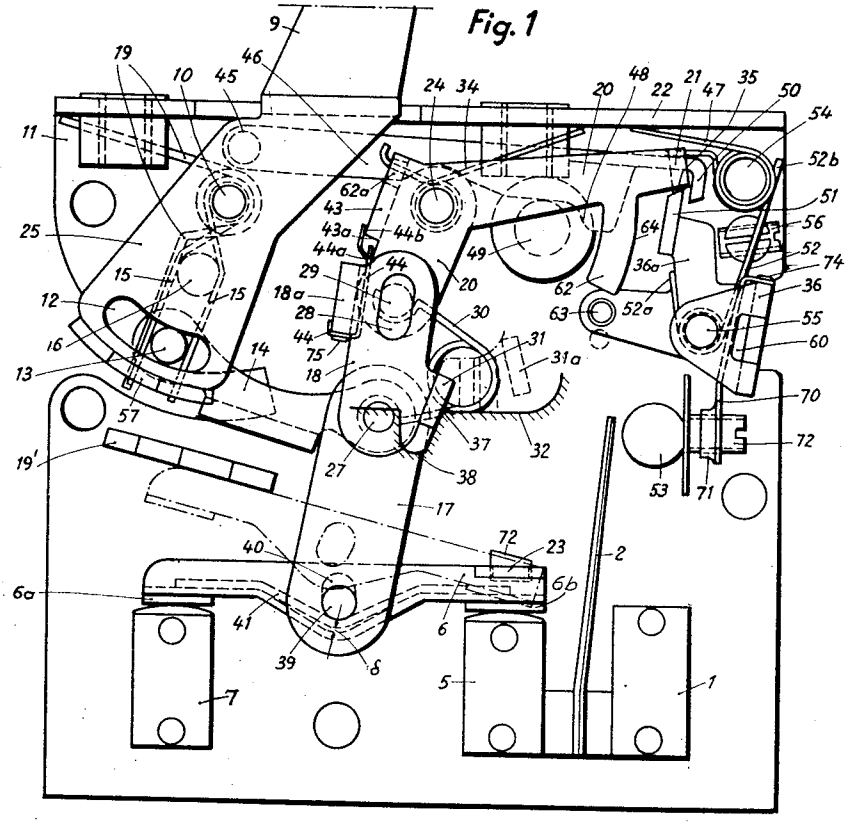
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Fig. 1



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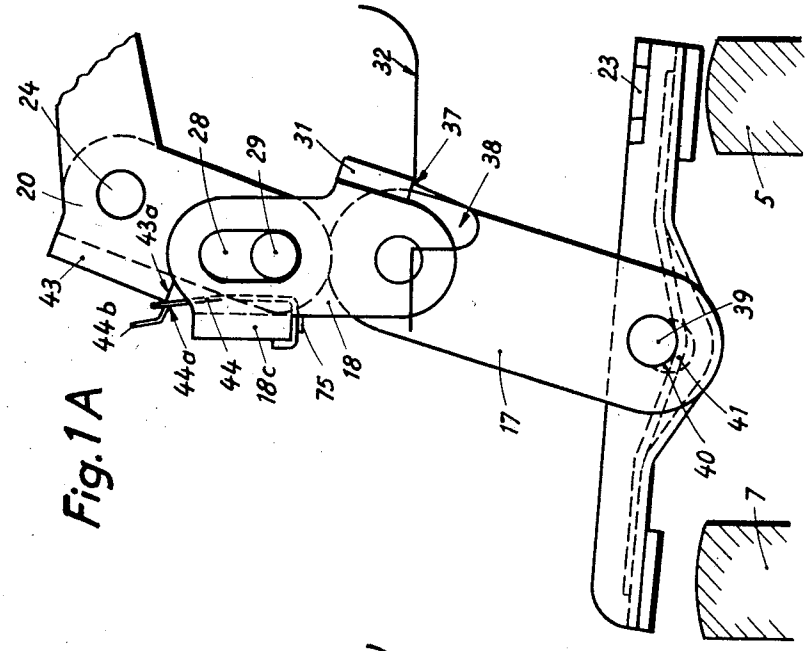


Fig. 1A

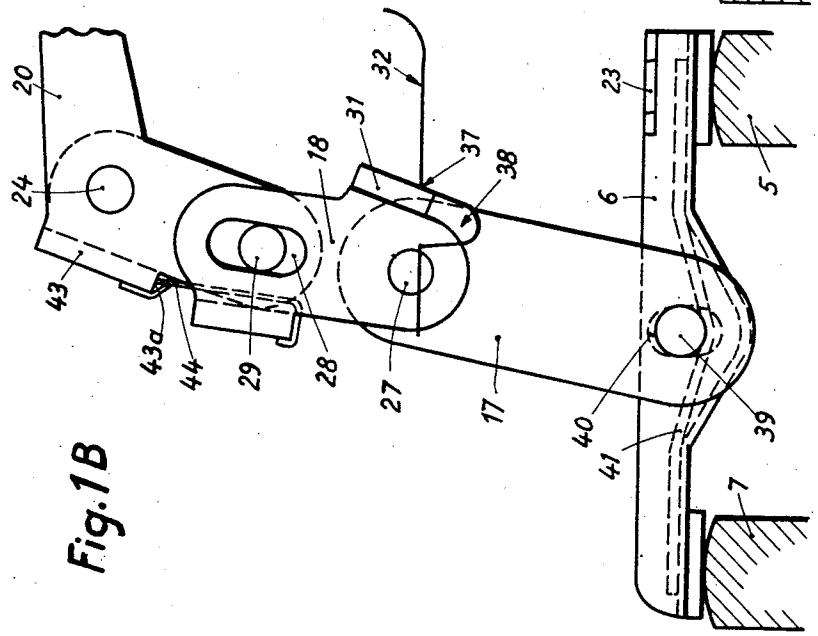


Fig. 1B

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Fig. 1C

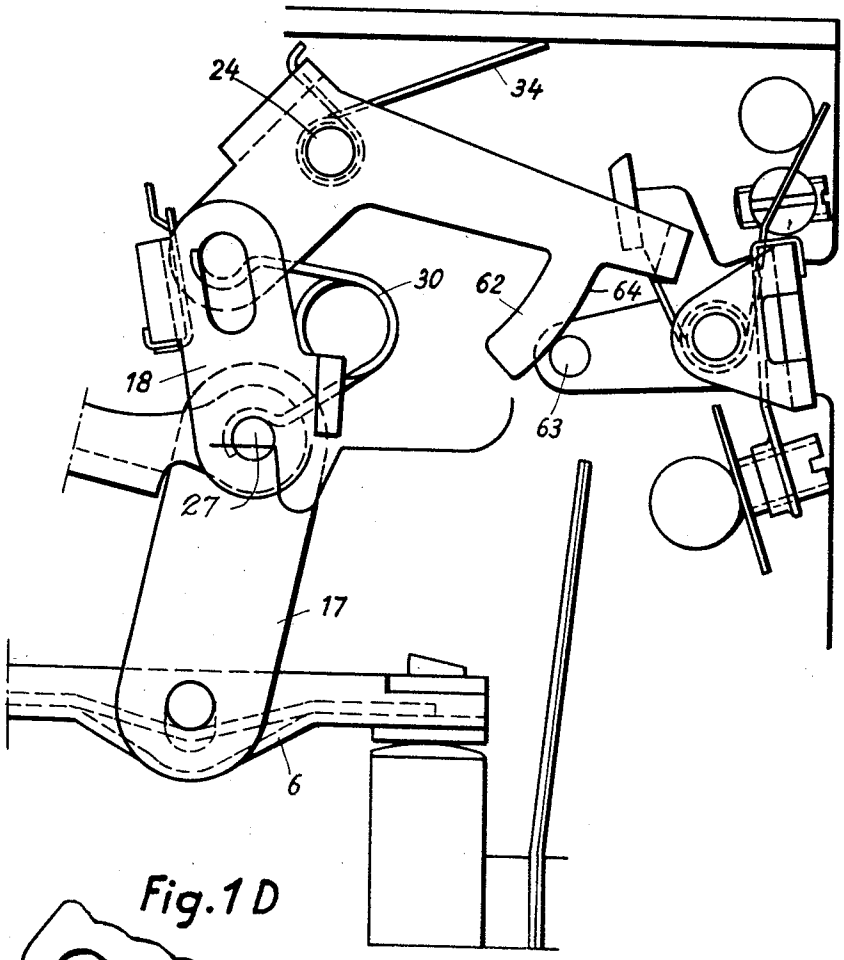
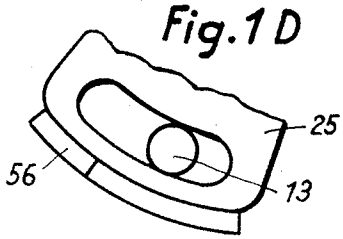


Fig. 1D



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Fig. 2

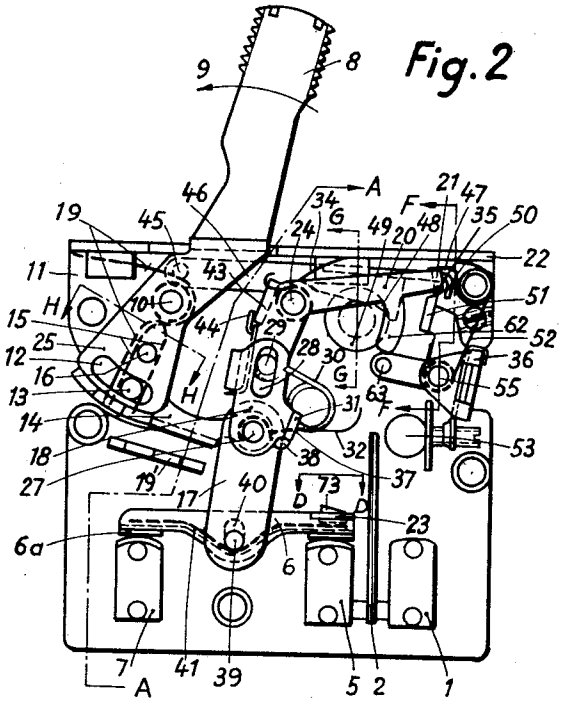


Fig. 3

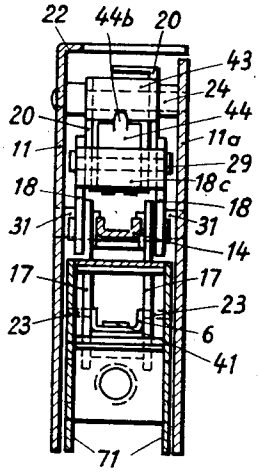


Fig. 4

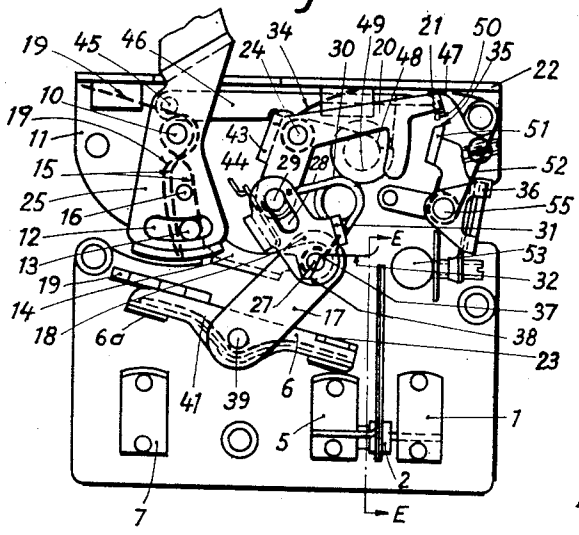


Fig. 4a



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Filed Dec. 22, 1954 8 Sheets-Sheet 5

Fig. 5

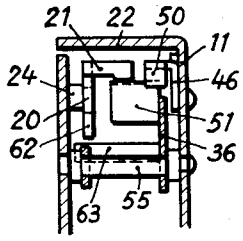


Fig. 6

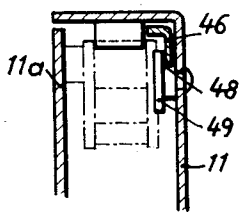


Fig. 7

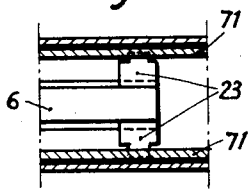


Fig. 8

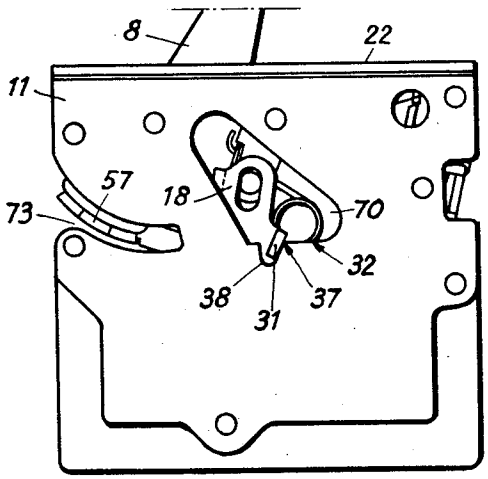


Fig. 12

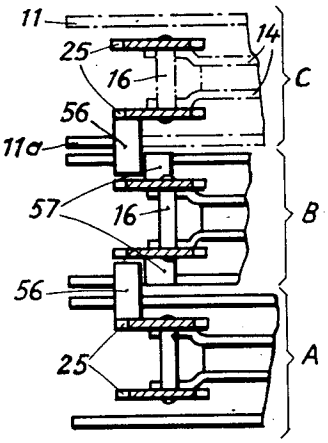
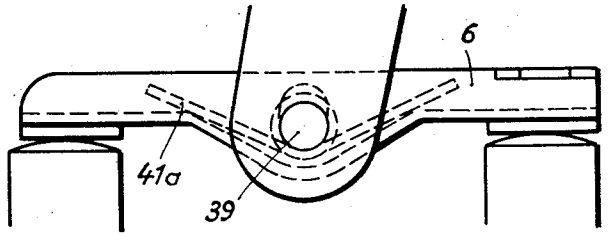


Fig. 9



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Fig.10

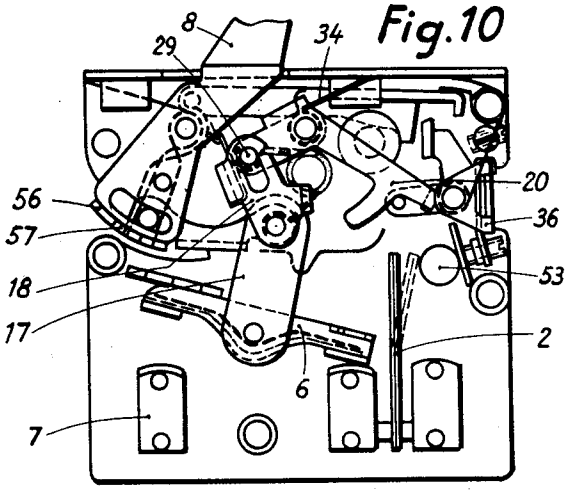


Fig.11a

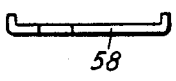


Fig.11

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Fig. 13 A

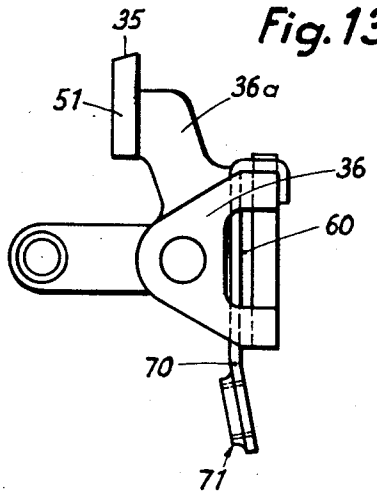


Fig. 13 B

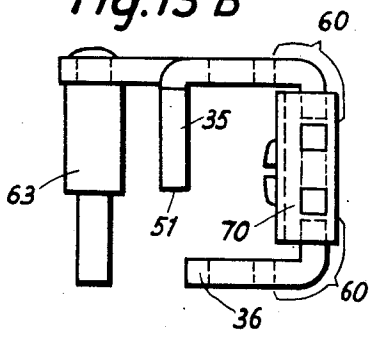
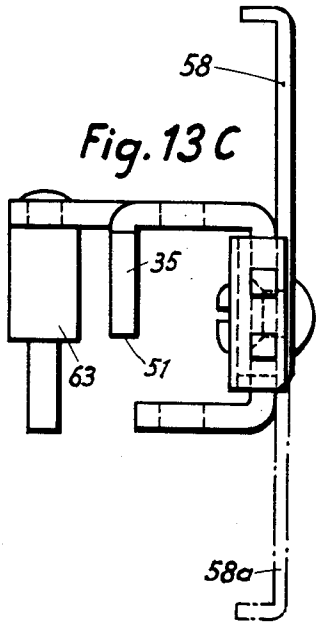


Fig. 13 C



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Fig. 14

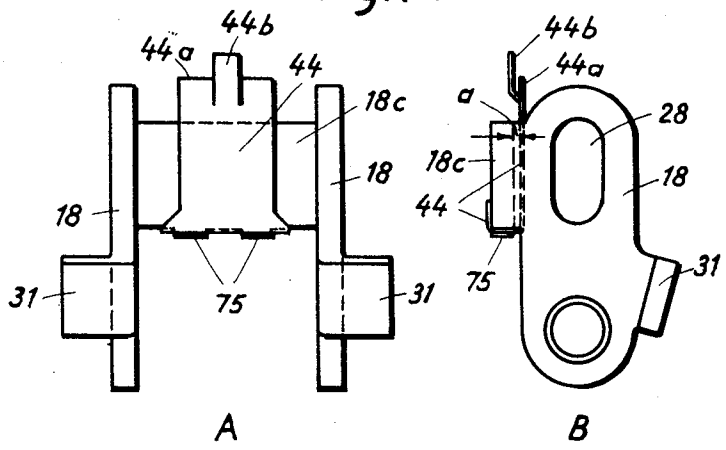


Fig. 15 A

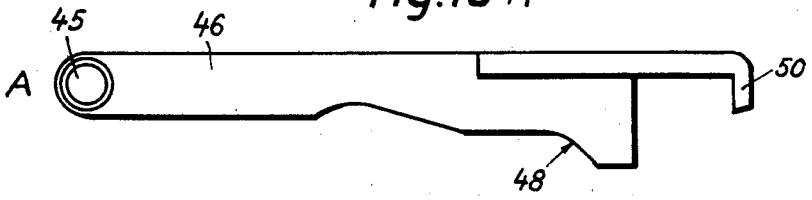
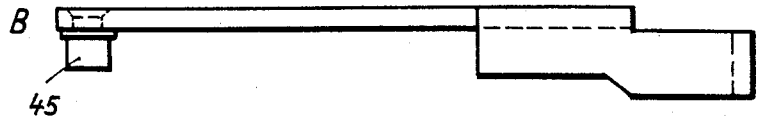


Fig. 15B



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United States Patent Office 2,816,986 Patented Dec. 17, 1957

2,816,986

OVERLOAD TRIPPING SWITCH

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Application December 22, 1954, Serial No. 476,954

Claims priority, application Sweden December 23, 1953

10 Claims. (Cl. 200—116)

The invention relates to an overload tripping switch of the type in which the operating system comprises a knee-joint mechanism whose motion can be controlled either by a manually adjusted, operating member or by the motion of a member, sensitive to the action of heat, e. g. a bimetallic strip. Such switches have the disadvantage that the switch, if it is in "on" position, opens due to jars or causes momentary interruptions in the circuit that the switch controls. Switches of this type which are known up to now have also a complicated design. The present invention intends to provide a switch of this type, in which the now mentioned disadvantages have been eliminated.

The invention will be further described with reference to the attached drawings which show a number of embodiments.

Fig. 1 shows on a large scale a switch viewed from the side with one side plate removed. Fig. 1 A–C shows the link mechanism shown in Fig. 1 in different positions. Fig. 1 D shows a part of the operating device in another position than that shown in Fig. 1.

Figs. 2, 4 and 10 correspond to Fig. 1 but are made on a reduced scale in which case the parts, however, shown in Figs. 4 and 10 are shown in the position they have when the switch is in "off" position. Fig. 4*a* is a section taken along the line E—E in Fig. 4. Figs. 3, 5, 6 and 7 are sections taken along the lines A—A, F—F, G—G and D—D respectively in Fig. 2.

Fig. 8 is a side view of the switch with mounted side plate.

Fig. 9 is an enlarged elevational view of the movable and fixed contacts.

Fig. 11 shows, viewed from the front, three switches which form a unit. Fig. 11*a* shows a detail.

Fig. 12 is a section taken along the line H—H in Fig. 2 whereby it is assumed, however, that three switches are placed side by side.

Fig. 13, A, B and C, show a blocking arm viewed from the side and the top respectively.

Fig. 14 A and B show a link viewed from the front and the side respectively.

Fig. 15 A and B show a connecting arm viewed from the side and the top respectively.

Figs. 16–19 show a modification whereby Figs. 16–18 show, viewed from the side in different positions, the parts of the mechanism according to Fig. 1 which are affected by the modification. Fig. 19 shows a section taken along the line I—I in Fig. 16.

All components of the switch are mounted between two side plates **11** and **11***a*, of which **11** in one edge is bent to form an L-member **22**. The turnable parts of the switch are carried by journals with bearings in the two side plates **11** and **11***a*. In Fig. 1 is shown the position of the various components when the switch is in "on" position. The circuit for the current that is to be switched off is connected to the terminals **1** and **7** and the current passes from the terminal **1** through a bimetal **2** and the

terminal **5** and through the contact arm **6** operated by the switch which is pivoted at its right end, the contact arm **6** (Figs. 1, 3 and 7) which is U-shaped in section being on either side provided with a tab **23** which rests in a slot **72** in a plate **71** of insulating material arranged on the inside of each side plate **11** and **11***a* respectively. Said slot **72** (Fig. 1) has a sloping edge at the top whereby the arm **6** is allowed to take the position shown by lines of dots and dashes in Fig. 1. The arm **6** is in its ends provided with contact members **6***a* and **6***b* which can be held against the fixed contact terminals **7** and **5**.

The operating members of the switch consist of a rocker arm **8**, **25**, whereby **8** is the handle and **25** the lower part of the arm comprising two pieces of plate of the same shape which are parallel with each other. The rocker arm is pivoted on a journal **10**, fastened between the side plates **11**. In the part **25** there is a slot **12**, in which the journal **13** rests on which is pivoted one end of a connecting arm **14**, whose other end is connected by a journal **27** with a knee-joint mechanism. This mechanism comprises two links **17** and **18** connected with each other by means of the journal **27** and a releasing arm **20**, connected with the link **18** by means of a journal **29**. The journal **13** is held in its position by the two shanks of a shear spring **15** (Fig. 1) which is placed around the journal **10** and whose shanks rest against a pillar **16** fastened to the rocker arm member **25**. A spring **19**, placed around the journal **10** and resting against the journal **13**, tends to turn the rocker arm in the direction of the arrow **9**. If the switch is in the "off" position (Fig. 4) the last mentioned turning tendency will result in that the left shank of the shear spring **15** pushes the journal **13** with the connecting arm **14** and the journal **27** to the right, which results in a pull in the links **17** and **18**. Thereby the free end of the link **17** tends, via the journal **39**, to turn the contact arm **6**, journalled in the tabs **23**, against a fixed shoe **19'** and the free end of the link **18** tends—by action of the journal **29** which is journalled in the releasing arm **20** and which in this position rests against the upper edge of a slot **28**, arranged in the link **18**—to turn the releasing arm **20** counter-clockwise around the journal **24**, on which it is journalled in the side plate, so that the free end **21** of this arm rests against the gable piece **22**. Hereby the components of the switch have the position shown in Fig. 4 and the connection between the contacts **6***a* and *b* and the fixed contacts **5** and **7** is broken. The arm **6** may have only one switching-off point **6***a*, **7** and the contact members **6***b* and **5** may be omitted. When the switch is operated in the "on" position, the parts should be changed from the position shown in Fig. 4 to the position shown in Fig. 2 and the handle **8** is thereby turned clockwise (Fig. 4). The spring **19** is hereby tensioned and the connecting arm **14** with the journal **27** and the links **17**, **18** is brought to the left through the pressure which is exercised by the right shank of the shear spring **15** against the journal **13**. A coil spring **30** whose free ends rest against the journals **27**, **29** tends to press the journals in the direction away from each other. When the journal **27**, influenced by the connecting arm **14**, is moved to the left (in Fig. 4), the knee, formed by the links **17** and **18**, will be straightened out which involves, partly that the link **17** turns the connecting arm **6** around its bearing **23** at the right end of the arm, so that its left contact **6***a* moves towards the fixed contact **7**, and partly that the pull from the link **18** upon the journal **29** ceases, through which the spring **34** (see also Fig. 1), which has its one end pressed against the L arm **22** and its other end brought through a hole **62***a* in the releasing arm **20**, can turn the connecting arm **20** clockwise until

the free end 21 of the arm 20 strikes against a shoe 51 on a blocking arm 36 (Figs. 1, 5 and 13).

As mentioned above, the link 18 is made with two equal link halves which are parallel with each other, each being provided with a tab 31 (Figs. 1, 3 and 8), which projects at right angles to the side plate 11 and is brought through a slot 70 in the side plate (Fig. 8). The lower edge 32 of the slot 70 forms a guiding surface for the tab 31, said guiding surface being provided with a notch 38. For the sake of simplicity only the edge 32 and the notch 38 of the slot 70 have been drawn in Figs. 1, 2, 4, 9 and 10. When the link 18 moves horizontally the tab 31 slides against the guiding surface and when the tab reaches the notch 38 it can drop down into the same which permits a displacement of the link 18 in a downwardly direction, which will be further described in the following. When the switch is in the "off" position the tabs 31 has the position shown in Fig. 4 and the position shown by dotted lines 31*a* in Fig. 1 and, when switching on, each tab 31 moves down and strikes against the guiding surface 32 and slides thereafter along the horizontal edge of the guiding surface. During the lastmentioned motion the left end 6*a* of the contact arm 6 takes a position between the shoe 19 and the fixed contact 7. At the same time the spring 30 is tensioned and the arm 18 with the slot 28 is brought upwards relative to the journal 29. The pull force in the arm 14—which is necessary to tension the spring 30 and to overcome the friction between the tabs 31 and the guiding surface 32, when the rocker arm 8, 25 has been turned clockwise during the motion—loads the shear spring 15 until the journal 13 rests against the right edge of the slot 12. Close to the final position of the rocker arm the tab 31 has been brought forward to the corner 37 on the action of guiding surface 32 (Fig. 1A) and by the shear spring 15—which presses against the journal 13 and brings this back to its rest position in the middle of the slot 12 between the shanks of the shear spring 15, when the friction between the tabs 31 and the guiding surface 32 decreases—the tab 31 is drawn over the corner (Fig. 1B), after which the tab 31 on account of the pressure from the spring 30 is quickly brought down into the notch 38 of the guiding slot. As a result, the contact arm 6 is quickly brought down against the contact members 5 and 7 through which a momentary closing of the current circuit is obtained. Necessary contact pressure is obtained by the pressure from the spring 30, whose whole pressure is taken up, partly by the journal 29 and partly—by means of the journal 27 and the arm 17—by the contact arm 6. The two halves of the link 18 (Figs. 3 and 14) are kept together by a middle piece 18*c* and that part of the releasing arm 20, which is located between the journals 24 and 29, also consists of two plate members, connected with each other, and kept together by a middle piece 43. Also the link 17 consists of two equal pieces which are parallel to each other (Fig. 3) suitably of insulating material in order to insulate the contact arm from the mechanism. From Figs. 1 and 14 it is clear that near the middle piece 18*c* on the link 18 is bent and fastened, e. g. by a rivet 75, a leaf spring 44 whose upper end 44*a* projects slightly over the middle piece 18*c* and co-operates with the middle piece 43 on the arm 20 in such a way that when the switch is in "on" position (Fig. 1) the upper edge of the end 44*a* is only a relatively short distance from the lower edge of the middle member 43, through which it is prevented that the links 17 and 18, when the switch is subjected to jars, move any appreciable distance in their lengthwise direction (upwards in Fig. 1). The leaf spring 44 has at the top a tab 44*b* (Figs. 1 and 14) which prevents the spring end 44*a* from sliding in to the right of the middle piece 43 which sliding would otherwise neutralize the blocking function of the spring 44. In the embodiment shown it is intended that there shall be a play of e. g. 0.2 millimetre between the upper edge of the spring end 44*a* and

the middle piece 43 when the switch is "on," which implies that the links 17 and 18 can only move 0.2 millimetre in the lengthwise direction. Thereby it is prevented that the switch releases for shakes since it is required for making a releasing by a jar possible, that the link 18 moves upwards (in Fig. 1) so much that each of the tabs 31, which is carried by the same, is moved out of the notch 38. From the drawing (Fig. 14*b*) it is clear that the spring 44 is firmly fastened to the middle piece 18*c* in such a way that there is a certain space *a* between the spring and the inner surface of the middle piece through which the spring can be bent when it presses against the middle piece. This means that when the link system is transferred from released to closed position (Fig. 1A) and each of the tabs 31 during their motion in the slot 32 is at the edge 37 of the notch 38, the spring end 44 strikes against the corner of the middle piece 43 and is bent against the middle piece 18*c* in order then, when the tabs sink down into the notch 38, to slip over the edge of the middle piece 43 and take the position shown in Fig. 1.

On the other hand, when the switch releases, the link 18 is turned relative to the arm 20 and the spring 44 is thereby brought to such a position that it cannot block the link 18 (see Fig. 4).

The spring 44 now described, in combination with a spring 41 in the contact arm 6 (see Figs. 1, 2 and 3), also prevents that the contact between the contact members 6*a*, 7 and 6*b*, 5 respectively is momentarily broken by jars, that is, blinkings are prevented. Said spring 41, which consists of a leaf spring, is placed in the bottom of the arm 6 which is U-shaped in section and provided with a cavity on the middle, in such a way that the ends of the spring rest against the bottom of the arm 6 but the center section is at a certain distance from same bottom. The journal 39 (Fig. 1), which is journalled in the link 17, passes through an oval-shaped hole 40 in the arm 6. When the contact between the arm 6 and the contact 7 is broken, as shown in Fig. 1A, the spring 41 presses the journal 39 against the upper edge of the hole 40, but when the switch is "on" (Fig. 1) the link 17 will, on account of the spring pressure from the spring 30, be pressed downwards, whereby the journal 39 is pressed down against the lower edge of the hole 40 by which the spring 41 is tensioned and the arm 6 is pressed against the contact 7. Even in closed position (Fig. 1) there is a certain space δ between the lower surface of the spring 41 and the bottom of the contact arm 6 and the spring 41 tends to press the journal 39 upwards. As mentioned above, the spring 44 on the link 18 allowed that the links 17 and 18 could be displaced by jars about 0.2 millimetre in their lengthwise directions. The play in the hole 40 (Fig. 1) for the journal 39 is greater than 0.2 millimetre and a motion of about 0.2 millimetre in the lengthwise direction of the links 17 and 18 will not cause the journal 39 to strike against the upper edge of the slot 40 and will therefore not involve that the contact arm 6 is lifted from the fixed contacts 5 and 7. The arm 6 will instead be held by the leaf spring 41 pressed against the contacts 5 and 7 provided that the jars are not too strong for the leaf spring 41 to withstand the accelerating forces from the contact arm 6. The weight of the latter should therefore be kept low in relation to the pressure exercised by the leaf spring. An improvement is hereby obtained of the security against momentary interruptions (blinkings) in the current circuit caused by blows and jars.

In Fig. 1B it is assumed that the system is subjected to an accelerating force in an upwardly direction. The links 17, 18 with the tabs 31 have been displaced upwards and the leaf spring 44 has struck against the shoe surface 43*a* of the middle piece. The journal 39 has been brought up into the slot 40 and the pressure from the leaf spring 41, which has relaxed somewhat, is sufficient to press the arm 6 against the fixed contacts 5 and 7.

The leaf spring 41 may be replaced by a coil spring

41*a*, e. g. a piano wire wound around the journal 39 and with its ends resting against the bottom of the arm 6, as shown in Fig. 9.

For a manual releasing of the switch the parts shown in Figs. 1 and 2 should be changed to the position shown in Fig. 4 and the rocker arm 8 is thereby turned counter-clockwise around the journal 10. During the turning the slot 12 will be displaced over the journal 13 and in final position the journal will be in the left half of the slot 12. At the same time the left shank of the shear spring 15 has been loaded and tends to move the journal 13 and the arm 14 (which carries the journal 13) to the right. The arm 14 is mechanically connected with the links 17, 18 through the journal 27 and as long as the tabs 31 are in their notches 38 the pressure from the arm 14 cannot overcome the knee formed by the links 17, 18 which is the condition for releasing the switch. To enable this there is an operating arm 46 journalled around a pin 45 in the rocker arm 8, 25, the appearance of said arm 46 being evident from Figs. 1 and 15 and which co-operates with the shoe 51 on the above-mentioned blocking arm 36, the latter one being pivoted around the pin 55, fastened to the bottom plate 11. A spring 52 is wound around the pin 55 and its one shank presses against a pillar 54 in the bottom plate 11 and its other shank is at its end 52*a* perpendicularly bent and presses against the upwardly directed part 36*a* of the blocking arm 36 by which this latter is given a counter-clockwise turning moment. The motion is limited by a firm stop member 56. The above-mentioned operating arm 46 is in its free end formed into a hook 50 and is on its lower part formed into a cam 48 which, when the arm 46 is displaced by the movements of the rocker arm 18, 25, slides against a pillar 49 fastened to the bottom plate, whereby the hook 50 is brought upwards or downwards. The cam 48 on the operating arm 46 is kept pressed against the pillar 49 through the spring 47 placed around the firm pillar 54. When the arm 46, on releasing the switch by the rocker arm 8, is moved to the left (Fig. 1) the hook 50 strikes against the shoe 51 (see also Fig. 5) and drives this so that the blocking arm 36 is turned counter-clockwise against the action of the spring 52. As mentioned before, the end 21 of the releasing arm 20 rests under spring pressure partly from the spring 30, which presses against the pin 29, journalled in the arm 20, thereby giving the arm 20 a clockwise turning moment, and partly from the spring 34 against the shoe 51 and when this latter one is by the hook 50 moved clear of the end 21 so that this end is no longer restrained by the shoe 51, the releasing arm 20 will turn clockwise, whereby the knee, formed by the arm 20 and the link 18, is bent to the left at a somewhat smaller angle than in Fig. 4. The pin 29, which is journalled in the releasing arm 20, is brought up against the upper edge of the slot 28 through the pressure from the spring 30 and during the continued motion, when the spring 34 alone turns the arm 20 clockwise, the pin 29 will carry with it the link 18 whereby the tabs 31 are pulled up from their notches 38. At this moment, when the parts of the mechanism take the position shown in Fig. 1*c*, the pressure from the arm 14 can be released and the pin 27 with the links 17 and 18 be rapidly carried to the right, whereby the link 17 pulls up the contact arm 6 so that switching-off is made and the link 18—by having the upper edge of the slot 28 resting against the pin 29—pulls the pin 29 downwards to the right, giving a counter-clockwise turning moment, which is greater than and counter to the moment from the spring 30, on the arm 20, so that the end of said arm, previously turned downwards, is carried upwards until it strikes against the L-member 22 of the bottom plate. All components of the switch have then been changed to the positions shown in Fig. 4. The hook 50 of the operating arm 46 has thereby—through co-operation between the cam 48 and the pillar 49—been carried upwards to enable that the blocking arm 36 with the shoe 51 operated by the spring 52 through a clockwise turning motion can be brought back to the position shown in Fig. 1.

The releasing of the switch can also be made thermally. For this purpose there is a bimetallic spring 2 (Fig. 4*a*), mounted on the terminals 1 and 5, through which spring the current passes and which is heated by the current. On the blocking arm 36 there is by the rivet 74 fastened a band-shaped arm 70 whose end is formed into a bushing 71, in which a screw 72 is threaded which carries a ball 53 of insulating material. The distance between the ball 53 and the bimetallic spring 2 can be adjusted by means of the screw 72. If it is assumed that the switch is "on" and the current exceeds a previously determined value, it is assumed that the blocking arm 36—through influence by the bimetallic spring 2 which by the heating has turned to the right—has turned counter-clockwise so much that the shoe 51 on the blocking arm has been carried away from the end 21 by which the releasing arm 20 rests against the shoe 51 and the arm 20 can therefore be turned clockwise and the parts thereby be returned in the abovementioned manner to the position shown in Fig. 4 under the influence of the spring 19 in the rocker arm which spring, when the switch is "off" (Fig. 1), tends to carry the arm 14 and therewith the knee between the links 17 and 18 to the right.

In the case that the rocker arm 8, after switching on, is retained in its position (as indicated in Fig. 10) and a switching off, caused in a thermal way occurs, the releasing arm 20 is under the influence of the spring 34 turned a greater angle than at a normal release. The pin 29 in one end of the releasing arm 20 will thereby bring with it the links 17 and 18 and also the contact arm 6 upwards, by which the contact between the arm 6 and the fixed contact 7 even in this case is broken.

A single-pole switch has been described above. In the case that a multi-pole switch is used, e. g. in three sections, it is desirable that all sections are released even if only one of the sections is overloaded. This requirement can be fulfilled by building together several switches according to the invention in a manner that will now be further explained.

In Figs. 11 and 12 is shown a three-pole switch, built together of three single-pole switches A, B and C, whereby only the middle switch has been provided with a handle 8. When switching on manually the handle 8 on the rocker arm of the switch B is operated and to enable thereby that also the switches A and C are switched on, the rocker arm of the switch B is provided with driving members which at the motion of the rocker arm in switch B bring with them the rocker arms in the switches A and C. The lower part of each rocker arm consists, as mentioned before, of two plate pieces 25 which are parallel to each other (see Fig. 12, which is a section along the line H—H in Fig. 2). Each plate piece 25 of the switch B is now provided with a tab 57 which is bent up perpendicular to the plate (see Fig. 1 and Fig. 12). The plate piece 25 on each side switch A and C respectively, which is located close to the switch B, is also provided with a tab 56 (Figs. 1*c* and 12), so placed that when the rocker arm in the middle switch B is turned when switching in, the rocker arms in the switches A and C are brought with it so that even these switches are switched in. The tabs 56 and 57 project out of the sides of the side plates 11 and 11*a* through openings 73 made in the same (see Fig. 8).

When switching off—manually or thermally—one of the switches, the motion-transmission to adjacent switch must be made via the blocking arm 36, as this arm controls the releasing of the switch. For this purpose the blocking arms 36 in the various switches A, B, C are connected together with one another by connecting arms 58 (see Fig. 11, details in Fig. 11*a*), which are perpendicularly bent out in the ends. Each blocking arm 36 is provided with two slots 60 (see Figs. 1, 11, 13A and C). The connecting arm 58 is riveted with the rivet 59 (see

Fig. 11) to the blocking arm **36** of the switch A and has its left end inserted in the left slot **60** in the same blocking arm. The right end of the arm **58** is inserted in the left slot **60** in the blocking arm **36** of the switch B. A connecting arm **58***a* is in the same manner fastened to the blocking arm **36** of the switch C as indicated in Fig. 11. The right (resp. left) end of the connecting arm **58** (resp. **58***a*) is consequently inserted into its corresponding slot **60** in the blocking arm **36** of the middle switch B, whereby there is a certain space **61** (Fig. 11) between the connecting arm **58** (resp. **58***a*) and the upper (resp. lower) edge of the slot **60**, which enables that one blocking arm **36** of the switches A, B or C respectively can turn a certain angle without the connecting arm **58** and **58***a* respectively touching any of the sides in the corresponding slot **60**, that is without the arm **58**, **58***a* driving the blocking arm **36** of the adjacent switch. The force obtained from the bimetal **2** on thermal releasing is not sufficient to turn all three blocking arms in the switches A, B and C, and the device has therefore been so designed that a certain additional motion is obtained when one of the switches has started to release, which additional motion causes that also the two other switches release. On the releasing arm **20** in each switch there is for this purpose a downwardly directed projection part **62**, which can strike against a pin **63** on the blocking arm **36** (Figs. 1, 2 and 5). If the switch from a closed position (Fig. 2) starts to release owing to that the bimetal **2** bends and acts upon the insulating ball **53**, the blocking arm **36** is turned in the manner previously indicated, so that the releasing arm **20** is made free and turns clockwise, whereby the projection part **62** strikes against the pin **63** on the blocking arm **36**. The clockwise turning moment of the releasing arm **20** is effected by the springs **30**, **34** and **41** and hereby the blocking arm **36** receives an essential contribution to the counter-clockwise turning motion that is given the arm on account of influence from the bimetal **2**, which contribution is sufficient that the blocking arm **36** of the switch that has released, e. g. the middle switch B, shall—on its turning—by means of the connecting arms **58** and **58***a*—be able to drive the blocking arms **36** of the switches A and C. The space **61** between the connecting arm **58** and the inner edge of the slot **60** should be so dimensioned that the end of the arm **58** does not make contact with the edge of the slot before the projection part **62** on the releasing arm **20** by striking against the pin **63** on the blocking arm **36** has given the blocking arm a small additional motion. In the case that one of the switches A or C, e. g. A, releases first, the blocking arm of this switch will carry with it through the arm **58** the blocking arm in the switch B, whereby this switch releases. Through the additional moment which is obtained in the last-mentioned switch through co-operation between the projection part **62** and the pin **63** in the last-mentioned switch, the connecting arm **58***a* will carry with it the blocking arm **36** in the switch C whereby all three switches will be released. In the case that by two-pole switching only two switches are used, only one connecting arm **58** will of course be required. The above-mentioned additional motion of the blocking arm **36**, which is effected through co-operation between the projection part **62** on the arm **20** and the pin **63** on the blocking arm **36** ceases after the tip of the projection part **62** has turned the blocking arm to such a position that the right edge **64** of the projection part **62** slides against the surface of the pin **63**. The last-mentioned edge is namely formed as a part of a circle, whose centre is the centre of the journal **24** (see Fig. 1).

The now described additional motion of the blocking arm **36** has been described in connection with thermal releasing, but this motion will also take place at manual releasing of the switch, whereby it may be assumed that the handle **8** of the three-pole switch shown in Fig. 11 is operated. The hook **50** on the arm **46** carries with

it as described above, the shoe **51** on the blocking arm **36** when the handle **8** on manual releasing is turned counter-clockwise. However, at the same time the arm **46** with the shoe **50** is lifted (Fig. 1), on account of co-operation between the cam **48** on the arm **46** and the pillar **49**, and in the movement when the hook **50** has turned the blocking arm **36** with the shoe **51** to such a position that the end **21** of the releasing arm **20** moves clear of the shoe **51**, so that the arm **20** can release, the hook **50** has been raised so much that, on the continued motion to the left of the arm **46**, it can no longer carry with it the shoe **51**. At this moment the tab **62** on the releasing arm **20** strikes against the pin **63** on the blocking arm **36**, for which reason even in this case an additional motion for the blocking arm **36** is obtained which is sufficient to turn the blocking arm of the adjacent switch.

The invention can be modified in several ways within the scope of the idea of the invention. The blocking of the link **18** may be effected, instead of by the leaf spring **44**, by a spring actuated blocking member **80**, journalled on the pin **29** (Figs. 16–19). The blocking member **80** is in its one end provided with a shoe **81**, intended to co-operate with the pin **27**, and in the other end provided with a flange **82**, against which one end rests of a coil spring **83**, wound around the pin **29**, which spring tends to turn the blocking member **80** counter-clockwise, so that the flange **82** rests against the middle piece **43** in the arm **20**. When the switch is on (Fig. 1) the parts take the position shown in Figs. 16 and 19, the shoe **81** is at a slight distance from the pin **27** and a displacement of the link **18** in its lengthwise direction is then prevented by the blocking member **80** since this is journalled on the pin **29**, which is fixed in this position of the mechanism. When the switch is to be released the arm **20** and the link **18** are turned—as described above—relative to each other and the arm **20** drives the blocking member **80** to the position shown in Fig. 17, in which the blocking arm **80** cannot prevent the motion of the link **18**. When the switch is to be operated to "on" position the pin **29** is—just before the tabs **31** fall into the notches **38**—in the lower part of the slot **28** and on turning the link **18** clockwise around the pin **29**, the pin **27** engages the shoe **81** and turns away the blocking member **80** clockwise, against the action of the spring **83**, from the position this has when the spring **83** presses the flange **82** against the middle-piece **43** (about the position the member **80** has in Fig. 16) and to the position shown in Fig. 18. From this position the tabs **31** fall down into the notches **38** in the way described above, whereby the blocking member **80** by the spring **83** is turned counter-clockwise to the blocking position shown in Fig. 16. As it would seem, even in this embodiment the blocking member prevents the link **18** to be displaced in its lengthwise direction more than a limited part when the switch is on, without the blocking member preventing the motion of the parts at "on" and "off" operation of the switch.

The invention can also be modified in such a way that the band-shaped arm **70**, carried by the blocking arm **36**, which carries the insulating ball **53** consists of a bimetallic strip, whereby temperature compensation is obtained for temperature variations in the ambient air. If e. g. the temperature of the ambient air increases, it is assumed that the bimetallic strip **2** turns to the right on account of which the distance between the strip **2** and the ball has decreased—in the case that the arm **70** consists of ordinary metal—without any current passing the bimetal. When the bimetal **2** is then heated by the current, it will make contact with the insulating ball **53** and release the switch for a lower current strength than before the temperature of the ambient air increased. To compensate this error the arm **70** consists of bimetal so arranged that when the temperature of the air increases also the arm **70** bends to the right, by which the distance

between the bimetal 2 and the ball 53 will be the same as before the heating.

I claim:

1. An overload tripping switch having a housing and a knee joint mechanism comprising a first link and a second link, a journal pivotally connecting one end of said first link to one end of said second link, a connecting arm having one end in engagement with said journal for effecting movement thereof, a movable contact member secured to the opposite end of said first link adapted to engage at least one fixed contact member, a releasing arm pivotally secured to said housing and being pivotally and displaceably connected at one extremity to the opposite end of said second link, a heat sensitive member controlling the pivotal movement of said releasing arm to a releasing position, blocking means comprising a spring actuated blocking member and a shoulder member, one of said members being associated with said second link and the other of said members being associated with said releasing arm, relative rotation of said releasing arm and said second link towards an engaged position of said movable contact member with said fixed contact member being operative to dispose said spring actuated blocking member in blocking longitudinal alignment with said shoulder member, said blocking means limiting relative longitudinal movement of said second link and said releasing arm towards each other when said movable contact member is in engaged position with said fixed contact member.

2. An overload tripping switch as set forth in claim 1, wherein said blocking member is secured to said second link, and said shoulder member is fastened to said releasing arm, said blocking member comprising a leaf spring having one end secured to said second link with the plane of said leaf spring at substantially right angles to the plane of said second link, the lengthwise direction of said leaf spring coinciding with the lengthwise direction of said second link.

3. An overload tripping switch as set forth in claim 2, wherein said second link and said releasing arm each comprise a pair of spaced parallel members, a middle piece connecting each pair of members intermediate their longitudinal extremities, said middle piece of said second link comprising said leaf spring, and said middle piece of said releasing arm forming said shoulder member.

4. An overload tripping switch as set forth in claim 1, wherein said movable contact means is rotatably and displaceably supported intermediate its ends by said first link on a journal and is adapted to be displaced in a direction perpendicular to the lengthwise direction thereof, spring means disposed in said connection between said first link and said movable contact member urging said movable contact member into a direction away from said first link.

5. An overload tripping switch as set forth in claim 4, wherein said journal is carried by said first link and said spring comprises a coil spring, said coil spring encompassing said journal and having its free end in engagement with said movable contact member on each side of said journal.

6. An overload tripping switch as set forth in claim 1,

wherein the connection of said releasing arm and said second link comprises a journal, said blocking member comprising a blocking arm rotatably supported on said journal and said shoulder member comprises said journal connecting said first link and said second link, spring means associated with said blocking arm urging said arm into engagement with said releasing arm, movement of said first link when said movable contact member is in engaged position with said fixed contact being limited by the engagement of said blocking arm with said journal connecting said first and second links.

7. An overload tripping switch as set forth in claim 1, wherein each side of said second link comprises a perpendicularly extending tab, said housing comprising a longitudinal cam terminating in a perpendicularly disposed notch, said tabs being slidable along said cam and into said notch as said movable contact member is moved into engagement with said fixed contact, the engagement of said tabs with said notch preventing movement of the connected ends of said first and second links in a direction perpendicular of the longitudinal direction of said links by said connecting arm while permitting displacement of said links in said longitudinal direction.

8. An overload tripping switch as set forth in claim 7, wherein said housing comprises a pair of parallel plates and said cams comprise openings in said plates, said second link comprising a pair of spaced parallel members disposed between said plates and each having a tab extending perpendicularly outwardly therefrom through said openings and into engagement with said cam surfaces.

9. An overload tripping switch as set forth in claim 1, wherein movement of said releasing arm to releasing position is controlled by a blocking arm, said heat sensitive member comprising first switch temperature responsive means associated with said blocking arm releasing said blocking arm from blocking relationship with said releasing arm in response to predetermined movement of said first temperature responsive means resulting from an increase in switch temperature, and second temperature responsive means associated with said first temperature responsive means regulating said predetermined movement thereof in response to changes in the ambient air temperature.

10. An overload tripping switch as set forth in claim 4, wherein said spring means disposed in said connection between said first link and said movable contact member comprises a leaf spring.

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