June 2, 1959 R. FREEDMAN ET AL 2,889,427

STRAIGHT LINE SWITCH

Filed July 9, 1958 2 Sheets-Sheet 1

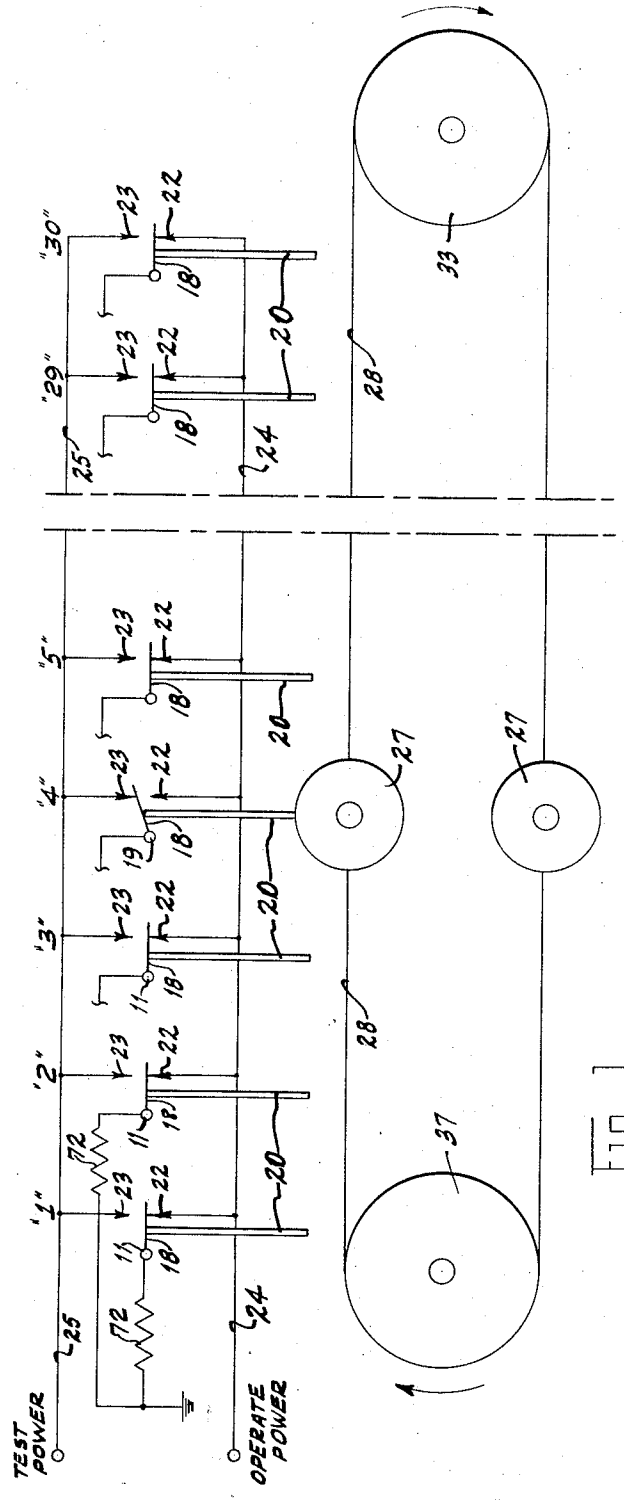


Fig 1

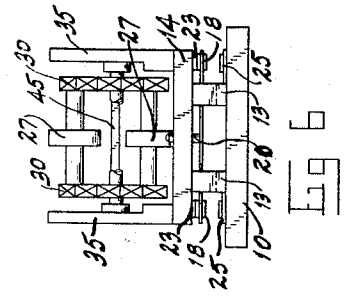


Fig 5

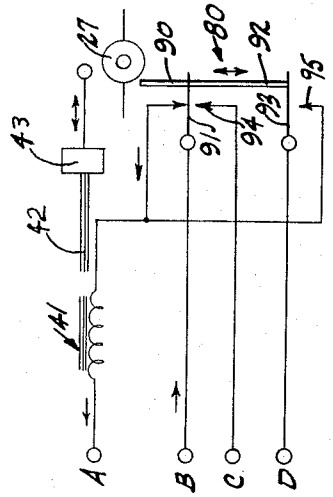


Fig 2

June 2, 1959 R. FREEDMAN ET AL 2,889,427

STRAIGHT LINE SWITCH

Filed July 9, 1958 2 Sheets-Sheet 2

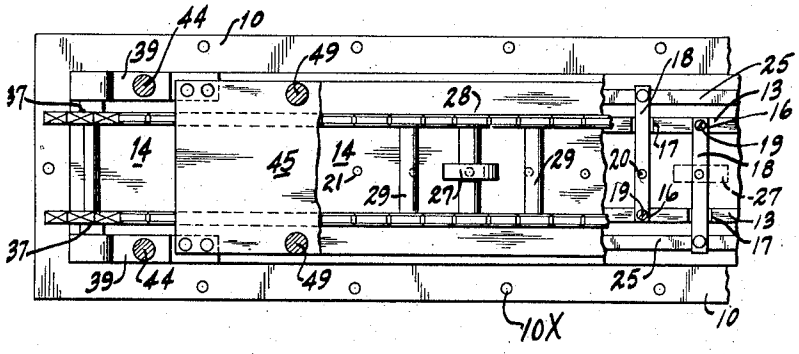


Fig. 3

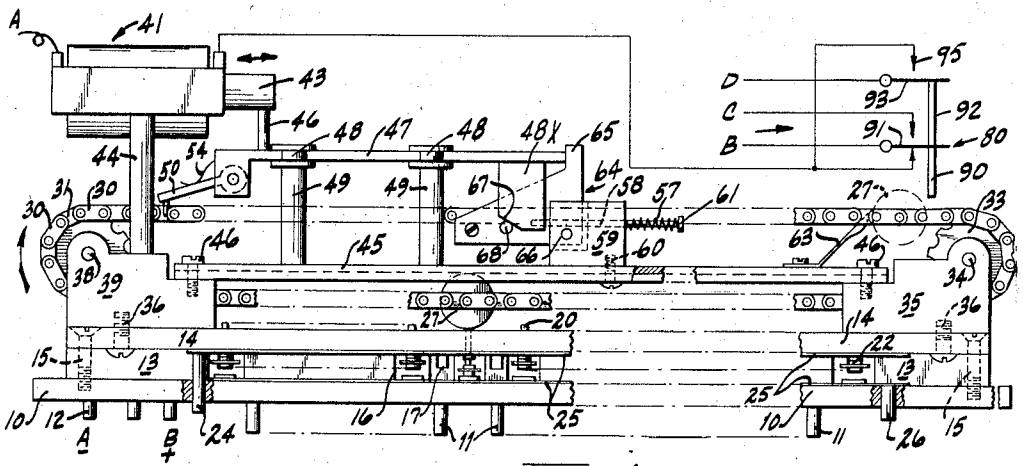


Fig. 4

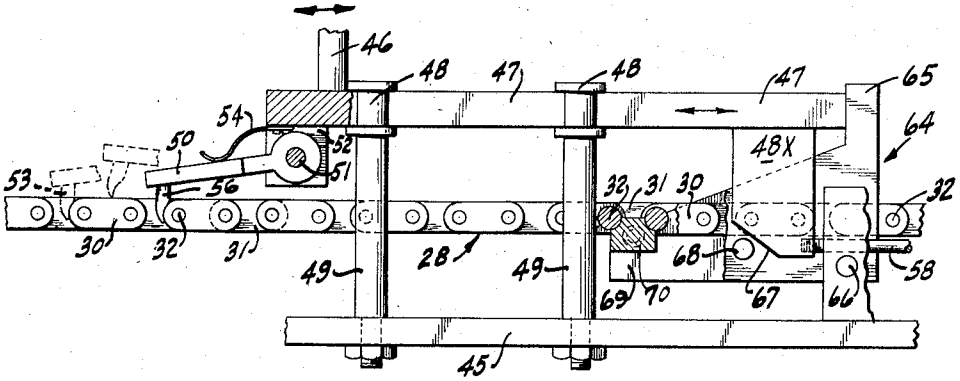


Fig. 5

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2,889,427

STRAIGHT LINE SWITCH

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2 Claims. (Cl. 200—104)

This invention relates to an electrical switch.

The use of rotary switch for testing purposes is attendant with many disadvantages, such as, excessive wiring, sliding contacts, cumbersome equipment, etc.

It is an object of this invention to provide a line switch capable of testing a plurality of test devices.

It is a further object to provide a switch wherein the contacts are pushed down into engagement.

It is another object to provide a compact switch of inexpensive construction adapted for multitudinous testing.

These and other objects of this invention will become apparent upon reading the following descriptive disclosure taken in conjunction with the drawing herein in which:

Fig. 1 is a schematic wiring diagram of the switch,

Fig. 2 is a diagram of the means for switching over from one line switch into another line switch when a plurality of line switches are used.

Fig. 3 is a top plan view broken-away in part to show the contact points and showing a portion of the pair of continuous chains used.

Fig. 4 is a side view of the switch showing the ends of the switch with the center portion of the switch length eliminated to save repetition.

Fig. 5 is a detailed side view of the means for advancing the chain a predetermined length and locking said advanced chain in an immovable manner, and

Fig. 6 is a front view of the switch.

Turning to the drawing and particularly to Figs. 3 to 5 a terminal board **10** of conventional insulator material, for example phenolic material, is provided with a plurality of apertures therein and a plurality of conventional terminal studs **11** are disposed therein. The operating lugs **12** used to operate the line switch alone or a part of a group of line switches are disposed to one end of the board **10**.

A pair of longitudinal spacer bars **13** of insulator material are disposed in parallel spaced-apart relationship upon board **10** and a top insulator support board **14** having a plurality of suitably spaced-apart apertures to receive a push rod are disposed centrally in the board **14**.

The terminal board **10**, the top support board **14** and the spacers **13** are thus made of suitable insulator material and are secured together as a unit by a plurality of screws **15** disposed through the said insulators in their longitudinal end portions.

The spacers **13** are provided with alternate deep U-shaped cuts **16** and shallow U-shaped cuts **17**. The pair of spacers **13** are so arranged or prepared that a deep cut **16** of one spacer **13** is disposed opposite to a shallow cut **17** on the opposed spacer **13**.

A leaf contact spring **18** is secured by a metal screw **19** to the spacer **13** in each shallow cut **17** of each spacer through a suitable aperture in said spacer to a terminal lug **11** in terminal board **10**. The springs **18** are all normally biased upwardly toward support board **14** and are each provided with a push rod **20** contacted thereto and disposed in the respective apertures **21** of board **14**.

Thus the spring **18** is secured in one spacer **13** in a shallow cut **17** and extends into a deep cut **16** of the opposed spacer. Thus each spring **18** is secured at one end to a terminal lug **11**, each lug **11** being insulated from one another, but the unsecured end of each spring **18** can be depressed from its continuously upwardly urged position to a depressed position by movement downwardly of the push rod **20** secured thereto.

The upward position of each spring **18** effects a contact to a top contact point **22** whereas the depressed position of the free end of spring **18** effects contact to a bottom contact point **23**.

All contact points **22** on each respective side of top board **14** are joined together by a common wire or metal tape **24** and lead to a respective terminal **24**.

Similarly all bottom contact points **23** on each side of board **10** are joined together by a metal tape **25** and lead to a respective terminal **26**.

Fig. 1 schematically shows the manner of operation of the springs **18** between contacts **22** and **23** by means of push rod **21** welded to spring **18**.

Clearly, a single set of contact springs operating between common line **24** and **25** on only one side of boards **10** and **14** are operable. However by utilizing the opposite longitudinal side of each board **10** and **14** a greater number of terminal lugs **11** are useable on a single board **10**. The distance between any two adjacent contact points **22** or any two points **23** must be sufficiently far to prevent breakdown or jumping of a spark between the respective points at for example, 15,000 volts.

The means for depressing the push rods **20** one after the other in linear succession is a dual chain assembly having a single insulator, nylon, roller wheel **27** disposed securedly between the pair of continuous metal chains **28**. Nylon chain separators **29** are used to keep the respective chains apart.

The separate chains **28** are of conventional make and are composed of a plurality of outer parallel links **30** and inner parallel links **31** secured in succession by cross pins **32** (Fig. 5).

The chains **28** are continuous and are each supported at their front in a separate sprocket **33** journaled to a common axle **34**, said axle being disposed in suitable apertures in a pair of spaced-apart metal supports **35** secured by screws **36** to insulator board **14**. The dual chains thus pass at uniform speed over the two sprockets **33** fixed to axle **34**.

Similarly the rear portion of the chains **28** pass over a pair of spaced-apart separate sprocket wheels **37** disposed fixedly on an axle **38** in a pair of spaced-apart metal supports **39** secured to insulator board **14** by screws **40**.

The means for actuating the locked together chains **28** a unit of distance equal to the distance between one push rod **20** and its adjacent push rod **20** will now be described.

To effect the forward movement of the chain and thus the rearward movement of the nylon roller wheel **27** over the push rods **20** the chain is indirectly actuated by an electrical pulse. The electrical pulse in plug D through a wire (not shown) actuates a solenoid **41** causing the solenoid core **42** to be pulled into the solenoid up to the core stop lug **43**. The solenoid is mounted on the two rear supports **39** on suitably tall pillars **44**, one on each support **39**.

A metal support plate **45** having a suitable depending channeled trough to receive roller wheel **27** is disposed upon suitable ledges in the end supports **35** and **39** and secured thereto by suitable screws **46**.

The chain operating moveable carriage assembly is disposed over the chains **28** and support plate **45** and adjacent to solenoid **41** and is shown in detail in Fig. 5. This assembly is moved intermitttently with the intermit-

tent pulse operation of solenoid 41. The solenoid core 42 is secured by conventional means such as welding to a fixed post 46 to a moveable carriage plate 47.

The carriage plate 47 is disposed in the channels of four nylon rotatable bearings 48 disposed up four support columns 49 secured by conventional means to plate 45. A pair of columns 49 is secured to each longitudinal side of plate 45 in opposed relationship and the chain passes between said pairs of spaced-apart columns.

A moveable pawl 50 is secured by an axle 51 to a lug 52 secured to carriage plate 47. The pawl 50 is provided with a pair of spaced-apart exterior teeth 53 which ride on the exterior top edge of links 30 of each chain 28 thereby lifting the pawl so that the pawl is moved rearwardly upon a stationary link 30. The pawl 30 is continuously urged downward by a leaf spring 54 secured by a conventional screw to the carriage plate 47. When the pawl has been moved the predetermined distance of the core 42 movement as determined by stop lug 43, the two teeth 53 of the pawl, one for each chain 28, have been pushed on to the top edge of the respective links 30 due to the curved configuration of the rear edge 55 of said teeth. The front edge 56 of the teeth 53 are each provided with a suitable curved crevice to catch the links 30.

Lugs 48X are provided with threaded cavities to receive a slide rod 58. An abutment 59 is secured adjacent each longitudinal edge of stationary plate 45 to said plate 45 by screws 60 with the pair of chains passing between said abutments 59. Each abutment 59 is provided with a longitudinal hole to receive a slide rod 58. Each slide rod 58 is provided with a screw cap 61 and a coil spring 57 is disposed on rod 58 between the stationary abutment 59 and the end cap 61.

As shown in Fig. 5 the rod 58 is threaded at each end and one end is passed slidingly through the hole in the respective abutment 59 and then into the threaded cavity of lug 48X. Thus as the carriage plate 47 with its lugs 48X moves toward the solenoid 41, the rod 58 is pulled toward the solenoid thereby compressing the respective springs 57. Upon release of the solenoid energizing pulse the springs 57 return the carriage plate toward the abutments 59.

It is advantageous to permit the chains to move as a unit only in one direction, from the solenoid end toward the front end. To this end a stationary restrainer 63 is provided. The restrainers, one for each chain, are secured to support plate 45 by conventional means such as screws and in effect are pikes to prevent rearward movement of the chain since the restrainers have pointed ends which engage the pins 32 of the chains. In other words due to the slope or angle of the pointed ends of the restrainers the chain can be pulled over a restrainer only in one direction.

To further lock the chain against displacement and in an immoveable state after each period of movement, it is advisable to employ a hinge lock. To this end a hinge plate 64 having a suitable upright tail 65 is hinged interiorly of and to each abutment 59 and between said abutment and a respective chain 28 by a journal 66. The sloped edge 67 of lug 48X rides on a protruding pin 68 disposed suitably in the hinge 64 causing it to be swung downwardly or toward the terminal board 10 when the carriage plate 47 moves toward the solenoid 41. Each hinge plate 64 has secured to its nose portion 69 a lock cam or stud 70 having a substantially truncated tapered top 71 adapted to be seated between two adjacent pins 32 of a chain. Clearly as carriage plate 47 moves leftwardly (Fig. 5) the edge 67 of lug 48X swings pin 68 and the hinge plate 64 downwardly thereby displacing lock stud 70 from engagement with a chain 28 between a pair of adjacent pins 32. When the carriage 47 returns due to springs 57 the rear edge 71 of the carriage hits the forwardly tilted tail 65 of the hinge plate 64 moving it to its upright position thereby swinging the hinge plate 64 back into its original position with lock stud 70 engaging a pair of adjacent hinge pins 32.

In the operation of the line switch a test resistance 72 is disposed in a respective terminal lug 11 (Fig. 1) and the other end of the resistance 72 is joined to a common ground. Therefore each piece of resistance equipment 72 under test may be treated with a line current by way of conduit 24 and contact point 22 and then by a test voltage or current by way of conduit 25 and contact point 23 upon automatic actuation of a contact switch spring 18 and push rod 21.

The line switch of this invention may be disposed in a suitable rectangular container having a peripheral horizontal lip to which terminal board 10 may be secured as by screws. The container may then be filled with oil, a dielectric to prevent sparking between the various electrical points.

Moreover, a plurality of line switches may be hooked up one to another so that after all the tests have been completed on one line switch the solenoid of an adjacent line switch becomes actuated without need for human attention. To this end the line switch is provided with an electrical multi-switch unit 80 (Fig. 2) to effect automatic change over from one unit to another.

Fig. 4 shows the multi-switch disposed over the front end of the line switch. A suitable support pillar may be secured to each support plate 35 and a bridge plate secured to said support pillars. The switch elements suitably separated from one another by insulator material are secured to this bridge plate over the front end of the switch. In Fig. 4 some of the electrical wires have been eliminated to prevent confusion with the mechanical switching material.

Turning to Fig. 2, the pulse is sent into the multi-switch and then into the solenoid as shown by single barbed arrows. This operates a single line switch unit of say thirty terminal plugs 11. As the wheel 27 completes the testing, a second wheel 27 disposed on and between the chains 28 in diametrically opposed relationship or about 180 degrees apart raises the nylon insulator pillar 91 secured to leaf contact spring 91 and raises also the nylon insulator pillar 92 secured to leaf contact spring 93, said pillar resting on spring 91. Thus spring 91 is brought into contact with contact point 94 and spring 93 is brought into contact point 95.

Where it is not desired to use a series of line switches actuated by a multi-switch but rather only one line switch, then only wheel 27 need be disposed upon chain assembly.

Where a second line switch is hooked up to a first line switch, terminals A and C of the first switch are connected to terminals A and B of the second switch. Terminal D of all banks of switches are connected together and a resetting pulse may then be applied as desired.

When the second line switch is activated the first bank automatically becomes inactive as the energizing current or pulse is transferred to said second line switch.

This invention has been described by means of an illustrative embodiment but clearly other embodiments are possible within its generic scope.

For example, in this invention the entire chain mechanism and switch contacts may be and preferably is disposed in a rectangular container filled with suitable oil. Thus plate 10 may be secured to the flat rim of a suitable rectangular container filled with suitable oil (not shown) by means of bolts passed through the many apertures 10X of plate 10 and said rim of said container. Where the solenoid and adjacent chain mechanism and contact switches are immersed in oil the test voltage used may be as high as 15,000 volts and the current used may be as high as 10 amperes with a non-inductive load.

We claim:

1. An electrical contact switch for actuating in suc-

cession a plurality of electrical contact points comprising a top longitudinal insulator board; a plurality of linearly disposed spaced-apart interconnected contact points secured to the undersurface of said top board; a bottom longitudinal insulator board disposed in space relationship to said top board; a plurality of linearly disposed spaced-apart interconnected contact points secured to the top surface of said bottom board and disposed directly beneath said contact-points secured to the undersurface of said top board; a plurality of linearly disposed spaced-apart continuously upwardly urged leaf contact springs disposed between said top and said bottom boards; a longitudinal insulator spacer disposed between and secured to said top board and said bottom board; means for securing one end of said leaf spring contacts to said spacer leaving the unsecured end of the spring contacts engaging the contact points of said top board; a terminal plug secured electrically to each secured end of said springs; a push rod disposed on each of said springs; mechanical linearly moved continuous spaced-apart link chains means adapted for intermittent movement in one direction for pushing successively said push rods and the respective spring associated therewith out of engagement with said top linearly disposed contact points and into engagement with said bottom linearly disposed contact points; electrical solenoid means for intermittently actuating said mechanical chain a distance equal to the distance between adjacent push rods; a roller wheel disposed between said pair of chains and secured therein; a solenoid having a pulse actuated core; a movable carriage disposed over said chains and below said movable solenoid core; means securing said core and

said carriage fixedly to one another; a longitudinal plate support disposed over and secured to said top board with said pair of chains encompassing said plate support; support means secured to said plate for holding said movable carriage; pawl means having teeth thereon secured to said carriage and having teeth to engage said link chain; spring means for continuously urging said pawl teeth into contact with said chain and spring means secured to said carriage for returning said carriage to its normal position after each intermittent actuation whereby said solenoid core upon actuation moves said carriages and said pawl a predetermined distance and then causing said pawl teeth to engage said chain in pulling contact thereby permitting said carriage return springs to pull said pair of chains a predetermined distance causing said roller wheel to push down a push rod.

2. The switch of claim 1 comprising an abutment secured to said plate support for arresting the return movement of said movable carriage and a lock cam secured hingedly to said abutment and adapted to cam engage said chain between the chain rollers thereof in a locking manner when said movable carriage is in abutting contact with said abutment.

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