March 25, 1952 O. C. WALLEY ET AL 2,590,223

ELECTRICAL REGULATOR

Filed May 24, 1951 2 SHEETS—SHEET 1

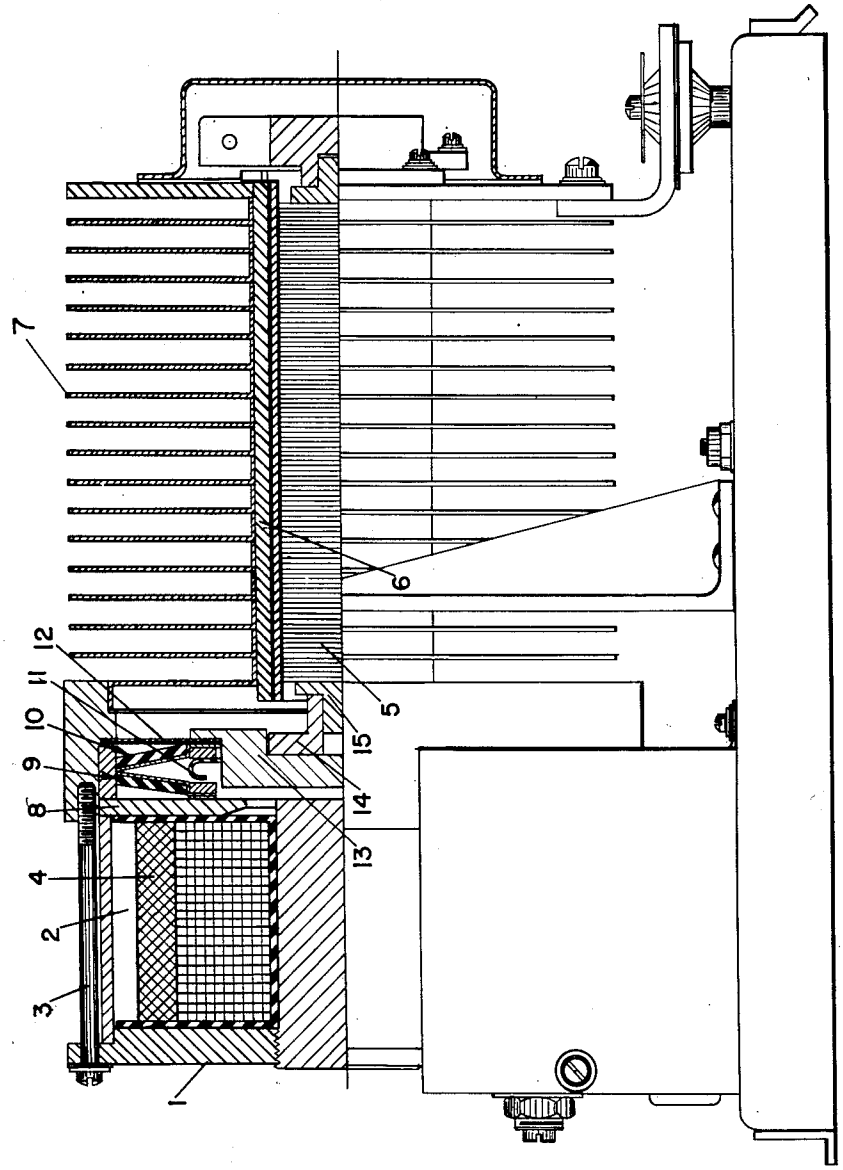


FIG. 1

INVENTORS
OMAR C. WALLEY
CARL F. SCHEU
BY Frank H. Harmon
Attorney

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FIG. 2

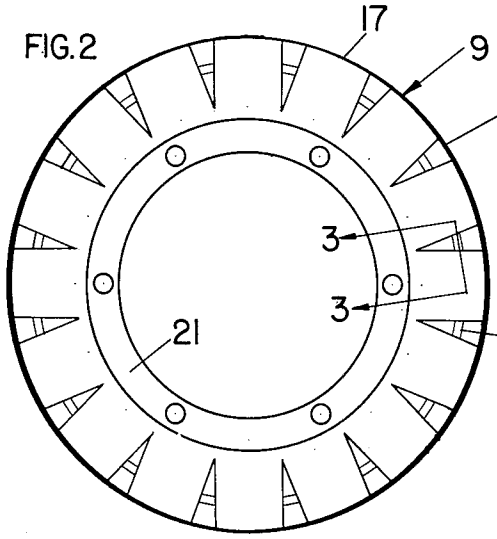


FIG. 3

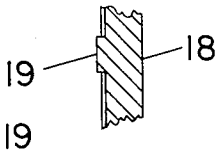


FIG. 4

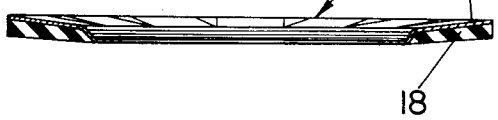


FIG. 5

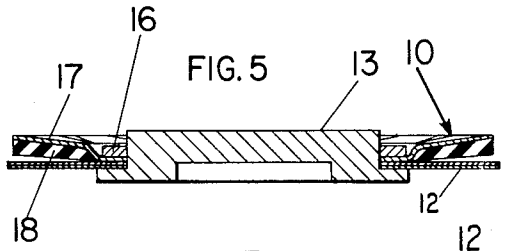
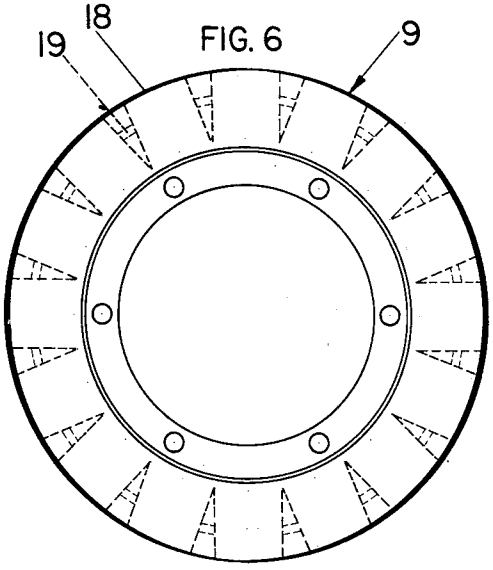


FIG. 6



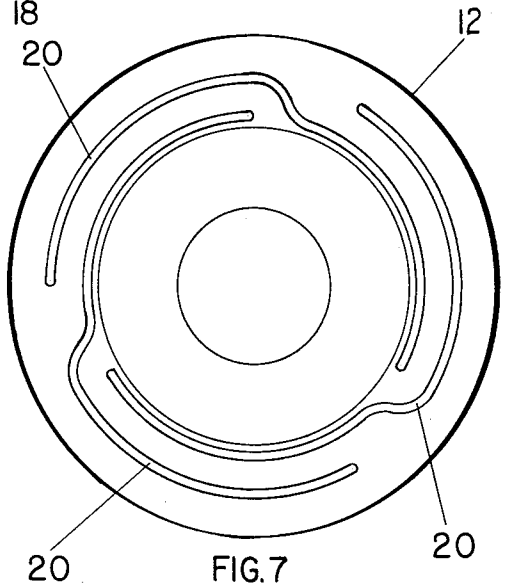


FIG. 7

INVENTORS
OMAR C. WALLEY
CARL F. SCHEU

BY
Frank H. Harmon
Attorney

Patented Mar. 25, 1952

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ELECTRICAL REGULATOR

Omar C. Walley, Cleveland, and Carl F. Scheu, Lakewood, Ohio, assignors to Jack & Heintz Precision Industries, Inc., Cleveland, Ohio, a corporation of Delaware

Application May 24, 1951, Serial No. 228,048

5 Claims. (Cl. 201—51)

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This invention relates in general to electric regulators and more particularly to improvements in carbon pile electric regulators.

One of the primary objects of the invention is to provide a regulator of simple construction, of small size and weight and consuming the minimum of power and which will provide highly sensitive regulation over a wide range.

Another object is to provide an improved means for damping vibrations produced by current fluctuations.

Among the approaches in efforts to solve this damping problem is the provision of liquid filled dashpots including a cylinder and a piston with a rod connected to an armature.

The present invention contemplates a built-in pneumatic cushioning arrangement inherent in the regulator spring construction that will effectively damp out the vibrations and provide for sensitive and steady control.

Basically, it is proposed to employ two generally circular forked control springs with their concave surfaces opposed. To the outside, or convex, surfaces is moulded a special compound of rubber which also extends through the spaces between the radial prongs of the spring rings. One of the rings is adjacent the usual electromagnet and the opposing ring bears against the armature. The peripheries of the rings cooperate to resiliently compress the discs of the carbon piles together and attraction of the armature and movement thereof by the electromagnet, opposes the spring action to release compression forces on the carbon discs. The arrangement of the rubber moulded spring rings is such that provides for a vibration damping air cushion between the opposed concave surfaces of the two spring rings.

With the foregoing and other objects in view the invention resides in the combination of parts and in the details of construction hereinafter set forth in the following specification and appended claims, certain embodiments thereof being illustrated in the accompanying drawings, in which:

Figure 1 is a view, the lower half of which is in side elevation and the upper half of which is in longitudinal section through a carbon pile electric regulator employing the present invention;

Figure 2 is a view of the concave surface of one of the rubber moulded spring rings;

Figure 3 is a view in section taken along line 3—3 of Figure 2;

Figure 4 is a view in cross section taken through the spring ring of Figure 2;

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Figure 5 is a view in cross section taken through the other spring ring and a portion of the armature;

Figure 6 is a view of the convex surface of the spring ring of Figure 2; and

Figure 7 is a plan view of the centering disc.

Referring more particularly to the drawings, the conventional carbon pile electric regulator includes end plates 1 and 8 with tie bolts 3 to house the electromagnet core 4 with an air gap 2. The stack of carbon discs 5 are housed in a ceramic tube 6 and the usual radiating fins 7 may be employed.

The two opposed novel concave regulator springs are generally indicated at 9 and 10. Interposed between rings 9 and 10 is a rubber ring 12 carried by the electromagnet armature 13 which is mounted to be longitudinally slidable and which carries a sleeve 14 which bears against a sleeve 15 that engages the left end of the carbon disc stack.

Each of the spring regulating rings 9 and 10 include a series of peripherally divided prongs 17 and a central ring 16 about its central aperture. Each of these rings is made of spring metal and so formed that its one surface is generally convex and its other side concave. Each ring is then placed in a special mold and coated with a special heat resistant highly flexible rubber compound so that its entire outside convex surface is covered and the spaces between the prongs 17 is covered with molded rubber 18 and with inwardly extending molded rubber extentions 19. Ring 9 bears against end wall 8 but ring 10 is carried by the slidable armature 13. Between ring 10 and the inner flange of armature 13 is interposed a centering disc 12 with lightening slots 20 to make it extremely flexible longitudinally but radially rigid against displacement.

As stated before, the two rings are so mounted that the peripheries are in engagement with each other and their concave faces opposing each other and thus exert a spring force to compress the carbon discs 5 together. When the armature 13 is drawn to the left as viewed in Figure 1, by the core of the electromagnet, this action is opposed by the spring rings 9 and 10. The rubber coating on the two rings, in combination with the compressible rubber ring 11 disposed therebetween, provides a pneumatic cushion to assist the spring action in damping out vibrations and excessive longitudinal movements of the armature and attending undesired variations in air gaps between the carbon discs of the carbon pile. The rubber molded onto the two spring rings

9 and 10 besides being heat resistant, is highly pliable so as to not interfere with the spring sensitivity of the springs themselves in their natural intended functions.

Thus it will be seen that there has been provided a carbon pile control spring assembly that besides being sensitive includes its own built-in inherent pneumatic cushion for absorbing undue vibrations without materially adding to the overall bulk, size, weight or expense of the electric regulator and one that is fully as efficient, if not more so, than conventional liquid filled cylinder and piston dashpot constructions.

We claim:

1. In an electromagnetic spring actuated carbon pile regulator having an electromagnet, a carbon pile having one end fixed relative to said magnet, a spring ring assembly engaging the other and movable end of said carbon pile and an armature of said magnet for carrying said spring ring assembly, said spring ring assembly comprising a pair of spring rings mounted to have their concave surfaces opposing each other in peripheral abutment with each other to exert a resilient compressive force on said carbon pile discs and form a pneumatic cushion to oppose and damp out linear movements of said armature against the action of said spring rings.

2. In an electromagnetic spring actuated carbon pile regulator having an electromagnet, a carbon pile having one end fixed relative to said magnet, a spring ring assembly engaging the other and movable end of said carbon pile and an armature of said magnet for carrying said spring ring assembly, said spring ring assembly comprising a pair of spring rings centrally apertured and mounted to have their concave surfaces opposing each other in peripheral abutment with each other to exert a resilient compressive force on said carbon pile discs and form a pneumatic cushion to oppose and damp out linear movements of said armature against the action of said spring rings.

3. In an electromagnetic spring actuated carbon pile regulator having an electromagnet, a carbon pile having one end fixed relative to said magnet, a spring ring assembly engaging the other and movable end of said carbon pile and an armature of said magnet for carrying said spring ring assembly, said spring ring assembly comprising a pair of spring rings centrally apertured, said rings being molded in rubber and mounted to have their concave surfaces opposing each other in peripheral abutment with each other to exert a resilient compressive force on said carbon pile discs and form a pneumatic cushion to oppose and damp out linear movements of said armature against the action of said spring rings.

4. In an electromagnetic spring actuated carbon pile regulator having an electromagnet, a carbon pile having one end fixed relative to said magnet, a spring ring assembly engaging the other and movable end of said carbon pile and an armature of said magnet for carrying said spring ring assembly, said spring ring assembly comprising a pair of spring rings centrally apertured and formed with a series of peripherally divided radially outwardly extending prongs, said rings being molded in rubber on their convex surfaces and between said prongs to provide cups and mounted to have their concave surfaces opposing each other in peripheral abutment with each other to exert a resilient compressive force on said carbon pile discs and form a pneumatic cushion to oppose and damp out linear movements of said armature against the action of said spring rings.

5. In an electromagnetic spring actuated carbon pile regulator having an electromagnet, a carbon pile having one end fixed relative to said magnet a spring ring assembly engaging the other and movable end of said carbon pile and an armature of said magnet for carrying said spring ring assembly, said spring ring assembly comprising a pair of spring rings centrally apertured and formed with a series of peripherally divided radially outwardly extending prongs, said rings being molded in rubber on their convex surfaces and between said prongs to provide cups and mounted to have their concave surfaces opposing each other in peripheral abutment with each other to exert a resilient compressive force on said carbon pile discs, a rubber ring interposed between said rings adjacent the central apertures thereof to cooperate with said rings to form a pneumatic cushion to oppose the damp out linear movements of said armature against the action of said spring rings.

OMAR C. WALLEY.
CARL F. SCHEU.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,398,679	Thompson	Apr. 16, 1946