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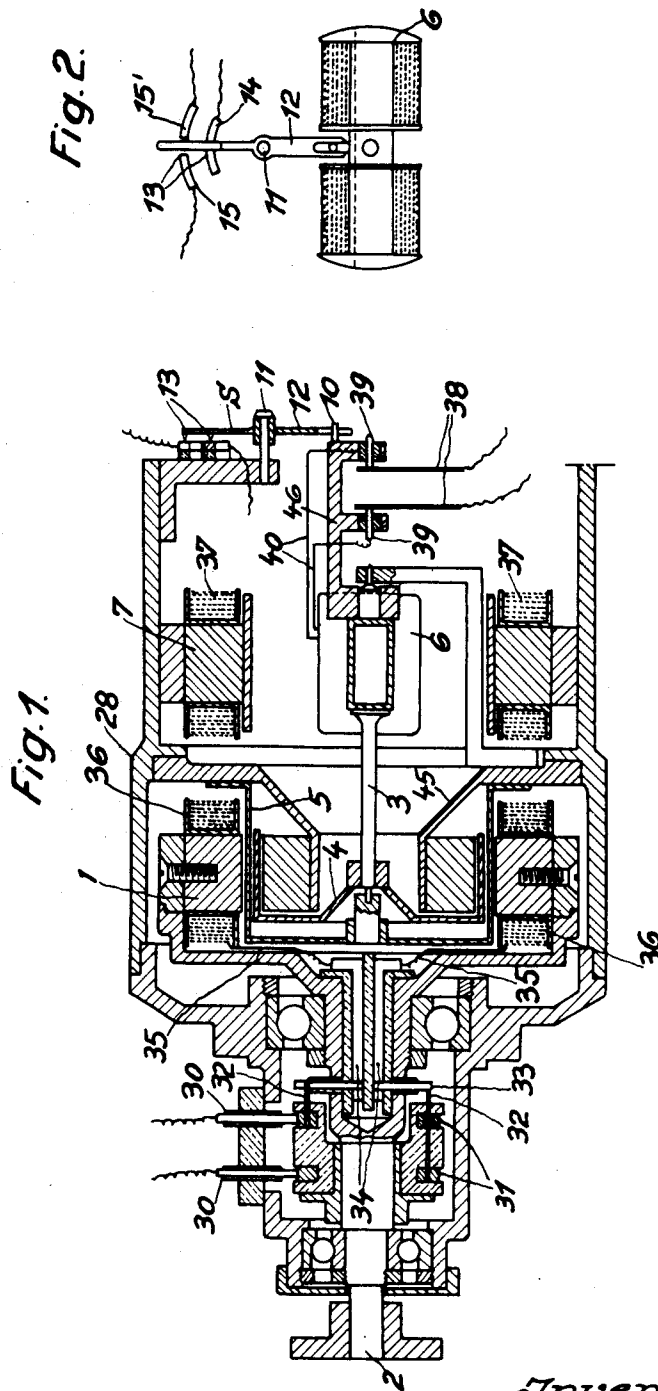
J. M. BOYKOW

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ELECTRIC CURRENT REGULATOR

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2 Sheets-Sheet 1



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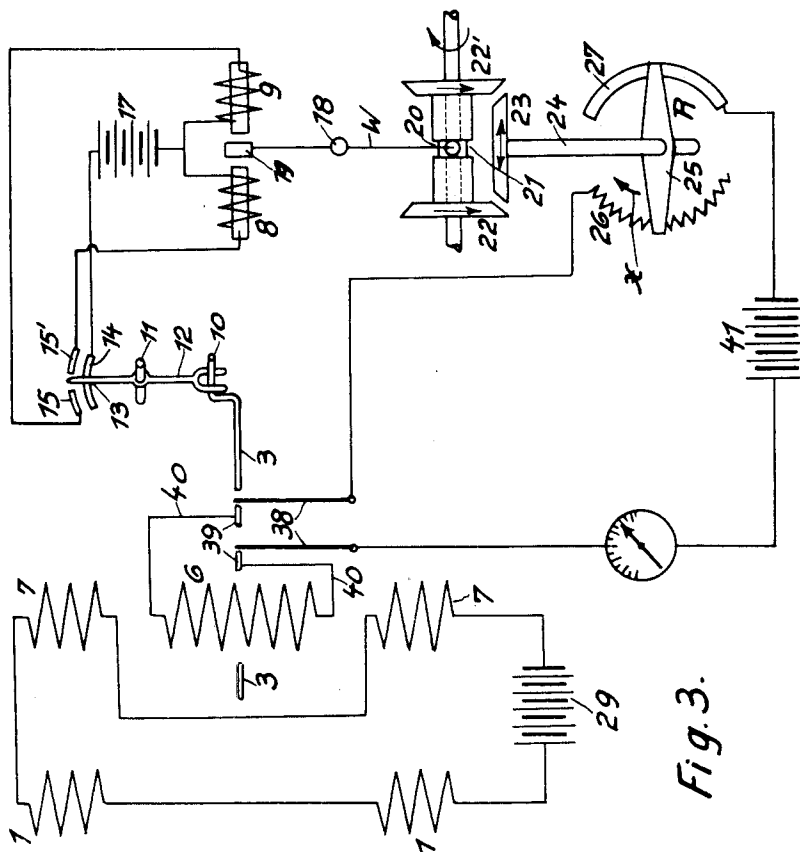
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UNITED STATES PATENT OFFICE.

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ELECTRIC-CURRENT REGULATOR.

Application filed November 1, 1926, Serial No. 145,691, and in Germany November 7, 1925.

My invention relates to improvements in electric current regulators, and the object of the improvements is to provide a regulator by means of which the intensity of an electric current may be regulated proportionally to the number of revolutions per minute of a rotary member so that upon measurement of said current the speed of said member may be determined. With this object in view my invention consists in combining an element upon which is exerted a torque by mechanism driven by the shaft whose speed is to be measured, such element, for example, comprising a cylinder made from electrically conductive material and disposed within a rotary field of forces, generated by said mechanism, with a brake, the braking power of which is generated by the current to be regulated, the braking moment being made equal to the torque exerted on said element automatically by means of the apparatus itself, so that the element is forced to remain stationary, and the electric current producing the braking moment being proportional to the angular velocity of the said rotary field, when the braking moment and the torque on said element or cylinder are alike.

In order that my invention be more clearly understood an example embodying the same has been shown in the accompanying drawings, in which the same reference characters have been used in all the views to indicate corresponding parts. In said drawings,

Fig. 1, is a sectional elevation showing my improved apparatus,

Fig. 2, is a detail view showing the braking coil and the switch controlled thereby for regulating the resistance regulating the intensity of the current flowing through the said coil, and

Fig. 3, is a diagram showing the electrical connections of the apparatus.

In the example shown in the figures, a shaft 2 rotated from a suitable source of energy at the desired velocity carries magnets 1. On a second shaft 3 a metallic cylinder 4 is mounted which is surrounded by a stationary cylinder 5 fixed to a head 45 secured to a casing 28, the object of the cylinder 5 being to prevent the air carried along by the magnets from acting on the cylinder 4 and affecting the moment thereof. Further, a coil 6 is carried by the shaft 3, which coil is located within a stationary magnetic field

7. Thus the coil 6 is rigidly connected with the cylinder 4.

At the end of the shaft 3 there is a switching apparatus S controlling electromagnets 8 and 9 of a reversing gearing W. The said reversing gearing is adapted to operate a current regulator R controlling the intensity of the current flowing through the coil 6.

The switching apparatus S, the reversing gearing W and the regulator R are constructed as follows: To the end of the shaft 3 a crank 46 is secured the pin 10 of which engages in the bifurcated bottom end of the lever 12 rockingly mounted on a fixed bolt 11 and carrying at its opposite end slide contacts 13 cooperating with contact segments 14, 15 and 15'. According to the position of the coil 6 within the stationary magnetic field 7 current is supplied from a source 17 to the electromagnet 8 or 9. Between the said electromagnets there is an armature 19 rockingly mounted at 18 which armature is formed with a bifurcated end 20, as is common with clutch levers of this type, engaging in an annular groove 21 of the hub of a pair of bevel gear wheels 22 and 22'. The said gear wheels are continuously rotated in the same direction from a suitable source of power.

The gear wheels 22 and 22' cooperate with a bevel gear wheel 23 the shaft 24 of which carries a contact brush 25 in sliding engagement with a segmental contact bar 27 and the turns or taps of a rheostat. Upon energizing either one of the electromagnets 8 or 9 the gear wheel 23 is engaged by either the gear wheel 22 or 22', respectively so that the brush 25 is turned in one or the other direction for increasing or reducing the resistance.

The rotary electromagnets 1 are energized by means of a source of electric current 29 through brushes 30 bearings on slide rings 31. The said slide rings 31 are electrically connected by rods 32 with rods 33 and 34 embedded in and insulated from the shaft 2. The rods 34 are connected by leads 35 with the coils 36 of the electromagnets 1.

The coils 37 of the stationary electromagnets 7 are connected in series with the coils 36, so that the current intensity is the same in both coils, and the fields produced thereby are in a definite ratio. The current is supplied to the coil 6 through contact springs 38 engaging contact pins 39 disposed coaxially

of the shaft 3, and connected with the coil 6 by leads 40. The contact springs 38 are connected respectively with a source of electric energy 41 and the rheostat R, so that the source
5 of electric energy 41, the coil 6 and the rheostat R are included in the same circuit.

The operation of the apparatus is as follows: Let us assume that the electromagnets 1 are rotated, when looking from the side of the electromagnets 7, in clockwise direction. Thereby the coil 6 and the crank 46 are turned in the same direction, so that the pin 10 rocks the switch lever 12 and shifts the contacts 13 thereof in the opposite direction. Thus the
10 contact segment 14 is electrically connected with the contact segment 15, and current is supplied from the source 17 over segments 14 and 15 to the coil of the electromagnet 9. The armature 19 is attracted by the electromagnet
20 9 and throws the bevel gear wheel 22' into engagement with the gear wheel 23, which is thereby rotated so as to rock the switch arm 25 in the direction of the arrow α shown in Fig. 3, thus reducing the resistance of the
25 circuit of the coil 6, until the intensity of the current flowing through the said coil is such that the moment of the coil exceeds that of the metal cylinder 4. Thereafter the coil 6 and the switch arm 12 and the contacts 13
30 carried thereby are moved in the opposite direction. When making contact with the segments 15' the contacts 13 connect the electromagnet 8 with the source 17, whereupon the operation of the rheostat R is repeated in
35 the reverse sense.

The operation is repeated until the moment of the coil 6 is equal to that of the cylinder 4, in which case the intensity of the current flowing through the coil 6 is proportional to the moment of the metal cylinder 4.
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The moment of the metal cylinder 4 depends only on the angular velocity of the electromagnets 1 and that in a higher degree the smaller the temperature coefficient of the
45 metal of the cylinder 4 is. Thus the intensity of the current flowing through the coil 6 is proportional to the angular velocity of the magnetic system 1.

The apparatus can be used for various purposes where it is desired to control a current in dependence on the rotary speed of an object. For example, the apparatus can be used in connection with measuring instruments for generating a moment corresponding to a certain number of revolutions, at a place located at a distance from the apparatus. By means of the apparatus I am enabled directly to measure velocities, to make long distance indications, etc.
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Where in the claims I employ the term "loose coupling" it will be understood that I include thereby such couplings as have a driving element and a driven element but no rigid connection between the two, so that
65 the driven element may be maintained sta-

tionary relatively to said driving element by means of an opposing force.

While in describing the invention reference has been made to a particular example embodying the same I wish it to be understood that my invention is not limited to the construction shown in the drawings, and that various changes may be made in the general arrangement of the apparatus and the construction of its parts without departing
75 from the invention.

I claim:

1. An apparatus for regulating electric current intensities proportionally to a number of revolutions per minute, comprising a
80 loose coupling having a rotary driving member and a driven member, an electric brake connected with said driven member, and means controlled by the driven member for regulating the current of said electric brake
85 so that the moment of the brake is equal to that of the coupling.

2. An apparatus for regulating electric current intensities proportionally to a number of revolutions per minute, comprising a
90 loose coupling having a rotary magnetic driving member, and a rotary metal cylinder within the magnetic field of said driving member, an electric brake connected with said driven member, and means controlled
95 by the driven member for regulating the current of said electric brake so that the moment of the brake is equal to that of the coupling.

3. An apparatus for regulating electric current intensities proportionally to a number of revolutions per minute, comprising a
100 loose coupling having a rotary magnetic driving member, a rotary metal cylinder within the magnetic field of said driving member and a cylindrical member between
105 said driving member and metallic cylinder, an electric brake connected with said driven member, and means controlled by the driven member for regulating the current of said electric brake so that the moment of the
110 brake is equal to that of the coupling.

4. An apparatus for regulating electric current intensities proportionally to a number of revolutions per minute, comprising a loose coupling having a rotary driving member and a driven member, an electric brake connected with said driven member comprising a stationary magnetic member and an electric coil connected with said driven member and included in the circuit the current intensity of which is to be regulated, and an electric switch apparatus connected with said coil for varying the intensity of the current flowing through said circuit.
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5. An apparatus for regulating electric current intensities proportionally to a number of revolutions per minute, comprising a loose coupling having a rotary driving member and a driven member, an electric brake connected with said driven member com-
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prising a stationary magnetic member and an electric coil connected with said driven member and included in the circuit the current intensity of which is to be regulated, and an electric switch apparatus connected with said coil and comprising a rheostat included in the circuit of said coil, electric regulating means for said rheostat, and a switch controlling said regulating means.

6. The method of measuring the speed of a rotating body which comprises creating a rotating magnetic field whose speed is proportional to the speed of said body and producing a torque on a conducting element positioned in said field, counteracting said torque with an opposing force so as to maintain said element in normal position, and measuring said force.

7. The method of measuring the speed of a rotating body which comprises creating a rotating magnetic field whose speed is proportional to the speed of said body and pro-

ducing a torque on a conducting element positioned in said field, counteracting said torque with an equivalent torque produced by an opposing regulatable magnetic field, and measuring the current required to maintain said last mentioned magnetic field.

8. An apparatus for regulating an electric current proportionally to the speed of a rotating body, comprising a loose coupling having a rotary driving member and a driven member, an electric brake connected with said driven member and including an electric coil traversed by a regulatable current, and a rheostat controlled by said driven member and included in the circuit of said coil, whereby the strength of the said current is proportioned to the braking force necessary to balance the torque on said driven member.

In testimony whereof I have affixed my signature.

JOHANN MARIA BOYKOW.