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RECIPROCATING TAPPET DEVICE OF VARIABLE TAPPET LENGTH

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Fig. 1

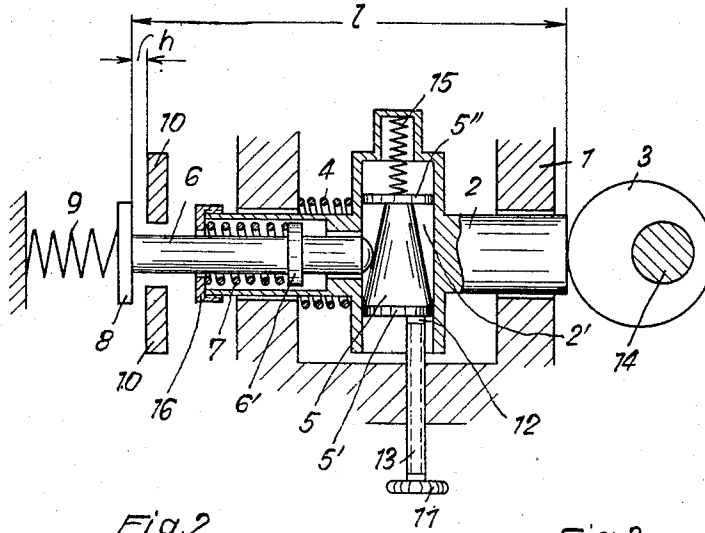


Fig. 2

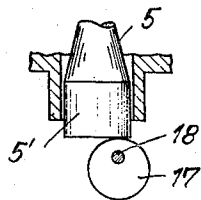


Fig. 3

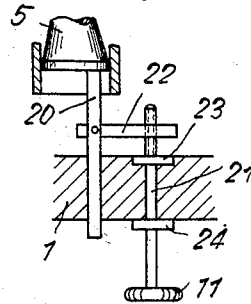
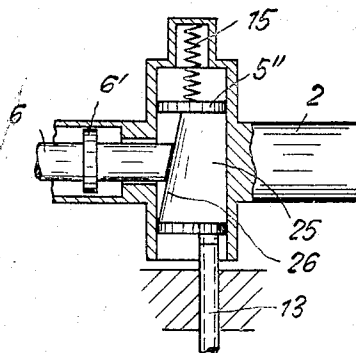


Fig. 4



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VARIABLE TAPPET LENGTH

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7 Claims. (Cl. 74-55)

1 My invention relates to reciprocating mechanisms in which a cyclically operating drive, such as a continuously revolving cam shaft, imparts a periodic motion to a driven member through a tappet whose length determines the interval of time within which the driven member is moved from its rest position during each cycle period of the drive. More particularly, the invention relates to devices in such tappet mechanisms that permit varying the tappet length for adjusting, control or regulating purposes.

Reciprocating tappet devices are used, for instance, in mechanical converters or contact rectifiers for electric currents, where these devices serve to periodically separate a movable contact from a stationary contact at a definite moment and for a definite interval of time within each cycle period of an alternating current. In such converters the length of the tappet and the revolving speed of a cam shaft driving the tappet determine the duration of the recurrent interval within which the circuit is closed by engagement of the movable contact with the stationary contact. In a more specific aspect, therefore, my invention also relates to such tappet-operated mechanical converting apparatus.

It is an object of my invention to provide a tappet device of the kind above-mentioned with means that readily permit adjusting and changing the tappet length during the reciprocating operation of the tappet device and that are also favorably distinct by a simple and reliable design readily suitable for either manual or automatic control.

According to my invention, the reciprocating tappet in a device, otherwise as described in the foregoing, consists of an assembly which comprises a first tappet portion (tappet body) guided for axial reciprocal motion, and a second tappet portion (tappet member) which is axially displaceable in the tappet body and is forced by a spring into engagement with a slanted adjusting structure. The adjusting structure is displaceable in the tappet body at an angle to the tappet axis with the aid of a control element that does not participate in the reciprocating movement of the tappet. This permits varying the length of the tappet assembly during the operation of the device and thus varying, for instance in a contact converter, the interval of time during which the electric circuit is closed, without change in the stroke frequency and in the amplitude of the driving motion imparted to the assembly.

It is preferable to make the adjusting struc-

2 ture displaceable in the tappet body in a direction perpendicular to the axis of tappet movement. The control element for displacing the structure may consist of a lever or of a screw spindle which acts upon the adjusting structure preferably in opposition to a spring.

The foregoing and more specific objects and features of my invention will be apparent from the embodiments of the invention exemplified on the drawing and described in the following. In the drawing, Fig. 1 is a sectional and partially schematic view of a contact converter with a cam-driven tappet device for controlling the movable converter contact; while Figs. 2, 3, and 4 show respective sectional views of three modifications of a detail pertaining to the tappet device.

As shown in Fig. 1, the tappet assembly is mounted on a stationary support 1 and has a main tappet portion or body 2 guided in the support for axially reciprocating motion. The tappet body engages an eccentric cam 3 on a cam shaft 14 which is in continuous revolution at constant speed during the normal operation of the converter. Instead of a cam shaft the tappet may be driven by any other suitable means, for instance, by a crank, or by a lever driven from an eccentric.

In the illustrated embodiment the tappet body 2 is held against the cam 3 by a spring 4 which abuts against the stationary support 1. However, the tappet body 2 may also be linked with the cam in a kinematically constrained manner, such as by a pin and groove engagement, so that a biasing spring is unnecessary.

Inserted into an axial bore of the tappet body 2 is a second tappet portion consisting in the illustrated embodiment of a cylindrical tappet member 6. Member 6 is axially displaceable in body 2 and is biased by a spring toward engagement with an adjusting structure 5. To permit inserting the tappet member 6 into the tappet body 2, the bore of body 2 is covered by a screw cap 16 which also forms an abutment for the spring 7 whose other end bears against an annular shoulder 6' of member 6.

In the embodiment of Fig. 1 the adjusting structure 5 is composed of a frusto-conical body and two cylindrical end discs 5' and 5''. The discs are in slidable engagement with the cylindrical wall of a transverse bore 2' in the tappet body 2. The tappet member 6 projects axially from the tappet body 2 so that the total axial length of the tappet assembly is determined by the position which the displaceable structure 5

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occupies in the bore 2'. The free end of tappet member 8 abuts against a movable contact member 9 of the converter during only a portion of the tappet stroke, the length of this portion being dependent upon the length of the tappet assembly. The movable contact member 9 is biased by a spring toward bridging engagement with two mutually insulated stationary contact members 10. During each cycle of tappet reciprocation the movable contact 9 is lifted from the stationary contacts 10 during a given interval of time and thereafter remains in bridging engagement with the stationary contacts 10 during another interval which occupies the rest of the cycle period.

A screw spindle 13 serves as a control element for displacing the adjusting structure 5 within the bore 2' of the tappet body 2. The outer end of spindle 13 carries a wheel or disc 11. The inner end of spindle 13 has a slide surface 12 with which it abuts against a corresponding slide surface of the adjusting structure 5, both slide surfaces extending parallel to the tappet axis. The screw spindle is threaded through a stationary part of the apparatus, for instance and as shown, through the support 1 which also guides the tappet body 2. When displacing the adjusting structure 5 relative to the tappet body 2, the tappet member 6 is axially shifted thus changing the length *l* of the tappet assembly as well as the lifting height *h* of the movable contact 9. Consequently, the contact closing interval can be adjusted and varied while maintaining a uniform tappet-stroke cycle during the operation of the converter. During the reciprocating movement of the tappet assembly the slide surface of the adjusting structure 5 moves along the slide surface 12 of the screw spindle 13.

For maintaining the adjusting structure 5 in a secure engagement with the spindle 13, the illustrated embodiment is equipped with a pressure spring 15. Such a spring is not necessarily required because the force exerted by the tappet member 6 upon the adjusting body 5 has a component which in Fig. 1 has a downward direction and which, with a suitable choice of the cone angle of structure 5, can be made large enough to overpower the frictional resistance.

The control means for displacing the adjusting structure, instead of having a screw spindle in engagement with the structure, may also be equipped with a straight rod or slider which is guided in the stationary structure of the apparatus and is axially shifted, for instance, by means of a lever. However, the displacement of the adjusting structure during the operation of the tappet device may also be effected by means of an eccentric or other cam member. To this end the lower cylindrical part 5' may be extended as shown in Fig. 2 to provide an end face at which it is in engagement with an angularly adjustable eccentric 17. The tappet length is changed by correspondingly turning the shaft 18 of the eccentric 17. Unintended displacements of the eccentric during the reciprocating operation of the tappet device are to be prevented.

In order to keep the control wheel 11 axially stationary while the adjusting structure is being displaced, the control device may be given a design as exemplified in Fig. 3. According to this modification, the adjusting structure 5 is slidably engaged by a cylindrical rod 23 which is axially displaceable in the stationary support structure 1. Journaled in the support 1 is a shaft 21 with two shoulders 23, 24 that prevent the shaft from

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axial movement relative to the support. The inner end of shaft 21 is threaded and engages the threaded bore of a part 22 which is firmly joined, for instance rivetted or pinned, to the rod 20.

While in the above-described embodiments the slanted adjusting structure 5 has a conical surface in engagement with member 6, it will be understood that this structure may generally have any suitable wedge shape. For instance, in the modification shown in Fig. 4 a substantially cylindrical structure 25 has a slanted and plane cut at the place of engagement with the tappet member 6. If the adjusting body has a plane and slanted wedge surface as at 26 in Fig. 4, a line or area engagement between this wedge surface and the tappet member 6 may be provided also as shown in Fig. 4. If desired, an intermediate body may be placed between the tappet member 6 and the adjusting structure.

Tappet devices according to the invention are not only applicable for contact converters but may be used to advantage for other purposes such as the control of cross sectional flow areas. For instance, a valve may be actuated by such a tappet device to open and close periodically, or the tappet device may serve to move a valve cylinder which uncovers one or more port openings during given intervals of time, the effective flow area of the port openings or the flow quantity per unit of time being then controllable by varying the displacement position of the adjusting structure.

It will be obvious that while the displacement position of the adjusting structure may be controlled manually, an automatic control or a control by means of a motor is readily applicable. For instance, a drive motor may operate the control spindle 13 or control wheel 11 through a suitable transmission.

It will also be understood by those skilled in the art upon a study of this disclosure that the invention permits of various other modifications and applications without departure from the essential features of the invention and within the scope of the claims annexed hereto.

I claim:

1. In a reciprocating tappet device of variable tappet length, a tappet assembly comprising a reciprocatorily guided tappet body, a tappet member inserted into said body and being axially displaceable relative to said body, an adjusting structure disposed in said body and being displaceable relative to said body in an angular direction to the tappet axis, said structure having a slanted slide surface, spring means engaging said body and said member and biasing said member against said structure so that the axial length of said assembly depends upon the displacement position of said structure, and stationarily mounted control means for displacing said structure.

2. A reciprocating tappet device, comprising a cyclical drive, a support, a driven member having a given rest position relative to said support and being biased toward said position, a tappet assembly reciprocatorily guided in said support and having two axially aligned portions telescopically displaceable relative to each other and spring means biasing said two portions toward each other, one of said portions being in engagement with said drive, said other portion being abutable against said driven member during only part of the tappet stroke to periodically hold said driven member away from said position during intervals of time depending upon the axial length of said tappet assembly, said tappet

assembly having an adjusting structure disposed between said two tappet portions, said structure being displaceable in a direction perpendicular to the tappet axis and having a surface slanted relative to said direction so that the total tappet length depends upon the displacement position of said structure and control means stationarily mounted on said support and in slidable engagement with said adjusting structure for varying said displacement position during reciprocating movement of said assembly.

3. A reciprocating tappet device of variable tappet length, comprising a support, a tappet body reciprocatorily guided in said support, a tappet member inserted into said body and being axially displaceable relative to said body, an adjusting structure disposed in said body and being displaceable relative to said body in an angular direction to the tappet axis, said structure having a slide surface parallel to the tappet axis and a slanted surface transverse to said axis, spring means engaging said body and said member and biasing said member against said structure so that the axial length of said assembly depends upon the displacement position of said structure, control means mounted on said support and engageable with said structure at said slide surface for displacing said structure, and a spring mounted on said body and engaging said structure so as to bias it against said control means.

4. A reciprocating tappet device of variable tappet length, comprising a support, a tappet body reciprocatorily guided in said support, a tappet member axially displaceable in said body and projecting from said body at one axial side thereof, an adjusting structure disposed in said body and being displaceable relative to said body in an angular direction to the tappet axis, said structure having a slanted surface transverse to the tappet axis, spring means engaging said body and said member and biasing said member against said structure so that the axial length of said assembly depends upon the displacement position of said structure, control means engageable with said structure and having a screw spindle in threaded engagement with said support for controlling the displacement of said structure.

5. In a reciprocating tappet device of variable tappet length, a tappet assembly comprising a reciprocatorily guided tappet body, a tappet member axially displaceable in said body and projecting from said body at one axial side thereof, a conical body disposed in said tappet body and having an axial direction transverse to the tappet axis, said conical body being displaceable in said direction relative to said tappet body, a spring biasing said tappet member against said conical body so that the axial length of said tappet assembly depends upon the displacement position of said conical body, and stationarily mounted control means engageable with said conical body for controlling said position.

6. A reciprocating tappet device, comprising a

cyclical drive, a support, a driven member having a given rest position relative to said support and being biased toward said position, a tappet assembly reciprocatorily guided in said support and having two axially aligned portions telescopically displaceable relative to each other and spring means biasing said two portions toward each other, one of said portions being in engagement with said drive, said other portion being abutable against said driven member during only part of the tappet stroke to periodically hold said driven member away from said position during intervals of time depending upon the axial length of said tappet assembly, said tappet assembly having a wedge structure displaceable in one of said two tappet portions in a direction transverse to the tappet axis, said wedge structure having a wedge face engaged by said other tappet portion, spring means biasing said other tappet portion against said wedge face so that the total tappet length depends upon the displacement position of said structure, and control means mounted on said support and engageable with said structure for varying said displacement position.

7. A reciprocating tappet device for a mechanical rectifier, comprising a support, a cam drive having a fixed axis of revolution relative to said support, two contacts stationary relative to said support, a movable contact member and a spring biasing said member toward bridging engagement with said two stationary contacts, a tappet body reciprocatorily guided in said support and having a spring biasing said body into engagement with said cam drive, a tappet member axially displaceable in said tappet body and projecting therefrom toward said contact member, said tappet member being in abutment with said contact member during only a portion of the tappet stroke to periodically disengage said contact member from said stationary contacts, a wedge-type adjusting structure displaceable in said tappet body transversely to the tappet axis and engaged by said tappet member, a spring mounted on said body and engaging said tappet member to bias it against said structure so that the total tappet length is determined by the displacement position of said structure, and control means engaging said structure for displacing said structure and being disposed on said support so as to be operable during tappet reciprocation.

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