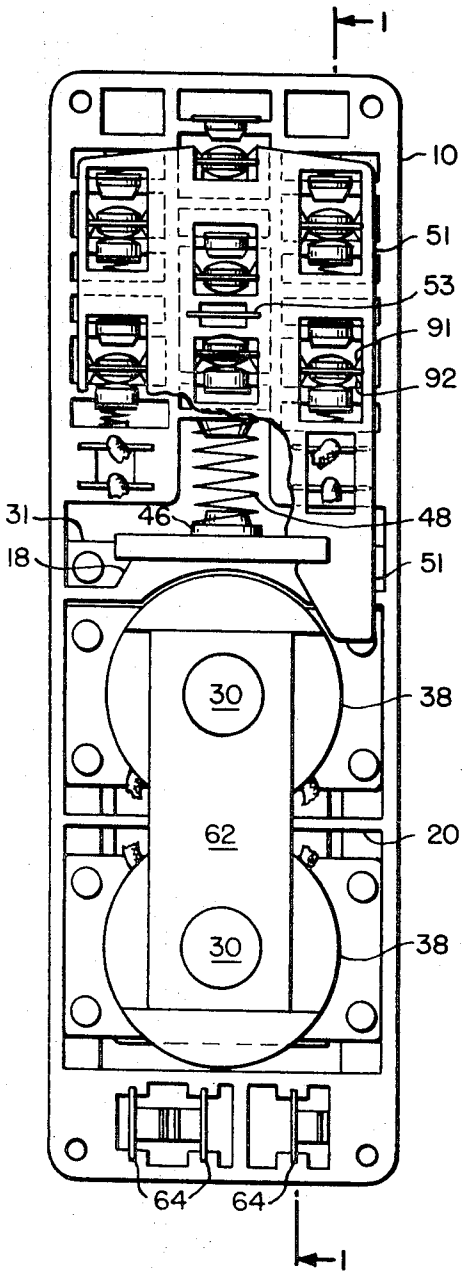
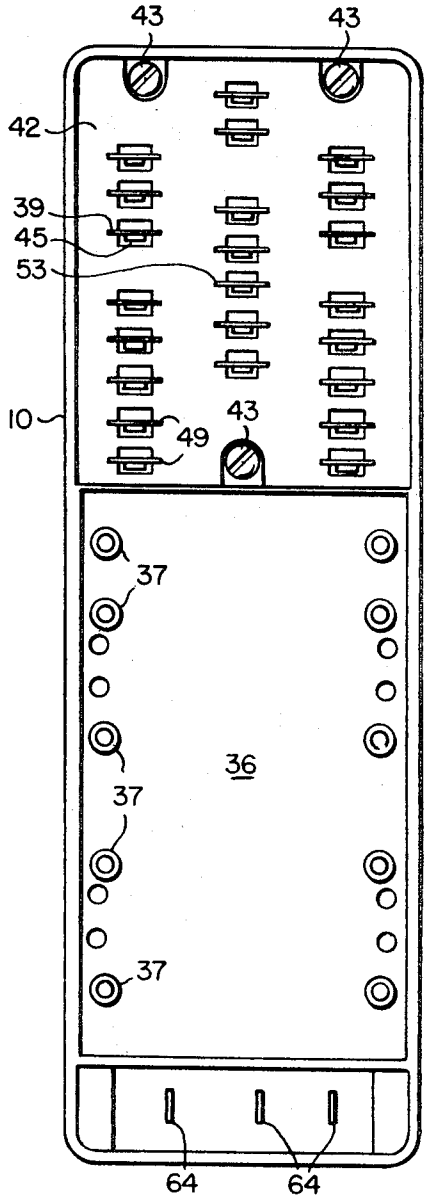


FIG. 3



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FIG. 4

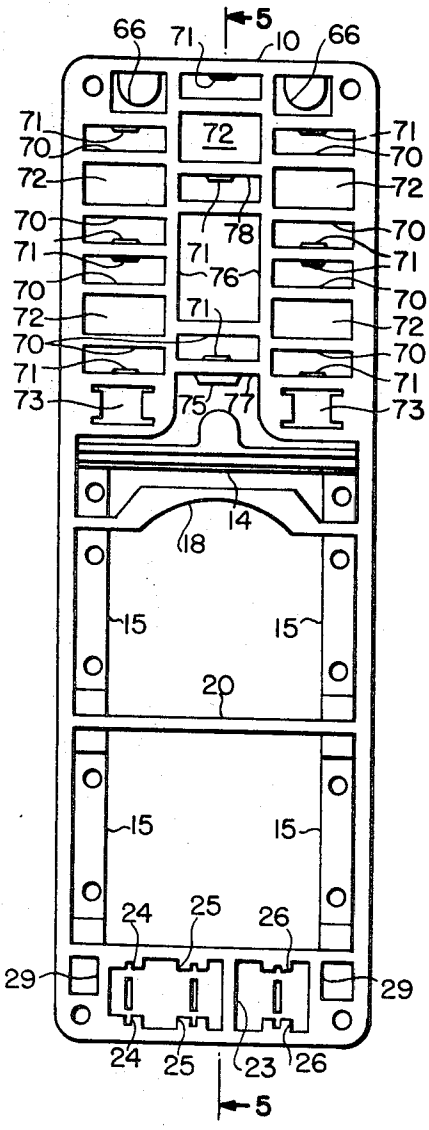


FIG. 5

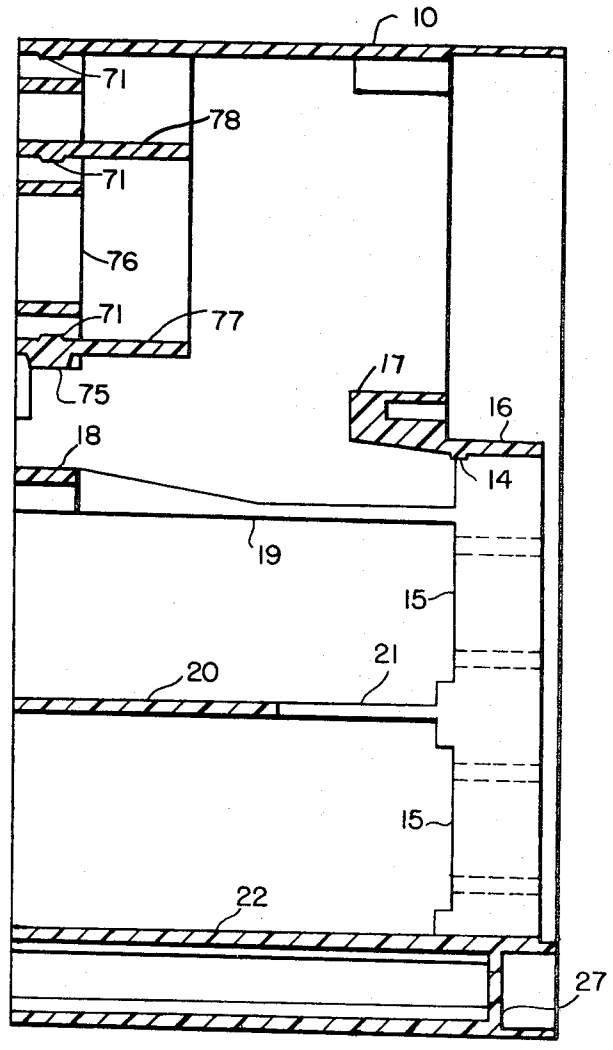
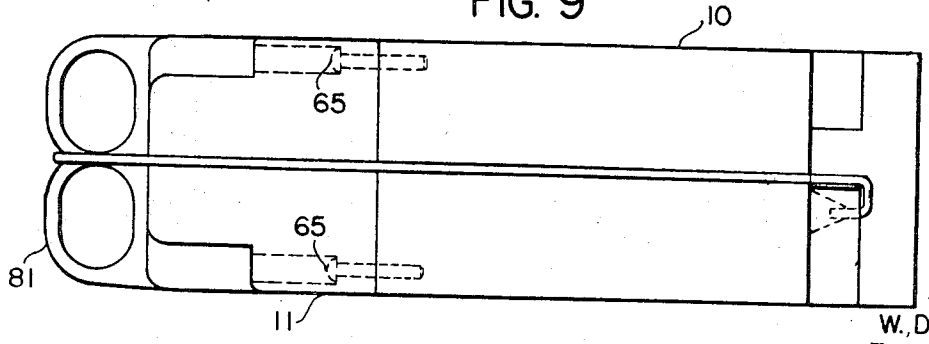


FIG. 9



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FIG. 7

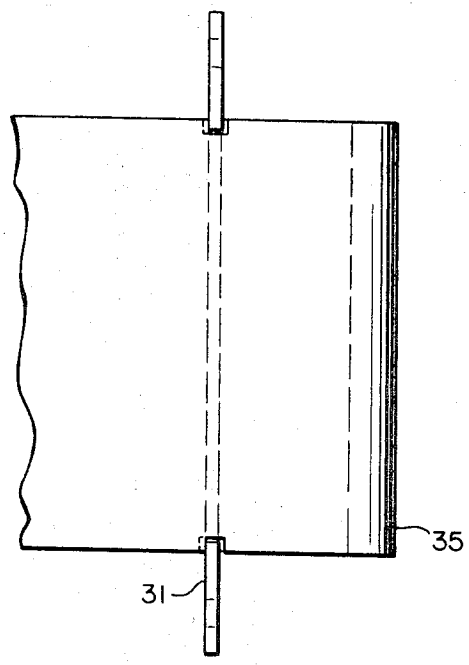


FIG. 8

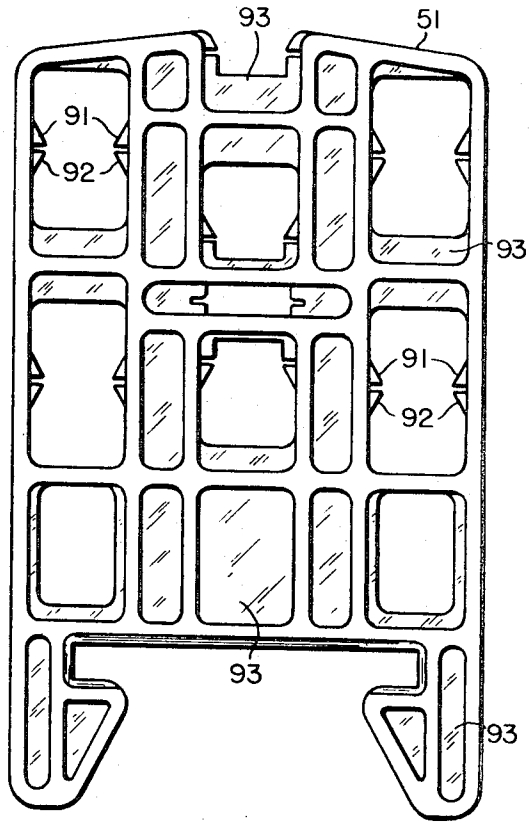
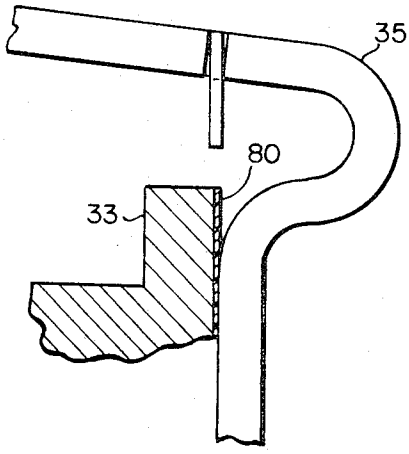


FIG. 6



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ELECTROMAGNETIC RELAY STRUCTURE

This is a division of the application of Wheeler D. Maynard and Edward A. Belanger, Ser. No. 681,209, filed Nov. 7, 1967, which has resulted in U.S. Pat. No. 3,509,502, issued Apr. 28, 1970.

BACKGROUND OF THE INVENTION

The present invention relates to railroad safety relays, and more particularly to an electromagnetic relay assembled from a multiplicity of parts and constituting an operable relay when once assembled without further adjustment.

Heretofore, electromagnetic relays of the safety type have been built which are highly efficient, but most expensive to manufacture. One of the reasons for the expense in manufacture is that the relay requires a fine adjustment after initial assembly in order to be properly operative. Also, such fine adjustment of the relay tends to deteriorate and reduce the life of the relay.

The present invention relates to a safety-type relay which has a gravity biased armature for operating the contacts, which armature is additionally biased by a suitable coil spring so as to minimize its response to vibration and bounce, and also to maintain its operability uniform over a long life. The armature operates the contact fingers of the relay through a contact pusher member connected to the contacts directly in line with their contact points to directly oppose any tendency to stick due to fusion effects that might develop through the relay operation; and also to avoid the variable deflection of the contact fingers.

Thus, the purpose of the present invention is to provide an improved safety relay which does not require adjustment after the initial assembly, and which is easily and rapidly assembled from parts that can be mass produced and yet meet the rigid requirements necessary for safety operations.

Another object of the present invention is to provide an improved relay assembly wherein the parts are readily assembled into precise positions due to the type of manufacture of the parts so as to provide the desired operating characteristics which are insensitive to minor production variations.

A further object of the invention is to provide a relay having an efficient magnetic structure which can be quickly and readily disassembled in part for the replacement of the coils on the relay.

SUMMARY OF INVENTION

In general, the relay of this invention includes a housing structure having the shape of a parallelepiped with rectangular bases, a lattice structure located inside the front of the housing structure and integral therewith, the lattice structure having spaced openings, with a guide block located in the housing structure abutting the lattice structure, and a slotted contact-mounting block located within the housing structure at the rear of the guide block, the slots in the contact-mounting block being located to match the spaces in the lattice structure, and the guide block having internal chutes with openings at one end matching the spaces in the lattice structure and with openings at the other end matching the slots in the contact-mounting block.

For a better understanding of the present invention together with other and further objects thereof, reference is made to the following description, taken in connection with the accompanying drawings, while its scope will be pointed out in the appended claims.

IN THE DRAWINGS

FIG. 1 is a side elevation partially in section taken on lines 1–1 of FIG. 2 which shows the parts of the electromagnetic relay constituting the structure of the present invention;

FIG. 2 is a front view with the cover of the relay removed and with parts shown in section to illustrate the assembly shown in FIG. 1;

FIG. 3 is a back view of the structure shown in FIG. 1 illustrating more particularly the slotted contact-mounting block and the coded back cover for the electromagnetic portion of the relay;

FIG. 4 is a front view of the housing structure only of the relay to show the form of the structure to which all of the other parts are related;

FIG. 5 is a side sectional view of the housing structure shown in FIG. 4;

FIG. 6 is an enlarged side view of the armature and its knife edge bearing;

FIG. 7 is an enlarged top view of the armature and its knife edge bearing as shown in FIG. 6;

FIG. 8 shows a front view of the contact-pusher member shown in side view in FIG. 1; and

FIG. 9 is a top view of the front cover as mounted on the housing structure and which is held in place on a terminal board by a wire bail fitted over the handle on the cover and extending to the two recesses in the terminal board.

Generally speaking, the electromagnetic relay of the present invention is comprised of a molded frame or housing structure 19 which encloses the various parts and to which a transparent cover 11 is attached. Inside the upper portion of the housing, the contact assembly is located, and in the lower portion of the housing, the electromagnetic structure is located.

The armature 35 is mounted on a knife edge bearing 31 riveted onto the housing between the upper and lower portions of the housing and near its back. The armature 35 is L-shaped and has a portion or arm which cooperates with the two-pole faces 33 and 34 of the two-cores 30 which are rigidly attached to the housing structure. There is also a contact-operating portion or arm 35A of the armature which extends towards the front of the housing between its upper and lower portions.

The knife edge bearing 31, the armature 35, the cores 30 and the coded back plate 36 are assembled and riveted in place in the housing at the same time on the two vertical bosses 15 located one on each side of the lower portion of the housing. The contact-operating portion of the armature 35A rests at its forward end against the upper side of a cross-bridge 18 arranged in the form of an arch connecting the two sides of the housing 10. Also, a flat cross-bridge member 16 is located at the back of the housing connecting the tops of the two vertical bosses 15. There are two horizontal ribs 19 connecting with the two vertical bosses and extending forward to the arched cross-bridge. In a similar fashion, two horizontal ribs 21 extend from the vertical bosses forward to a flat cross-bridge 20 at the front of the housing located between the space allotted to the cores and coil members of the electromagnetic structure.

The first-mentioned flat cross-bridge 16 at the back of the housing and connecting the tops of the two vertical bosses 15 has a downwardly extending abutment 14 running crosswise directly above the armature on its knife edge bearing and acting to hold the armature downwardly on such knife edge bearing.

At the front of the upper portion of the housing is a honeycomb or lattice structure for providing back stops for certain fixed contact fingers and providing supports for the coil springs located to supply the bias to such fixed contact fingers. This honeycomb or lattice also has a back stop for the coil spring which biases the armature to a normal position against the arched cross-bridge 18. In addition, this lattice structure provides rigidity to the housing. The back upper portion of the housing is open so as to receive a contact guideblock 40 which is also of a honeycomb form. In addition, a rear contact-mounting block 42 is provided with suitable slots and is bolted into position following the insertion of the contact guide block 40.

The contact fingers, such as finger 39, are moved into position from the front of the housing. As they enter their respective spaces in the lattice structure at the front of the housing,

they also enter the respective chutes, such as chute **44**, in the contact guide block which guides the end of the finger to enter the appropriate slot in the contact-mounting block **42** at the rear of the relay. As a small portion of this contact **39** extends out of the slot at the rear of the mounting block **42**, a tool is used to grasp the extending end and pull it rearwardly until the contact finger-locking member **45** springs downwardly and engages the side of the slot in the block **42**. When all the contact fingers are in position, the coil springs **41** are inserted into the lattice structure in a way to bias the fixed contact fingers against their respective stops in the lattice structure. Also, the coil spring **48** for biasing the armature is placed in position in the lattice structure.

Assuming that all of the contact fingers are in appropriate positions, the contact pusher member **51** is mounted over the armature arm **35A** and each movable contact finger is inserted in the respective slots in the pusher member **51**. When the pusher member **51** is appropriately located, a lock finger **53** is then slipped into position through the slot in the pusher member **51** and through the contact guide block **40** and into the rear contact-mounting block **42** until it is locked into position. This lock finger **53** has projections at the front which extend to the right and left as viewed from the front so as to hold the contact-pusher member **51** in position against the rear projections on each of the movable contact fingers mounted in the pusher member.

The test fingers **64** are provided with narrow projections at each end. Each finger **64** may be slid into its appropriate position in the slide runways provided at the base of the relay.

The two coils **28** on suitable plastic spools **38** are inserted over the cores **30** and moved into their positions. Their lead wires come out at the front of the relay for attachment to the lead fingers **49** located at the sides of the lattice structure. The quick detachable connectors **50** actually insert through a suitable space in the pusher member **51**. When this has been done, a back yoke **62** is fitted onto the two extending cores **30** with such back yoke **62** having holes for receiving the cores which provide a smooth and accurate fit with the core members. The cover **11** is then positioned over the front of the relay to enclose the electromagnetic portion and the contact assembly. A spring **63** is located in the cover to hold the back yoke tightly in position on the cores. The placement of the cover **11** also receives the ends of the test fingers **64** through slots in the cover.

A flat cross-bridge **69** in the cover **11** fits appropriately just about the winding lead connectors **50** to separate them from the movable contact fingers extending through the contact-pusher member. Such cover is held in position by suitable screws inserted into appropriate recessed holes in the corners of the cover and extending into the housing member at its four corners. The relay is then ready to be fitted into a suitable terminal board.

More specifically and with reference to FIG. **1**, the electromagnetic relay structure is shown in a side elevational view with certain parts in section as taken in general on lines **1–1** of FIG. **2**. This relay comprises a housing structure **10** and a cover member **11**. The housing structure **10** is shown with a front view in FIG. **4** with all parts removed and in a side sectional view taken on lines **5–5** in FIG. **5** also with all parts removed.

Referring to FIG. **4**, the housing structure **10** is molded of a fiber glass filled resin in a single piece in the form of a rectangular boxlike shape sometimes termed a parallelepiped with rectangular bases. Such molding includes different compartmental separations and structure to give added strength and rigidity to the structure, as well as providing certain functions broadly explained above.

In FIGS. **4** and **5**, it can be seen that the housing structure **10** has inwardly extending vertical bosses **15** along the rear inside edge on both sides. At the top of these bosses **15** is a cross-bridge **16** which is flat and extends between the two sides of the housing **10**. An upstanding central boss **17** is provided for receiving a screw. Around the inside of the wall of the housing **10** adjacent the rear edge is a depressed strip making the wall of the housing slightly thinner. This makes a recess for receiving the slotted contact-mounting block **42**. This block **42** has screws inserted in the boss **17** at the bottom of the upper space or portion and also inserted in the two bosses **66** at the top (see FIG. **4**). Therefore, the top floor of the cross-bridge **16** is raised slightly on each side of the boss **17**; and similarly the underside of the same portion is slightly raised. The abutment **14** joins these two levels underneath and extends downwardly an appropriate amount to meet the top of the armature. In FIG. **4**, it can be seen that the lower edge of the abutment **14** is very slightly curved downwardly (see thick line) in the center just a sufficient amount to just barely clear the armature. This allows the armature to ride flat on its knife edge bearing **31** without binding as seen in FIG. **1**, and yet be properly held in position.

At the front of the housing **10** is an arched cross-bridge **18** which extends from side to side. Running along each side of the housing **10** on the inside are ribs **19**. Each of these ribs **19** connects the arched cross-bridge **18** with the corresponding vertical boss **15** on its side of the housing. To give added strength, the ribs **19** have raised edges near the front and leading into the sides of the upper floor of the arched cross-bridge **18** as best seen in FIG. **5**.

Another flat cross-bridge **20** connects the sides of the housing **10** at the front thereof, and this cross-bridge **20** also has ribs **21** extending backwardly along the sides to the corresponding vertical bosses **15**.

At the bottom of the housing **10** is a compartment for receiving the test fingers **64** which compartment is provided with the enclosing flat bridge **22** located at the bottom of the vertical boss **15**. A vertical rib **23** near the center of the compartment runs the length of it to give stability. Similar ribs **29** are located at each side of the compartment for the same reason. Within the two smaller compartments are pairs of grooved ribs **24**, **25** and **26**. At the back of this lower compartment, located a short distance inwardly is a horizontal enclosing rib **27** having three vertical slots seen in FIG. **4**.

The upper portion of the housing structure **10** is a honeycomb or lattice structure which forms the back stops **70** for the fixed contacts and also the seats **71** for the coil springs biasing such contacts. Spaces **72** are also provided for the movement of the movable contacts. At the bottom of this honeycomb there are two grooved spaces **73** for receiving pairs of coil connector fingers. A seat **75** is also provided for the armature-biasing coil spring **48**. In the four corners of the housing **10** are bosses for receiving self-tapping screws adapted to secure the cover **11** in place.

The inside of the honeycomb or lattice structure has two further inwardly projecting ribs **76** for giving added strength to the lattice structure and also for limiting the inward position of the contact guide block **40**. These two ribs **76** extend downwardly from the top of the housing **10** to the slot **77**. An intermediate slot **78** also connects the two vertical ribs **76** which are in line from the front of the lattice structure to the near midportion of the contact compartment.

With the above general understanding of the housing structure, it can be readily seen that the cores **30** can have their pole pieces **33** and **34** fitted into recesses in the vertical bosses **15**. Also, a knife edge-bearing plate **31** can be placed in the recess between the cross-bridge **16** and the ribs **19**, so as to receive the armature **35**. The coded back plate **36** is placed over the compartment and rivets **37** are slipped through the pole pieces **33** and **34**, the bosses **15** and the coding plate **36**. The flattening of the heads of these rivets **37** thus secure the core pieces **30**, the armature **35** and its bearing **31**, the coded back plate **36** in position. The core pieces **30** thus extend outwardly towards the front of the housing **10**. The armature **35** has two vertical slots, one on each side, which are slightly wider than the bearing strip **31** (see FIG. **6**). The position shown in FIG. **6** is with the armature in its attracted position at which time the armature lays flat against the flat plastic residual strips **80** on the pole faces. Such strips are placed on

the pole faces just before they are fitted into the vertical bosses **15**. With the armature in this position, the entire slot of the armature is required for the sides of the bearing which merely enter the slots which is best seen in FIG. **7**. The right-hand side of the bearing plate is in exact alignment with the left side of the armature. The coil button **46** is also slipped into its receiving hole in the armature **35A**.

The contact guide block **40** is slipped into the upper portion of the housing structure **10** and is held in position against the back of the lattice structure by placing the contact-mounting block **42** in position where it is held by inserting three self-tapping screws **43**.

The fixed contact fingers **39** are slid into appropriate spaces in the lattice structure and enter the contact guide chute **44** in the contact guide block **40**. Upon the further insertion of the contact, it is guided to enter its slot in the mounting block **42**. When a sufficient portion of the finger exits through the slot in the block **42**, a tool is inserted into the recess at the rear of block **42** adjacent the slot and is used to pull it through until the lock finger **45** springs downwardly and holds the contact in place. This fit of the contact **39** in the block **42** is snug and tight on both the upper and lower surfaces of the contact and particularly so with regard to the side edges. It is the snug slot in this block plus the continuing longitudinal sliding portions into the block which determine the relatively exact perpendicular projection of the forward end of the contact finger **39**. When the fixed contacts are positioned, then the movable contacts **59** are similarly slid into their positions where they lock in place. When all of these contacts are in position, suitable coil springs **41** are placed on their seats in the lattice structure for biasing the fixed contacts to their appropriate normal positions. In addition, insulated seat **46** is inserted into a hole **47** in the armature and a biasing spring **48** slipped into position onto the two opposing seats **46** and **75**.

The winding connector fingers **49** are slipped into position the same as the other contact fingers, but these contact fingers merely extend forwardly for receiving quick detachable connectors **50**.

When all of the fingers have been placed in position, the contact pusher member **51** shown in front view of FIG. **8** is positioned over the armature arm **35A** and gently laid against the movable contacts which may need slight adjustment in order to enter the slots in the extending fingers **91** and **92** of the contact pusher member. These fingers **91** and **92** grasp each of the movable contacts exactly opposite their contact-making points so that such contacts are forcibly moved by operation of the armature removing any tendency of the contacts to burn closed as the pusher member **51** is moved by the armature.

When the pusher member **51** is moved inwardly so that it abuts against the contact side extensions, then a lock finger **53** is inserted which has projections at its outer end for holding the pusher member **51** in position. This lock finger **53** has the same kind of locking fingers **45** for the contact block **42** as previously described.

The coils are wound on plastic spools **38** which readily slide over the core members **30** with the coil ends suitably positioned and having the quick detachable contact members **50** attached at their ends. Thus, the two coils can be slipped over their respective cores **30** and their four terminals suitably connected to their respective fingers **49** rather quickly through appropriate spaces left in the contact pusher member **51**. The outer ends of the spools **38** have a raised portion at one side. These raised portions are placed at the top and the bottom of their respective spools so that a back yoke **62** can be slipped over the ends of the cores. This fit of the back yoke **62** is snug so as to make ready magnetic contact with the cores **30**. This back yoke **62** is molded from powdered magnetic material which is amalgamated into a unitary structure which has high magnetic permeability.

A spring **63** is located in a suitable space on the cover for contacting the back yoke **62** and holds it firmly in position, when the cover is placed in position. The test fingers **64** may have to be slightly adjusted to enter their respective slots in the cover.

When the cover is in position, the screws **65** are inserted to hold the cover **11** onto the housing **10**. When the relay is thus constructed, it is complete and ready for operation.

To place it in operation, it is merely mounted on a plug board adapted to receive its projecting contact fingers and having coded projections to enter the coded holes in the coded back cover **36**. A wire bail **60** is connected in the slot on the terminal board and is sprung over the outer handles **81** of the relay as shown in FIG. **9**. In this way the relay is held on the terminal board and is removable when desired.

It is noted that FIG. **8** shows an enlarged front view of pusher member **51** which can also be found in FIGS. **1** and **2**. This front view shows the extending lips **91** and **92** which take hold of the contact fingers directly adjacent the contact points as can also be seen in FIGS. **1** and **2**. Also, mild shading is shown in areas of FIG. **8** to illustrate the thin webs **93** of molded material between major portions or bars of the material. These thin web portions **93** act to give strength and stability to the pusher member **51**. The larger fingers **94** act to grasp the armature arm **35A** as can be seen in FIG. **2**. (It is noted that one of these fingers **94** is omitted from FIG. **2**.)

While there has been described what is at present considered to be the preferred embodiment of the invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein, without departing from the invention; and, it is, therefore, intended that the appended claims shall cover all such changes and modifications as fall within the true spread and scope of the invention.

We claim:

1. An electromagnetic relay having a plurality of contacts wherein the improvement comprises a housing structure having a shape of a parallelepiped with rectangular bases, a lattice structure located inside the front of said housing structure and integral therewith, said lattice structure having spaced openings for receiving the contacts, a guide block located in said housing structure abutting said lattice structure for guiding the insertion of the contacts into the relay structure, a slotted contact-mounting block located within said housing structure at the rear of said guide block, said slots being located to match the spaces in said lattice structure, and said guide block having internal chutes with openings at one end matching said spaces in said lattice structure and with openings at the other end matching the slots in said contact-mounting block.

2. A relay according to claim **1** in which contact fingers are mounted in said housing structure with one end of each finger fastened in said slotted contact-mounting block and with the other end of each finger being movable in its respective one of said spaced openings of said lattice structure without interference by said guide block.

3. A relay according to claim **1** in which said slotted contact-mounting block has grooved slots for receiving flat contact fingers and causing them to be held in perpendicular position, the other end of each finger being capable of flexing in its chute of said guide block and in its opening of said lattice structure.

4. A relay according to claim **1** in which said slotted contact-mounting block has a recess to the rear of each slot, two parallel grooves in each said recess running from said slot to the rear of the said block, said slot and grooves of each recess holding its finger substantially perpendicular to said block and providing a holding rib for the spring lock of said contact.

5. A relay according to claim **4** wherein each recess to the rear of each slot provides access on each side of the slot for a tool to grasp the contact finger inserted into that slot.