Jan. 28, 1958 F. KESSELRING 2,821,609

RECTIFIER CONTACT STRUCTURE

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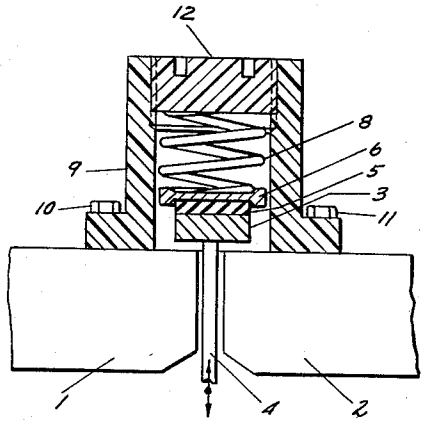


FIG. 1

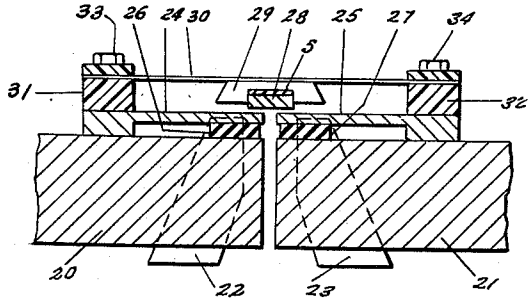


FIG. 2

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RECTIFIER CONTACT STRUCTURE

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7 Claims. (Cl. 200—166)

My invention relates to contact structures for rectifiers, and is more particularly directed to novel anti-bounce and dampening means for electro-magnetic and mechanical rectifiers.

The contact structure to which my invention is particularly adaptable may be utilized in electro-magnetic rectifiers as shown in co-pending applications Serial No. 237,721, filed July 20, 1951; Serial No. 237,693, filed July 20, 1951; Serial No. 249,594, filed October 3, 1951; Serial No. 656,562, filed March 22, 1946; Serial No. 115,983, filed September 16, 1949; Serial No. 183,577, filed September 7, 1950; Serial No. 249,731, filed October 4, 1951; Serial No. 343,077, filed March 18, 1953; Serial No. 343,078, filed March 18, 1953; Serial No. 343,079, filed March 18, 1953; and in mechanical rectifiers such as those shown in co-pending applications Serial No. 301,880, filed July 31, 1952; Serial No. 307,024, filed August 29, 1952; Serial No. 307,067, filed August 29, 1952; Serial No. 331,467, filed January 15, 1953.

In co-pending application Serial No. 361,777, filed June 15, 1953, there is shown a spring structural arrangement which is particularly adaptable for use in the contact structure of electro-magnetic rectifiers, in order to reduce contact chattering and bouncing.

My invention is related to the same object as this co-pending application. However, my instant invention achieves the desired results and eliminates the necessity of various dampening springs. That is since prolonged use of moving contact rectifiers may alter the characteristics of the springs, I have provided a novel means to achieve anti-bouncing and dampening of the cooperating contacts without the necessity of providing auxiliary springs for this purpose.

In my novel arrangement, I provide cushioning material having resilient properties such as rubber or materials having a silicone base, which are vulcanized or secured to either the movable or semi-stationary contacts in order to absorb the excess kenetic energy.

The utilization of a cushioning material, which may be sandwiched in a variety of locations within the contact structure, not only enables the elimination of anti-bouncing springs, but also substantially reduces the mass which must be carried by the cooperating contacts. That is, since the specific weight of non-metallic elastic materials is in the order of 1.0 it is possible to maintain the movable contact of an electro-magnetic rectifier as a substantially massless structure.

Furthermore, the non-metallic cushioning material will substantially reduce the chattered noise which has heretofore been considered inherent in the operation of both mechanical and electro-magnetic rectifiers.

Accordingly, the primary object of my invention is to provide a novel arrangement for both mechanical and electro-magnetic contact means, wherein contact chatter and bouncing is eliminated without the necessity of adding dampening masses or resilient springs.

Still another object of my invention is to provide non-metallic materials having elastic and resilient characteristics which may be secured to the movable contact of a mechanical or electro-magnetic rectifier or to the semi-stationary contacts of a electro-magnetic rectifier; to provide proper dampening and anti-bounce characteristics for the structure.

A still further object of my invention is to provide resilient cushion material such as rubber or material having a silicone base for the contact structure of a rectifier, which will eliminate contact chatter and bouncing without increasing the mass of the cooperating contact structure, will substantially reduce the noise of operation and will retain its initial characteristics although subjected to constant operation.

These and other objects of my invention will be apparent from the following description when taken in connection with the drawings in which:

Figure 1 is a schematic sectional view of the contact structure which may be used in a mechanical rectifier.

Figure 2 is a schematic section view of a contact structure which may be utilized in an electro-magnetic rectifier.

Referring now to Figure 1. In Figure 1 I have shown a contact structure which may be utilized in a mechanical rectifier such as that described in co-pending applications Serial No. 301,880, filed July 31, 1952; Serial No. 307,024, filed August 29, 1952; Serial No. 307,067, filed August 29, 1952; Serial No. 331,467, filed January 15, 1953. The contact structure consists of the stationary contact buses 1 and 2 having a gap therebetween which is bridged by the movable contact 3 when the structure is in a closed position.

In the illustration of Figure 1, I have shown the cooperating contacts 1, 2—3 in a disengaged position, that is the push rod 4, which may be driven by a synchronous motor through a cam mechanism as described in the above-identified co-pending applications, is forcing the movable contact 3 upward against the force of the spiral biasing spring 8 to thereby hold the contacts in the illustrated disengaged position.

An insulating housing 9, secured in any desirable manner, as for example, bolts 10 and 11, houses the movable contact 3 and its biasing spring 8. A cap 12 which may be threadably engaged with the housing 9 is utilized to adjust the magnitude of bias, in course, of the spiral spring 8 on movable contact 3.

A plate 6 is positioned below the spiral spring 8 and a non-metallic elastic and resilient cushioning material 5 is positioned between the plate 6 and the movable contact 3. The cushioning 5, which may be rubber or a material of the silicone base, is secured to both the plate 6 and the movable contact 3, as for example, by a vulcanizing process.

In the position shown in Figure 1 the push rod as noted above, is holding the contacts shown, thereby compressing the non-metallic resilient material 5 between the movable contact 3 and the plate 6.

Hence, when the insulated push rod 4 is moved downwardly the entire structure consisting of the plate 6, the cushioning material 5 and the movable contact 3, will be driven downwardly due to the closing biasing force of the spiral spring 8.

When the movable contact 3 initially engages the stationary contacts 1, 2 it will tend to bounce off the stationary surfaces. However, there is a continuous downward force on the contact. Due to the biasing spring 8 the excess kinetic energy of the movable contact 3 will be temporarily absorbed by the cushioning material 5, so as to prevent chattering or bouncing of the cooperating contacts.

Hence, with my novel arrangement as above described, and disclosed in Figure 1, it is possible to eliminate chattering and bouncing without the necessity of additional

anti-bounce springs and still retain the weight of the movable contact at a minimum and partly reduce the noise during the contact opening and closing operations.

In Figure 2 I have a contact structure for an electromagnetic rectifier wherein **20** and **21** represent the bus bars which form a portion of the stationary contacts. Semi-stationary contacts **24** and **25** are respectively secured to the bus bars **20** and **21**, in any desirable manner.

Magnetic poles **22, 23** are energized when current flows from the bus bar **20** to the semi-stationary contact **24** through the bridging movable contact **28**, to the second semi-stationary contact **25**, to the bus bar **21**.

The leaf spring **30** which is supported at its end by the insulators **31** and **32**, which in turn are secured to the structure by means of the bolts **33** and **34**, carry the armature **29** and the movable contact **28**. The switch of Figure 2 is shown in the contact disengaged position. This structure can be used in any of the aforementioned co-pending application which relates to electro-magnetic rectifiers wherein a non-metallic resilient member **5** is inserted between armature **29** and movable contact **30**.

A non-metallic cushioning material having a resilient and elastic characteristic, as above described, in connection with the cushion **5** of Figure 1, may be sandwiched between the semi-stationary contacts **24, 25** and the bus bars **20, 21**, respectively.

Thus, when the rectifier is energized, the armature **29** will move downwardly to engage the pole faces of the magnetic poles **22, 23**. That is, the entire structure will move down against the opening bias force of the leaf spring **30** to thereby bring the movable contact **29** into electrical bridging engagement with the semi-stationary contacts **24** and **25**. Since the semi-stationary contacts **24** and **25** have cushioning material **26** and **27** respectively, positioned underneath, the excess kinetic energy during the closing operation will be absorbed by the elastic material **26** and **27** and the elastic material **5** positioned between armature **29** and movable contact **30**.

The cushioning material **26, 27** may be secured to the semi-stationary contacts **24, 25** and to stationary bus bars **20, 21** in any desirable manner, for example by means of the vulcanizing process.

As is well known in the electro-magnetic rectifier art, after the contacts are moved to engaged position the flow of load current through single turn winding will create a sufficient electro-magnetic force to hold and maintain the cooperating contacts in height pressure electrical engagement.

Thus, it is noted that by providing elastic resilient material **26, 27**, which has low residual stress, it is possible to construct a switch arrangement wherein contact chatter and bouncing can be eliminated.

Furthermore, it is noted that the device has these dampening characteristics without the necessity of adding additional springs and metallic units. In addition to these features the non-metallic cushioning material will substantially reduce the noise during the continuous opening and closing operations.

It will be noted that I have shown preferred structural arrangements in the embodiments of Figures 1 and 2. However, it will be apparent to those skilled in the art that the cushioning material may be situated in positions other than those indicated and still achieve the same desired results. For example, in the embodiment shown in Figure 2 it is possible to sandwich a non-metallic elastic material between the movable contact **28**, and the armature **29** and secure same to both units, so that it will be capable of absorbing the excess kinetic energy when the impact velocity exceeds a pre-determined limit, as for example, 30 centimeters per second.

In the foregoing, I have described my invention only in connection with preferred embodiments thereof. Many variations and modifications of the principles of my invention within the scope of the description herein are obvious. Accordingly, I prefer to be bound not by the specific disclosure herein but only by the appending claims.

I claim:

1. In a switching device for a rectifier comprising a pair of stationary contacts and a movable contact having an engaged and disengaged position with respect thereto, means to effect said contact engagement and disengagement between said stationary and movable contacts; non-metallic resilient material fastened to said movable contact and positioned between said movable contact and said contact engaging means to prevent contact chattering and bouncing when said contacts are moved to said engaged position.

2. A contact structure for a mechanical rectifier comprising a pair of stationary contacts and a bridging contact, said bridging contact having engaged and disengaged position with respect to said stationary contacts; bias means to bias said movable contact into contact engagement with said stationary contacts; non-metallic resilient member positioned between said movable contact and said biasing means; a push rod to defeat the force of said biasing means and move said movable contact into disengaged position with respect to said stationary contacts; said cushioning means preventing contact chatter and bouncing when said movable contact is moved into electrical bridging engagement with said stationary contacts.

3. A contact structure for an electro-magnetic rectifier comprising a pair of stationary contacts, a pair of semi-stationary contacts, a magnetic pole, an armature and a movable contact; a leaf spring secured at each end, said leaf spring carrying said armature and said movable contact; said semi-stationary contacts secured to said stationary contacts; a first non-metallic cushioning means positioned between said stationary contacts and said semi-stationary contacts a second non-metallic resilient member fastened to said movable contact and positioned between said movable contact and said armature, said movable contact having engaged and disengaged position with respect to said semi-stationary contacts; said leaf spring biasing said armature and said movable contact into said disengagement with respect to semi-stationary contact; said first and second non-metallic resilient members dampening the oscillation of said movable contact when said movable contact is moved into bridging contact engagement with said semi-stationary contacts.

4. In a contact structure for an electro-magnetic rectifier comprising a pair of stationary contacts, a movable contact and an armature; said movable contact having an engaged and disengaged position with respect to said stationary contacts, biasing means to carry said armature and said movable contact and to bias said movable contact into disengaged position with respect to said stationary contact; non-metallic elastic means secured to and positioned between said movable contact and said armature; said cushioning means preventing chattering and bouncing of said contacts when said movable contact is moved into engaged position with respect to said stationary contacts.

5. A contact structure for a mechanical rectifier having an armature and comprising a pair of stationary contacts and a bridging contact, said bridging contact having engaged and disengaged position with respect to said stationary contacts; bias means to bias said movable contact into contact enagement with said stationary contacts; non-metallic resilient member positioned between said movable contact and said biasing means; said non-metallic resilient member secured to said armature; a push rod to defeat the force of said biasing means and move said movable contact into disengaged position with respect to said stationary contacts; said cushioning means preventing contact chatter and bouncing when said movable contact is moved into electrical bridging engagement with said stationary contacts.

6. A contact device comprising a first contact, a second contact, a non-metallic resilient member, and means to move said first contact into and out of engagement with said second contact; said means including a biasing means for contact engagement, said non-metallic resilient member positioned between said biasing means and said first contact to absorb kinetic energy upon engagement of said first and second contacts.

7. A contact device comprising a stationary contact, a movable contact, a first means to operate said movable contact into engagement with said stationary contact and a second means to operate said movable contact out of engagement with said stationary contact; a

non-metallic resilient member compressible to absorb kinetic energy developed in said movable contact and said stationary contact, said non-metallic resilient material fastened to said movable contact and positioned between said first means to operate said movable contact into engagement with said stationary contacts and said movable contact.

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