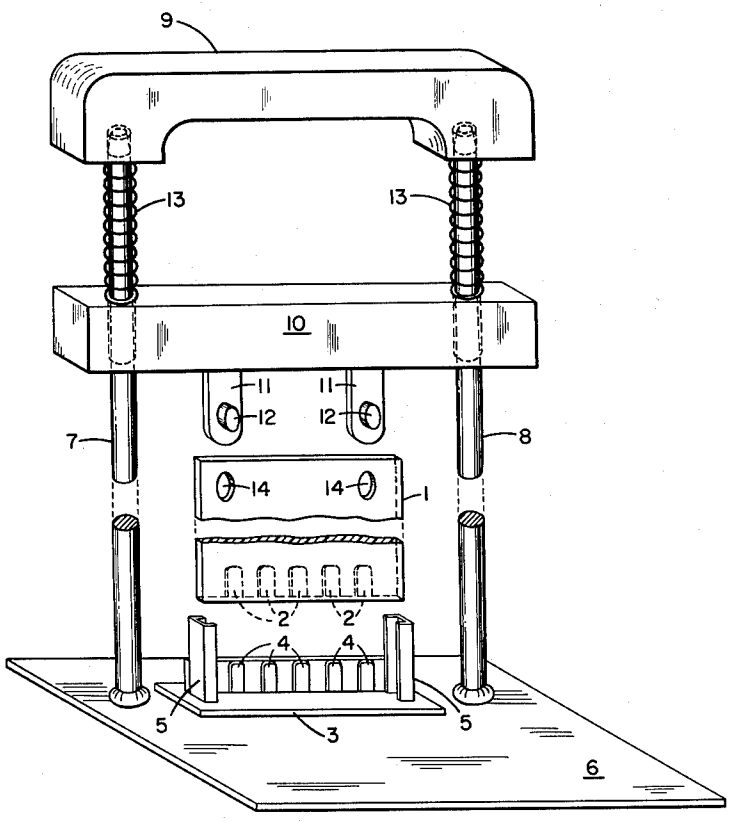
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TOOL FOR USE WITH RIGID CARDS

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INVENTOR.
JOHN T. RONDASH

BY

ATTORNEY

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TOOL FOR USE WITH RIGID CARDS

John T. Rondash, Rochester, N.Y., assignor to General Dynamics Corporation, Rochester, N.Y., a corporation of Delaware

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My invention is directed to a tool suited for manipulating substantially rigid sheets or cards, such as printed circuit cards, relative to their mounting sockets or connectors.

It is presently the practice to arrange contact-bearing connectors on a mounting panel or other structure in a closely spaced file, and to insert in each such connector a circuit card having contacts corresponding in number and position to the connector contacts. The connectors are oriented so that the principal faces of cards received within adjacent connectors are opposed to each other. While the resulting "package" of cards is efficient from the point of view of space utilization, the close spacing of the cards makes difficult the insertion and extraction of an individual card from its connector. This difficulty is heightened when, in order to minimize the possibility of damage to contacts and connectors, the additional requirement that the cards be moved only along a particular line is imposed.

Therefore, it is an object of my invention to provide a new and improved tool for manipulating cards made of substantially rigid material.

Another object of my invention is to provide a new and improved tool for inserting and removing circuit cards from closely spaced connectors.

Another object of my invention is to provide a new and improved tool for use with circuit cards which tends to prevent damage to the card and its connector during the time that the card is being inserted or removed from its connector or socket.

I accomplish these and other objects set forth in the description of the preferred embodiment of my invention which follows. In order to assist the reader, reference is made in the following description to the drawing attached to and forming a part of the present specification. The drawing shows a single view of a circuit card, a connector, and a tool for use with the card and connector.

Referring to the drawing, my invention may be used with a substantially rectangular card 1 of finite width and having an end to which a plurality of contact electrodes 2 are fixed in spaced apart relationship. At the end of card 1 remote from the aforementioned contact-bearing end, I provide a pair of spaced apart means, in this case openings 14, which pass through card 1, for engaging the working parts of a manipulating tool. The use of openings 14 is more fully explained hereinafter.

In order to extend connections from external equipment to components (not shown) which are mounted on card 1, connector assembly 3 is provided. Connector assembly 3 is substantially longer than card 1 is wide and is fixed to a structure, such as panel surface 6, by any suitable means. Connector assembly 3 includes contact electrodes 4 spaced apart from each other along the length of assembly 3 and otherwise oriented to engage corresponding ones of card electrodes 2 when the electrode-bearing end of card 1 is inserted within assembly 3. In order to guide and position card 1 with respect to assembly 3, it is conventional to provide parallel troughs 5 fixed to opposite ends of the contact-bearing portion of assembly 3 and extending above the electrode-bearing portion of assembly 3 in a direction substantially normal to panel 6. Troughs 5 are parallel to the line of movement followed by card 1 as it is inserted and extracted from assembly 3. Troughs 5 receive the opposed edges

of card 1 which are adjacent to the electrode-bearing end of card 1. With this arrangement, when card 1 is received within the upper ends of troughs 5 and pushed downwardly toward panel 6 to the end of its travel, each of card electrodes 2 engages a particular one of the assembly 3 electrodes 4, and card 1 thereafter may be maintained within assembly 3 by friction between card 1 and assembly 3 elements, such as electrodes 2 and 4. It is to be seen that card 1 can be removed and inserted, within assembly 3 an indefinite number of times without damage to card 1 or assembly 3, even though electrodes 2 and 4 are fragile, if the motion of the electrode-bearing edge of card 1 is purely transverse and has no rotational element about itself or with respect to connector assembly 3. However, should the motion of the contact-bearing edge of card 1 also includes a rotational element, troughs 5 and contacts 2 and 4 may be damaged.

Having described the card-connector combination and some of the problems connected with it, I next turn to the consideration of the tool used for manipulating the card and forming the preferred embodiment of my invention. The tool has first and second legs 7 and 8 of substantially equal length. Legs 7 and 8 are fixed to and depend parallel to each other from handle 9. Legs 7 and 8 are separated from each other by a distance substantially greater than the width of card 1, so that the width of card 1 may be received betwen legs 7 and 8 in the manner to be described presently.

I further provide a sliding member having hand-engaging portion 10 and substantially rigid strips 11 depending therefrom. Studs 12 are fixed to the ends of strips 11 remote from hand-engaging portion 10. Each of studs 12 is smaller than the aforementioned openings 14 in card 1, the studs being spaced apart from each other by a distance substantially equal to the separation between openings 14 in card 1, so that placement of the studs 12 within openings 14 causes the hand-engaging member of the tool to engage or grasp card 1 and thereby fix card 1 to resist movement, including rotational movement, with respect to the length of the aforementioned sliding member.

The aforementioned sliding member is slidably mounted on legs 7 and 8 by means including openings passing through portion 10, the openings being spaced apart from each other by a distance substantially equal to the separation between legs 7 and 8. Owing to the fact that the surface of member 10 formed at the openings has substantial length, the mounting means is operative for constraining the sliding member including portion 10 to travel transversely along the length of legs 7 and 8. Coil springs 13 are threaded onto legs 7 and 8 between and have their ends fastened to or engaging handle 9 and hand-engaging portion 10. With this arrangement, member 10 is normally positioned at a neutral or normal point along the lengths of legs 7 and 8 and is biased against movement along the length of legs 7 and 8 away from its normal position.

To use the above-described tool, the free ends of legs 7 and 8 are butted at points adjacent and fixed with respect to opposite ends of assembly 3, the points lying on a line passing through the contact-bearing part of assembly 3. In the drawing, legs 7 and 8 are shown butted against such points on panel 6. The tool is positioned with respect to panel 6 and connector 3 so that studs 12 are received within openings 14 of card 1 and so that handle 9 and hand-engaging member 10 are directly over the electrode-bearing part of assembly 3, with legs 7 and 8 substantially parallel to trough members 5 of assembly 3. With the tool so positioned, movement of the hand-engaging member along the lengths of legs 7 and 8 moves card 1 in translation only with respect to electrodes 4 and troughs 5 of connector assembly 3. By forcing the

aforementioned sliding member downwardly and away from handle 9, card 1 and electrodes 2 thereon are lowered into engagement with assembly 3 and electrodes 4, respectively. When card 1 is in engagement with connector assembly 3, and the tool is positioned in the above-described manner, the operator forces hand-engaging member 10 and card 1 upwardly and out of engagement with assembly 3 by sequeezing hand-engaging member 10 toward handle 9, so that the card 1 is removed from assembly 3 in a transverse motion only.

While I have shown and described a specific embodiment of my invention, other modifications will readily occur to those skilled in the art. I do not therefore desire my invention to be limited to the specific arrangement shown and described, and I intend in the appended claims to cover all modifications within the spirit and scope of my invention.

What is claimed is:

1. A tool for manipulating an apertured plate-like circuit card which is normally slidably mounted in an electrical apparatus, including a first structure having an elongated handle portion and a pair of legs connected to opposite ends of the handle portion and extending forwardly from said handle, said legs being spaced from and parallel to each other and forming an open-ended U with said handle; a second structure extending between the legs of said first structure in a common plane with said first structure and having a forward portion extending toward said open end of said U and having two

end portions, each of said end portions being slidably supported by one of said legs of said first structure, said second structure having free-ended pins extending in the same direction from said forward portion normal to said common plane; and spring means connected between said first and second structures for urging said second structure in said forward direction relative to said first structure into a neutral position, whereby the legs of the open-ended U may be placed against said apparatus to straddle a circuit card and the pins of the second structure engaged in card apertures, and thereafter the handle of the first structure and the second structure may be manually gripped and drawn together to pull the second structure and card in a rearward direction from said apparatus.

2. A tool as set forth in claim 1 in which said pair of legs are spaced apart a given distance to straddle said apertured plate-like circuit card edgewise.

3. A tool as set forth in claim 1 in which said pair of legs placed against said apparatus to straddle a circuit card are substantially of equal length.

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