Aug. 5, 1969 F. GUSTAVSON 3,459,914

CONTACTS FOR THE POLES OF ELECTRICAL SWITCHGEAR

Filed Sept. 27, 1967

Fig. 1.

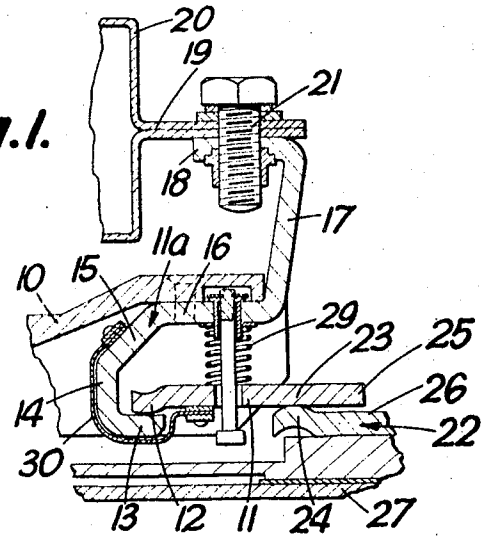
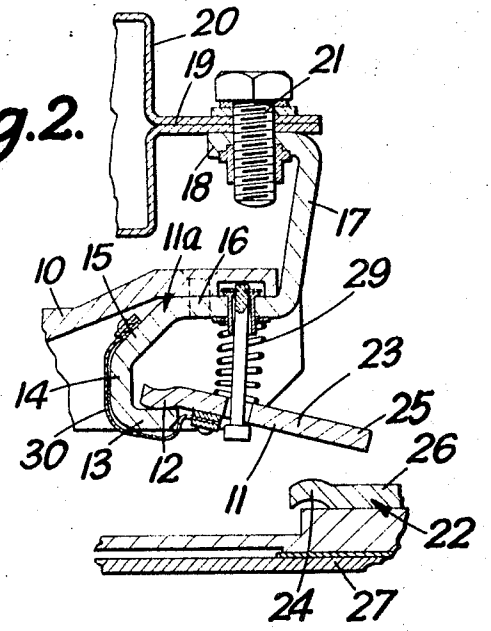


Fig. 2.



INVENTOR

FREDRIK GUSTAVSON

By Young & Thompson

ATTYS.

United States Patent Office 3,459,914 Patented Aug. 5, 1969

3,459,914

CONTACTS FOR THE POLES OF ELECTRICAL SWITCHGEAR

Fredrik Gustavson, Lahall, Sweden, assignor to Aktiebolaget Peritus Enkoping, Sweden, a Swedish body corporate

Filed Sept. 27, 1967, Ser. No. 670,996
Int. Cl. H01h 1/50
U.S. Cl. 200—170 4 Claims

ABSTRACT OF THE DISCLOSURE

A contact system for one pole of electrical switchgear. The contact system has a fixed contact and a further contact which is resiliently mounted on a movable contact bridge. The current path through the system bends back on itself and has a part in anti-parallel relationship to the two contacts so that the movement of the resiliently mounted contact away from the fixed contact is assisted by a force derived from the interaction of the currents flowing in the said part and the contacts.

This invention relates to a contact system for single-pole or multi-pole electrical switchgear comprising per pole at least one series-connected contact system.

Contact systems for switchgear wherein contact pressure is increased by an electrodynamic force originated by the actual flow of current are known. With low-voltage switchgear in particular, where the distances between phases (the distances between poles) are relatively small as compared with the possible heavy excess currents with which the contacts may have to deal, and where, too, dimensions are small in other respects and the current paths are short, there are considerable difficulties in achieving adequate contact pressures by simple means and reasonable mechanical dimensioning.

It has often been found, more particularly with low-voltage switchgear, that contact systems formed as parallel knives or as parallel or anti-parallel current paths or as current paths at right-angles and so on, cannot satisfactorily provide the increased contact pressure desirable for some kinds of switchgear. Each current path both in contact systems and in switches must always somewhere be so arranged that the force components originated by the current tend in some respects to reduce contact pressure—i.e. they are directed in the directions of contact opening.

The idea underlying the present invention is that forces produced by the current and acting on the contacts in the closure direction should be very considerable and forces produced by the current and acting on the contacts in the opening direction should be very reduced. Only then can the resultant force operative in the direction of contact closure be very considerable. To ensure that the resulting force, originated by the current and acting on the contacts, can be increased and can be built up by super position of the various force components originated by the current and the current paths, consideration cannot be given only to the shape and relative arrangement of the current paths. Consideration must also be given more particularly in the case of low-voltage switchgear, to the iron components forming part of the mechanisms and frame. Constructional items made of a magnetic material can either reduce or increase force components acting on the contacts. Of course, such components can be arranged to act in both the contact-closing and contact-opening directions.

An object of the invention is to provide a simple and economical contact system which is well adapted for use

in compact low-voltage switchgear. The shaping of the current paths and the positioning of the branches of the current paths in the mutual relationship specified by the invention lead to the resulting force which is produced by the current on the resilient contact in the closure direction thereof being increased very considerably.

Further objects and features of the invention will be apparent from the following description of one embodiment thereof, reference being made to the accompanying drawings in which:

FIGURE 1 is a partly sectioned diagrammatic view of a contact system with contacts in the closed position; and

FIGURE 2 is a view similar to FIGURE 1 of the same contact system but in the open position.

Referring to FIGURES 1 and 2 there is illustrated a contact system having a single pair of co-operating contact elements. A moving contact bridge **10** carries a movable contact member comprising a resiliently mounted part **11**, one end **12** of which bears against a portion **13** of the remaining rigid part **11***a* of the movable contact member. This part includes portions **14**, **15**, **16** and **17**. The resiliently mounted part **11**, in the closed position, is substantially parallel to the portion **16**.

The rigid part of the moving contact member is bent through nearly a right angle between portions **16** and **17**, the resiliently mounted part **11** being outside this angle. The end portion of the right part may be bent in another direction to be connected to another contact system: alternatively, and as shown, the portion **17** is bent so that its end **18** may be connected to one terminal **19** of a fuse holder **20** by a bolt **21**.

The fixed contact member adapted to co-operate with the movable contact member comprises a bar or strip or the like **22** formed at one end as the fixed contact portions **24**, **26** forming a main contact and a break contact respectively co-operating with portions **23**, **25** of the resiliently mounted part **11**. In the closed position, a contact spring **29** and a ribbon flexible connection **30** hold the contacts **23** and **24** together. The other end of the element **22** can be connected to a supply source.

When the contact system is in the closed state, current flows through the fixed contact member **22** and the main contact **24** to the resilient main contact **23** of the moving contact part **11**. The current flows through the moving contact so that the resilient part thereof and the rigid part **16** are traversed by anti-parallel currents. The distance between these anti-parallel current paths is arranged to be a few millimetres only; the electrodynamic force component acting on the resilient part **11** in the direction of contact closure is relatively great. The resilient part **11** is disposed outside the angle formed by the portions **16** and **17**, and thus the electrodynamic force component acting on the part **11** in the sense to open the contacts and deriving from inter-action between, on the one hand, the current flowing in the part **11** and, on the other hand, the current path which is formed by the portion **17** and which extends towards the part **11** substantially at right angles is very small. If a current substantially parallel to the resilient part **11** flows through the rigid element **19**, a component of force is produced which tends to open the contacts. However, the distance between these latter current paths is large compared with the distance between the current path in the resilient part **11** and its anti-parallel current path in the portion **16**, and so this latter component of force is also much less than the component operative in the sense of a closure. Consequently (except for very high currents), the current itself acts to increase the contact pressure. Of course, there are further magnetic field components, and therefore force components, acting on the resilient part **11**

in all directions; this and conditions in the contacts **23** and **24** between the contact members can mean that there is an upper current limit at which the forces acting on the resiliently mounted part **11** are greater in the sense of an opening than in the sense of a closure. The upper current limit is normally very high, and even where spring forces are moderate and the current paths, the contacts and the between-phase distances are of small dimensions, sufficient contact forces can be produced to withstand the forces produced by the heavy short-circuit current which may flow in modern electricity distribution systems. The electrodynamic force acting on the part **11** in the closure direction might be further increased by disposing the plate **27** (which normally forms part of the housing) parallel to the current path through the resilient part **11** and as close as possible thereto, so that such element **27** co-operates with the current flowing through the resilient part **11** to produce a force component which acts on the part **11** in the direction of contact closure and thus further increases the contact pressure.

Of course, due to reactive interactions of the current paths in the iron plate, force components are also in this case produced which act upon the resilient contact member in contact-opening direction. In a way similar to the one described above with reference to the direct interaction between the current paths, said force component in contact-opening direction will until a certain current limit be less than the force component in contact-closing direction. Consequently the resulting electrodynamic force acting in contact-closing direction will be further increased.

To ensure that arcing occurring at rupture shall occur at the break contacts i.e. the outer end **25** of the resiliently mounted portion **11** and the corresponding fixed break contact **26**, the resilient part **11** is secured at one end by the connection **30** and its contact spring **29** is disposed between the two ends. Consequently, at rupture, the resilient part **11** forms an angle (less than a right angle) outwards from the rigid portion **16**. This position is shown in FIGURE 2. The break contacts **25**, **26** first close, and only then do the main contacts **23**, **24** separate, whereafter the break contacts separate and draw out the arc between them. Owing to the hairpin-shape of the current path via the substantially parallel portions **16** and **11** and the portions **16** and **17**, the electrodynamic forces blow the arc outwards from the free end **25**. Rupturing is therefore satisfactory; if required, an arcing chamber can be placed in front of and around the break contacts in conventional manner.

The contact system can of course be modified from the foregoing without departing from the scope of the invention. For instance, the contact parts of the fixed and movable contact members can be changed over so that the movable contact member becomes fixed and the fixed contact member becomes movable.

The ability of the invention to increase effectively contact pressure by means of the current itself and also to provide satisfactory rupturing is usually greatest in cases where the current paths extend parallel and at right angles, but in practical constructions there are bound to be slight deviations from this state of affairs. The contact system, as well as being of use for various kinds of low-current switchgear, is also useful for all kinds of switchgear in which the actual current is required to increase the contact pressure.

I claim:

1. A contact system for at least one pole of electrical switchgear, comprising a movable contact member and a fixed contact member, one contact member comprising a resiliently mounted contact part and a rigid contact part, wherein the rigid contact part is formed with two portions substantially at a right angle in the plane containing the longitudinal axis of the resiliently mounted contact part and the latter is resiliently mounted in the same plane and is pivotally connected in series with one end of the rigid contact part, whereby the resilient contact experiences in the direction of contact closure a force deriving from cooperation between current in the resiliently mounted contact part and the current which flows, in anti-parallel relationship to said current, in one of said portions in said rigid contact part; said resiliently mounted contact part being placed at a small distance from said one portion, the electrodynamic force acting on the resiliently mounted contact part in the closure direction being increased by a ferrous element which is wider than the rigid contact part and whose plane is substantially at right angles to contact movement.

2. A contact system for at least one pole of electrical switchgear, comprising a movable contact member and a fixed contact member, one contact member comprising a resiliently mounted contact part and a rigid contact part, wherein the rigid contact part is formed with two portions substantially at a right angle in the plane containing the longitudinal axis of the resiliently mounted contact part and the latter is resiliently mounted in the same plane and in pivotally connected in series with one end of the rigid contact part, whereby the resilient contact part experiences in the direction of contact closure a force deriving from cooperation between current in the resiliently mounted contact part and the current which flows, in anti-parallel relationship to said current, in one of said portions in said rigid contact part; said resiliently mounted contact part being placed at a small distance from said one portion, the rigid contact part being pivotally connected in series at one end with one end of the resiliently mounted contact part, the mounting of the resiliently mounted contact part being arranged so that arcing occurs between the outer free end of the resiliently mounted contact part and the other contact member.

3. A system as claimed in claim 2, wherein one end of the resiliently mounted contact part projects inwards of one end of the other contact member.

4. A system as claimed in claim 3, wherein the rigid contact part of one contact member is connected to a holder for a fuse.

References Cited

FOREIGN PATENTS

1,092,100 11/1960 Germany.

H. O. JONES, Primary Examiner