Dec. 20, 1966 G. S. COLLIER ETAL 3,292,430

TERMINAL CHECKING DEVICE

Filed Oct. 7, 1964 2 Sheets-Sheet 1

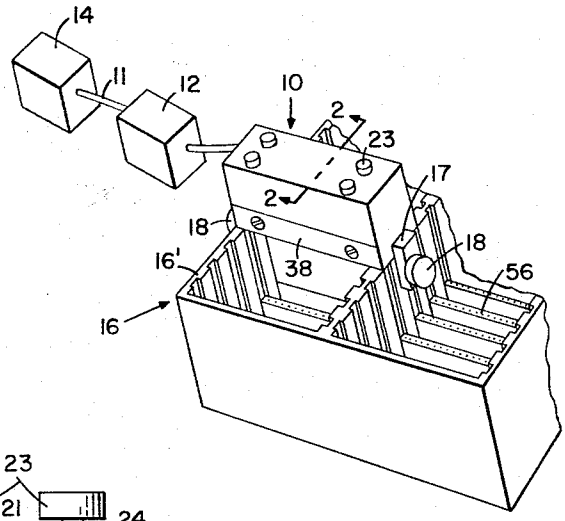



FIG. 1

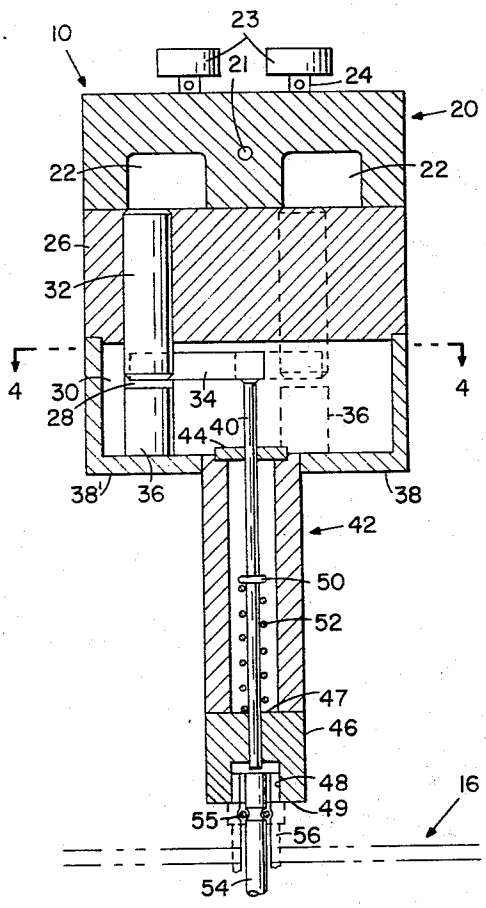



FIG. 2

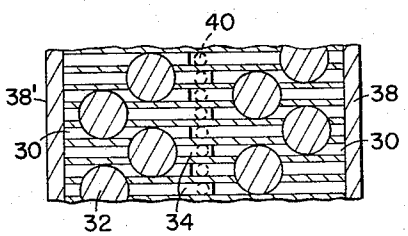



FIG. 4

George S. Collier
Raymond J. Puglia,
INVENTORS.

BY Harry M. Saragovitz
Edward J. Kelly
Herbert Berl
Howard L. Barnes, Jr.
ATTORNEYS

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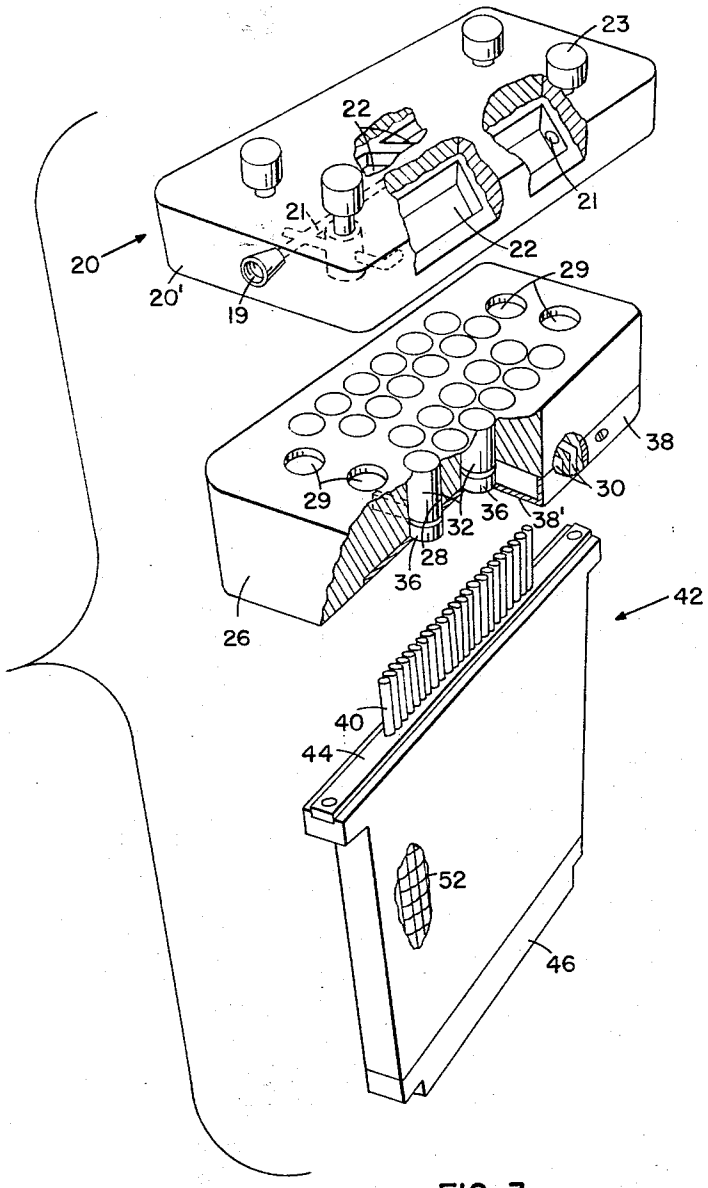



FIG. 3

George S. Collier
Raymond J. Puglia,
INVENTORS.
Harry M. Saragovitz
BY Edward J. Kelly
Herbert Berl
Howard E. Barnes, Jr.
ATTORNEYS

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# TERMINAL CHECKING DEVICE

George S. Collier, Winter Park, and Raymond J. Puglia, Orlando, Fla., assignors to the United States of America as represented by the Secretary of the Army

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8 Claims. (Cl. 73—141)

This invention relates to a device for checking the seating of terminal pins within the connectors of a chassis. These pins are held in place, if properly seated, by locking springs which resist pressure tending to dislodge them from their respective connectors.

In the past it has been necessary to check the seating of each individual terminal pin by manually pushing against it with a composition stick. This has been both time consuming and inexact, due to the human factor involved, i.e. the degree of pressure exerted may vary so as to fail to dislodge improperly seated pins or in some cases to dislodge properly seated pins. Failure to properly seat all of the terminals causes an excessive amount of rework due to broken electrical circuits because of the necessity of removing the chassis and finding the broken circuits.

It is a primary object of this invention to provide a mechanical device which will uniformly check the seating of electrical terminals within the connectors of a chassis to avoid the excessive rework noted above.

It is a more specific object of this invention to provide a device which will apply a uniform pressure on terminal pins within the connectors of a chassis and which pressure is sufficient to partially dislodge any improperly seated terminal pins but insufficient to dislodge properly seated terminal pins.

The foregoing and other objects of this invention will become more fully apparent from the following detailed description and the accompanying drawing in which:

FIGURE 1 is a perspective view of the invention in one mode of use;

FIGURE 2 is a sectional view taken along line 2—2 in FIGURE 1;

FIGURE 3 is an exploded perspective view of the checking device with portions of the device broken away so as to better illustrate the interaction of the various elements of the invention; and

FIGURE 4 is a fragmentary sectional view taken along line 4—4 in FIGURE 2.

In the drawings, wherein, for the purpose of illustration, the preferred embodiment is shown, the reference characters are utilized to designate the same elements throughout. Referring now particularly to FIGURE 1, which shows the checking device **10** in position within a chassis **16**; this position being its normal checking position. The checking device is retained in this position by a pair of locking means or studs **18**, one of which is mounted in a locking bracket **17** disposed at each end of the checking device and positioned outside of the chassis walls **16'**. Each of the locking means comprises a shaft or stud threaded through its locking bracket in such a manner that its inner end portion (not shown) presses against the chassis wall whenever said shaft is rotated in its locking direction, all in a manner well known in the art. Thus, the device is placed in its normal working position and each of the locking means is rotated to lock the checking device in this position.

Once the checking device is properly positioned, gaseous fluid, e.g. air, is supplied by a fluid source **14** through a fluid supply line **11** and a pressure regulating device **12** to the checking device. The use of device **12** is optionable but is preferred because the pre-selected fluid pressure must be maintained at a constant level



within the checking device. The construction and operation of the fluid supply system is well known in the art and therefore have not been described in greater detail. Other systems could be utilized as will be obvious to those skilled in the art, with the sole requirement being that a constant pre-selected fluid pressure be supplied to the checking device. The pressure must be constant in order that the checking device will uniformly check the connectors within the chassis as will be more readily apparent hereinafter.

The checking device is illustrated in detail in FIGURES 2 and 3 and comprises a manifold **20** having four spaced individual fluid compartments **22**. Pressurized fluid from the source is selectively supplied, through an inlet **19**, located at one end of the manifold, through a fluid supply line **21**, and through a plurality of three-way supply and exhaust poppet valves **23** to compartments **22**. One such valve **23** is disposed so as to control the fluid flow into each of the compartments. Whenever valve **23**, for any given compartment, is depressed to its lowermost position, the fluid flows into that compartment. Valves **23** are so constructed that when it is released it returns to its uppermost position, thereby exhausting its compartment through an exhaust port **24**. Valves **23** are of a type well known in the valve art and therefore have not been shown in detail since any type of supply and exhaust valve will suffice to control the flow of fluid to the compartments.

Disposed in abutting relation with the manifold is a cylinder block **26**. Cylinder block **26** has a plurality of spaced bores **28** extending therethrough and further includes a plurality of depressions or seats **29** to provide seating space for the lower portions of valves **23** when the device is assembled.

Each of the bores is fitted with a fluid piston **32** adapted for reciprocating axial movement within the bore. The pistons are constructed with such close tolerances that there will be a fluid seal between the pistons and the walls of the bores when the pistons are in place. In the specific embodiment of the invention under discussion there is a total of twenty-three pistons because the chassis this device is designed to check has a total of twenty-three connectors in each row. Since there is an odd number of pistons in this embodiment they are divided as equally as possible among the fluid compartments, thus three of the compartments have a total of six bores and pistons opening thereinto while the fourth compartment has only five bores and pistons opening thereinto. The foot of lower portion of each piston is slotted, with a push arm **34** brazed in the slot. The use of the push arms will be described in detail subsequently. For ease of assembly, and to permit push arms **34** to reciprocate with pistons **32**, the lower portion of cylinder block **26** is bisected with slots **30**, i.e. one for each push arm. Each bore is also provided with a cylindrical buffer plug **36** which rests beneath each piston in such a manner as to be compressed by the downward movement of the piston. The plug may be of any resilient compressable material such as foam rubber, which has been found to be satisfactory. Angle plates **38** extend from one end of block **26** to the other and are attached thereto by conventional means, e.g. assembly screws. The horizontal leg **38'** of each plate closes the lower ends of bores **28** and a portion of slots **30** and extends into abutting relation to a pressure pin guiding housing **42** so that the upper surfaces of legs **38'** and the upper end surface of the housing are substantially coplanar. Thus, plates **38** retain plugs **36** and pistons **32** within the bores of the cylinder block while still permitting the reciprocating movement of the pistons.

Pressure pin guiding housing **42** contains the actual instrumentalities for checking the seating of the terminal pins. These consist of a plurality of pressure pins **40**

which are disposed within the housing in aligned spaced relation free for reciprocating axial movement corresponding to like movement of the pistons noted, supra. The diameter of these pins is substantially the same as the thickness of the push arms and can never be substantially greater because these pins must enter slots **30** and thus maintain engaging contact with the push arms. If the diameter of the pins is greater than the width of slots **30** the device cannot properly function since the movement of the push arms is limited to movement within the slots. The pins are maintained in their spaced relation by passing through suitably formed openings through a top guide plate **44** and a bottom guide plate **46**, which are carried at the top and bottom, respectively, of housing **42**. A spring retaining ring **50** is carried by each pin **40** intermediate its end portions. A spiral spring **52** is disposed about each of the pin's intermediate ring **50** and the top surface **47** of the bottom guide plate so as to exert resilient pressure against ring **50** in such a manner that pin **40** is normally maintained in its uppermost position when the device is asembled as shown in FIGURE 2. In this position, pins **40** enter slots **30** and abut with push arms **34** since housing **42** is normally disposed in a centrally perpendicular abutting relation with the lower or bottom surface of the cylinder block and extends outwardly therefrom. The resilient pressure exerted by springs **52** against rings **50** maintains the upper ends of pins **40** in abutting relation with push arms **34** within slots **30** so that axial movement of pistons **32** (and push arms **34**) is translated into like movement of pins **40**. Housing **42** is maintained in place with block **26** by conventional means such as assembly screws, not shown.

Bottom guide plate **46** of housing **42** is provided with a slot or groove **48** opening through the bottom surface **49** thereof and adapted to be seated upon a row of upstanding connectors **56**. When properly placed, the bottom guide plate is so seated that pressure pins **40** are aligned with terminal pins **54**. Terminal pins **54** are normally held in place within connectors **56** by a locking spring **55**, carried within each connector **56** whenever the terminal pin is properly seated. The retentive force exerted by spring **55** is sufficient to withstand the pressure exerted by pressure pins **40** if the terminal pin is properly seated.

*Operation*

As seen in FIGURE 1, checking device **10** is placed within chassis **16** with bottom guide plate **46** resting upon a row of connectors **56**. Locking brackets **17** are then disposed outside of walls **16'**, and locking means **18** are actuated to lock the checking device in the chassis. When the device is locked in place the operator proceeds to test the seating of the terminal pins in that row of connectors. He does this by depressing, in sequence, each of three-way poppet valves **23**. When valve **23** is depressed the pressurized fluid flows from supply line **21** through valve **23** into compartment **22**. This fluid then exerts a force of four to six pounds per square inch against pistons **32** and, through push arms **34**, against pressure pins **40**, thereby compressing spring **52**. Pressure pins **40** then press against terminal pins **54**. Properly seated pins will resist the force applied while improperly seated pins will be pushed approximately $\frac{5}{16}$ inch out of the rear of the chassis. After the terminal pins have been tested, poppet valve **23** will be released, thereby exhausting compartment **22**. The exhausting of compartment **22** permits spring **52** to impel pin **40**, and along with it, push arm **34** and piston **32** to their uppermost position. Spring **52** is assisted in impelling piston **32** by the expansion of buffer **36**. Thus, the filling and the exhaustion of compartment **22** results in vertical reciprocal movement of pins **40**, provided that there is no obstruction of their initial downward motion sufficient to withstand the force exerted thereon by the fluid admitted to compartment **22**. This procedure will be repeated for each row of connectors to be tested until the entire chassis has been checked. Then the chassis will be turned over and visual inspection will determine which terminal pins are to be reseated.

The embodiment described above is exemplary of the invention rather than restrictive thereof. Other variations will be obvious, e.g. while the manifold shown has four separate compartments, a lesser or greater number may be used as desired. A single compartment could also be used. This choice will be dictated to a great extent by the degree of pressure properly seated pins will withstand and still permit the use of a fluid pressure which will be effective to dislodge improperly seated pins. Also, the number of pistons, push arms, bores, pressure pins, etc. will understandably vary with the type of chassis with which the checking device is designed to be used. Here, the chassis to be checked had twenty-three connectors in each row and the checking device had a corresponding number of pressure pins.

Another permissible variation would be the substitution of a pressure plate in lieu of push arms **34** to drive a plurality of pressure pins **40**.

Further, the shape of the checking device **10** will vary according to the type of chassis to be checked, e.g. the device could be made circular to check cable connectors.

Still further, the device could be used to insert the terminal pins by inverting the chassis and placing the device against the opposite ends of pins which had been placed loosely within the connectors.

Other drive means could be utilized to drive the pressure pins if desired, e.g. electromagnetic force could be used to impel the pressure pins in lieu of the fluid pressure drive disclosed herein.

The above noted variations, as well as others which will be obvious to the artisan may be made without departing from scope or the spirit of the invention as embraced by the subjoined claims.

We claim:

1. A checking device comprising:
   (a) a pressure pin guiding housing,
   (b) a plurality of spaced pressure pins having upper and lower ends disposed for reciprocating motion along their longitudinal axes within said housing,
   (c) a cylinder block disposed in abutting relation with said housing, said cylinder block having a plurality of bores extending therethrough,
   (d) a plurality of cylindrical pistons having first and second end portions disposed within the bores of said cylinder block for reciprocal motion along their longitudinal axes, said pistons having a fluid seal within said bores, said first end portion of said piston having a surface adapted to receive fluid under pressure,
   (e) a push arm integrally connected to said second end portion of each of said pistons and disposed in abutting contact with said upper end of one of said spaced pins,
   (f) a manifold disposed in abutting relation with said cylinder block, comprising a fluid compartment into which the fluid receiving surface of the pistons open and valve means for controlling the flow of pressurized fluid into and out of said compartment, and
   (g) a source of fluid under pressure operatively connected to said valve means, whereby the admittance of said fluid into said compartment causes the pistons opening thereinto to move axially along their longitudinal axes from an uppermost position to a lowermost position, thereby, through the push arms, moving said pressure pins axially along their longitudinal axes from an uppermost position to a lowermost position.

2. In a checking device as set forth in claim **1**, wherein said manifold comprises a plurality of compartments, each compartment being adapted to individually receive pressurized fluid.

3. In a checking device as set forth in claim 2, wherein a plurality of said fluid actuated pistons open within each of said compartments.

4. A checking device for detecting improperly seated terminals within a row of connectors of a chassis, comprising:

(a) a guiding housing comprising a top guide plate and a bottom guide plate, said guide plates having a plurality of spaced openings therein, and said bottom guide plate provided with seating means for alignment of said openings with said terminals,

(b) a plurality of spaced pressure pins disposed at least partially within said housing, each of said pins passing through an opening in each of said guide plates whereby said pins are maintained in spaced relation,

(c) first means for impelling each of said pressure pins in a first direction along its longitudinal axis from an initial position within said housing to a second position of engagement with said terminals for application of a predetermined force thereto to partially displace said terminals from said chassis if the terminals are improperly seated therein, and

(d) second means for impelling said pins in a second direction for returning said pressure pins to their initial positions whenever said first impelling means is rendered inoperative.

5. In a checking device as set forth in claim 4, wherein the means for impelling said pressure pins in said first direction comprises a fluid actuated driving device.

6. In a checking device as set forth in claim 4, wherein the means for returning said pressure pins to their initial positions comprises a resilient spring disposed about each of said pressure pins in such a manner that the spring is compressed whenever pressure pins are impelled in said first direction.

7. A checking device comprising:

(a) a pressure pin guiding housing comprising a top guide plate and a bottom guide plate, each of said plates having a plurality of spaced openings therein,

(b) a plurality of pressure pins, having upper and lower end, disposed at least partially within said housing, each of said pins passing through an opening in said top and bottom guide plates,

(c) a cylinder block having upper and lower surfaces disposed in abutting relation with said housing, said block having a plurality of bores extending from said upper surface to said lower surface,

(d) a plurality of cylindrical pistons having first and second end portions, disposed within said bores for reciprocal motion along their longitudinal axes, said first end portion having a surface adapted to receive fluid under pressure,

(e) a push arm integrally connected to said second end portion of each of said pistons and in abutting contact with said upper end of one of said spaced pins,

(f) a closing plate for closing said bores at the lower surface of said block,

(g) first resilient means disposed within said bores between the second end portions of said piston and said closing plate, said first resilient means being adapted to be compressed when said pistons move along their longitudinal axes toward said closing plate, thereby storing enargy for impelling said pistons away from said plate,

(h) a manifold disposed in abutting relation with said cylinder block, comprising a fluid compartment into which the fluid receiving surface of a plurality of



said pistons open and valve means for controlling the flow of pressurized fluid into and out of said compartment,

(i) a second resilient means disposed about each of said pressure pins adapted to be compressed when said pressure pins move along their longitudinal axes toward said bottom guide plate, thereby storing energy for impelling said pins away from said bottom guide plate, and

(j) a source of fluid under pressure operatively connected to said valve means, whereby the admittance of said fluid into said compartment causes the pistons opening thereinto to move axially toward said closing plate, thereby compressing said first resilient means, the said movement of said pistons, through said push arms, impelling said pressure pins toward said bottom guide plate, thereby compressing said second resilient means; and whereby the exhaustion of said fluid from said compartment permits the expansion of said first and second resilient means, thereby impelling said piston away from closing plate and said pressure pins away from said bottom guide plates, respectively.

8. A checking device for detecting improperly seated terminals within a row of connectors of a chassis, comprising:

(a) a pressure pin guiding housing comprising a top guide plate, having a plurality of spaced openings extending therethrough and a bottom guide plate, having a plurality of spaced openings extending therethrough and aligned with the said openings in said top guide plate, said bottom guide plate also having a groove in its lower surface extending from one end of the plate to the other whereby said plate is seated on said row of connectors during use, said row of connectors entering said groove, and the openings in the bottom guide plate are aligned with the terminals within said row of connectors;

(b) a plurality of spaced pressure pins disposed within said housing extended through the said openings in the top guide plate and extending into the openings in the bottom guide plate, wherein the lower ends of said pins are disposed for engagement with corresponding terminals when the bottom plate is in its normal position during use, said pins being free for reciprocal motion within the openings of said guide plate;

(c) fluid actuated means disposed adjacent the upper ends of said pressure pins adapted to exert against said pins a force of such magnitude as to displace said pins from a first position to a second position along their longitudinal axes and to displace improperly seated terminals within the connectors; and

(d) resilient means disposed in opposition to said fluid actuated means and adapted to displace said pins from said second position to said first position when the fluid actuated means is inoperative.

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RICHARD C. QUEISSER, *Primary Examiner.*

JAMES H. WILLIAMSON, *Assistant Examiner.*