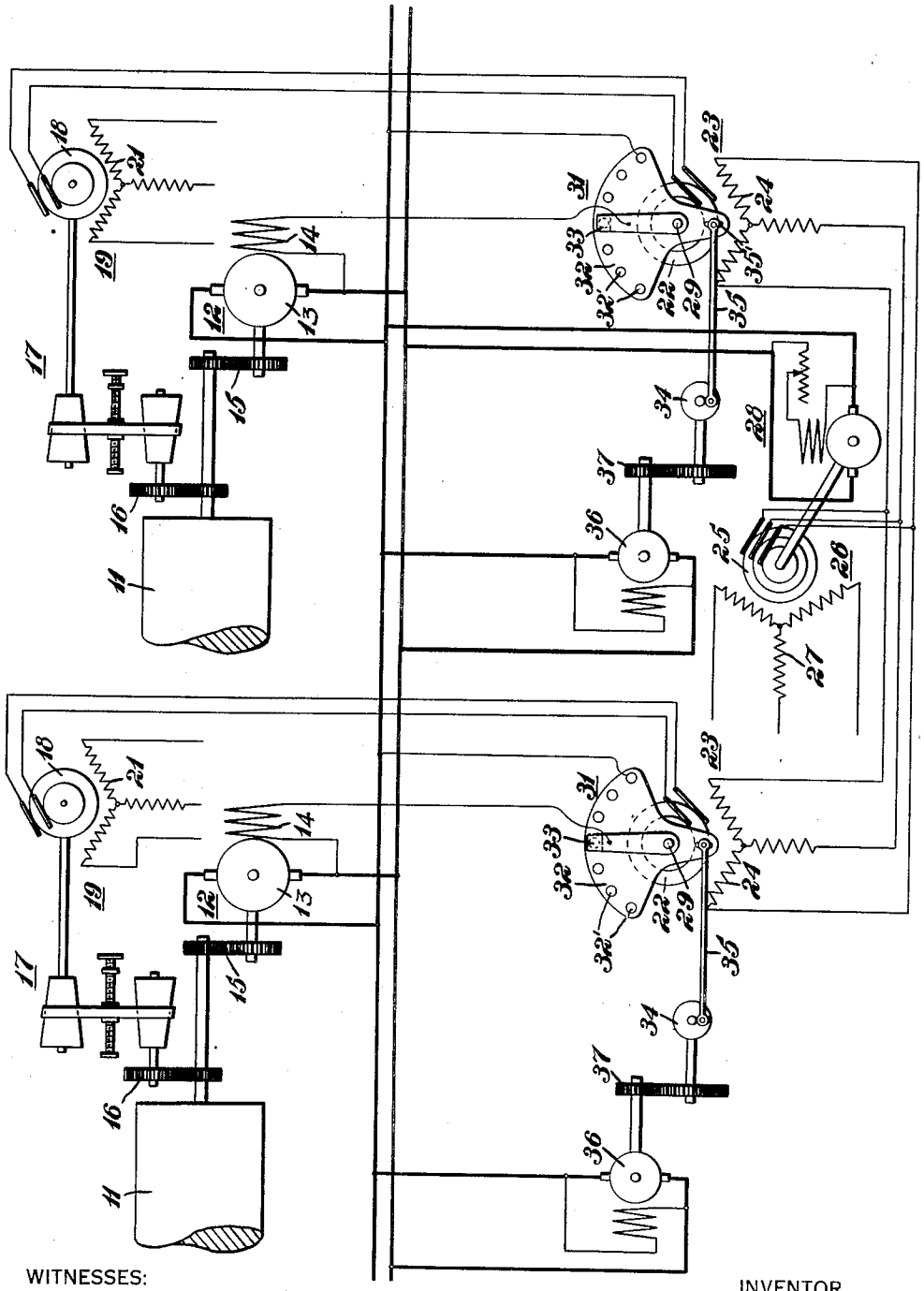
Dec. 30, 1924. 1,520,973

S. A. STAEGE

SPEED REGULATOR SYSTEM

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SPEED-REGULATOR SYSTEM.

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To all whom it may concern:

Be it known that I, STEPHEN A. STAEGE, a citizen of the United States, and a resident of Pittsburgh, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Speed-Regulator Systems, of which the following is a specification.

My invention relates to regulator systems and it has special relation to systems adapted to maintain a substantially-constant speed ratio between a plurality of moving members.

One object of my invention is to provide a speed-regulator system of the above-indicated character which shall be inexpensive in construction and simple and efficient in operation.

Another object of my invention is to provide a regulator system which shall include, as a portion thereof, a rheostat having concurrently movable elements.

The present invention is shown as applied to the speed regulation of a plurality of roll units of a paper-mill, wherein each set of rotatable members is propelled by a variable-speed motor. Each rotatable member operates a speed-changing device, which, in turn, operates a frequency changer that is electrically connected to one winding of a second frequency changer. The other winding of the second frequency changer is connected to a source of constant frequency which is common to all of the roll units. The second frequency changer, therefore, is an electric differential, or a differential relay.

The illustrated embodiment of the present invention contemplates mounting upon the shaft of the differential, a rheostat having one portion thereof operated by the differential to increase or decrease the resistance value of the field-winding circuit of the propelling motor to maintain constant speed thereof with varying loads. Another portion of the rheostat is adapted to be oscillated, or vibrated, by means of a motor-operated eccentric. Normally, therefore, that is, when the differential is inactive, the contact arm may be maintained stationary while the rheostat face plate may be continuously moved so that engagement may be made between the one or the other of two contact points thereof. Hence, a mean effective resistance value may be obtained that is equivalent to that of a point between the two contact points continually engaged.

Reference may now be had to the accompanying drawing, wherein the single figure is a diagrammatic illustration of the circuits and apparatus embodying my invention, as applied to a plurality of rotatable members.

Since the apparatus of the roll units are alike, the present invention will be described with reference to a single unit of rotatable members, and illustrated duplicate parts will be given like reference numerals.

A set of rotatable members is diagrammatically indicated by a roll 11 which is adapted to be driven by a variable-speed-controlling motor 12, having an armature 13 and a field-magnet winding 14, through suitable gearing 15. Roll 11 drives a speed changer 17, of any well-known construction, here shown as of the cone-pulley type, through gearing 16. The speed changer operates the rotor 18 of a frequency changer 19, the stator winding 21 of which is energized from any suitable source.

The rotor 18 is electrically connected to the rotor or secondary winding 22 of a second frequency changer 23. The stator or primary winding 24 of frequency changer 23 is connected to the rotor 25 of a frequency changer 26 which is common to all of the roll units. The stator winding 27 is adapted to be energized from any suitable source, preferably that to which the stator windings 21 are connected. The frequency changer 26 is driven by a motor 28 to supply a constant frequency to the windings 24 of the differential machine 23.

It will be apparent that, if the frequencies applied to the windings 22 and 24 of the frequency changer 23 are identical, there will be no movement of the shaft 29 of this machine. However, any variations in frequency will be indicated by a rotation of the shaft 29. Hence, in its operation, the frequency changer 23 becomes a differential machine.

Mounted upon the shaft 29 is a rheostat 31, having a face plate 32 and a contact arm 33. The rheostat is in circuit with the field-magnet winding 14 of the propelling motor 12. The contact points 32′ are connected, by means of flexible connections, to the resistance units of the rheostat in any well-known manner, not requiring illustration. The contact arm 33 is rigidly mounted upon the shaft 29 so as to turn therewith. The face plate 32 is adapted to be continuously oscillated or vibrated by means of a crank 34 which is connected to the face plate 32 by means of a connecting rod 35. The oscillatory movement of the face plate 32 may be adjusted by varying the connection of the rod 35 in the slot 35′. The crank 34 is driven by a motor 36, through suitable gearing 37. The crank mechanism oscillates the face plate to vary the contact engagement to obtain resistance values intermediate the adjacent contact points and, hence, to provide resistance values to compensate for minor speed changes of the propelling motor.

Assuming a change in load upon the roll 11 that requires an increase in resistance value in the field-winding circuit of the propelling motor, the differential will operate to move the contact arm 33 in a direction to increase the resistance the desired amount. The rheostat face plate is continuously vibrated, so that, as the contact arm nears the proper correcting position and the differential comes to a halt, there will be the same vibratory action continued to cause the rheostat to assume the correct position without hunting action.

In other words, the steps of the rheostat are generally too great or too small for exact regulation of the propelling motor. With the present mechanism, the contact arm will come to rest on the point nearest correct resistance value for the new load, and then the vibratory mechanism will cause the face plate to oscillate so that the next contact point nearest correct position will be brought into intermittent engagement with the contact arm. By reason of the vibratory action, a mean resistance value intermediate the two engaged points will be maintained in the field of the propelling motor.

The mean resistance value may be any value between the two engaged points since the position of the arm will be such that it will be in engagement with the point most nearly correct, and the oscillations will tend to introduce a different resistance value only in proportion to the correction required. Thus, the contact arm may be in engagement with two of the points, each fifty per cent of the time, or in engagement with one point seventy-five per cent and the other point only twenty-five per cent of the time.

It will be understood that, while the rheostat having concurrently movable parts is illustrated in connection with a speed-regulator system, it is equally applicable to other regulator systems. Also, it is immaterial whether the contact arm is vibrated and the differential movement imparted to the face plate only or also to the resistance unit. Furthermore, the differential movement could embrace more than two contact points of the rheostat.

Accordingly, modifications in the system and in the arrangement and location of parts may be made within the spirit and scope of my invention, and such modifications are intended to be covered by the appended claims.

I claim as my invention:—

1. In a speed-regulator system, the combination with a rotatable member, a propelling motor therefor, a rheostat in circuit therewith comprising a face plate and having a contact arm, a speed-changing device associated with said member, a frequency changer driven thereby, a source of constant frequency, and an electric differential located between said frequency changer and said constant source, said differential being adapted to vary the position of the contact arm of said rheostat in accordance with the speed variations of said member, of means for vibrating one part of said rheostat.

2. In a regulator system, the combination with a dynamo-electric machine, a rheostat in circuit therewith having a contact arm, and a differential associated with said machine and adapted to vary the position of the contact arm of said rheostat, of means for vibrating one part of said rheostat to vary the effective value of said rheostat in said circuit.

3. In a regulator system, the combination with a dynamo-electric machine, a rheostat in circuit therewith having a plurality of movable parts, and means associated with said machine and adapted to control said rheostat, of means for vibrating one part of said rheostat to vary the effective value of said rheostat in said circuit.

4. In a regulator system, the combination with a dynamo-electric machine, and a rheostat in circuit therewith having a contact arm and co-operating face plate, of means controlled by said machine for moving said contact arm, and means for vibrating the face plate of said rheostat.

5. In a speed-regulator system, the combination with a rotatable member, a propelling motor therefor, a constant power source, a differential means located between said rotatable member and said source, and a rheostat in circuit with said motor and controlled by said differential, of means for producing vibratory control of said rheostat.

6. In a regulator system, the combination with a dynamo-electric machine, a dif-

ferential associated with said machine, and a rheostat in circuit with said machine and controlled by said differential, of means for producing vibratory movements of one portion of said rheostat.

7. In a regulator system, the combination with a dynamo-electric machine having a rheostat in circuit therewith having a plurality of movable parts, of means for vibrating one of the parts of said rheostat to vary the effective value of said rheostat in said circuit.

8. In a speed-regulator system, the combination with a propelling motor, a constant-power source, differential means connected between said motor and said source, and a rheostat in circuit with said motor and controlled by said differential, of means adapted to effect pulsatory movement of said rheostat between two of its contact points to prevent hunting action.

9. In a regulator system, the combination with a dynamo-electric machine, differential means associated therewith, and a rheostat in circuit with said machine, of means adapted to effect pulsatory movement of said rheostat between two of its contact points to prevent hunting action.

10. In a regulator system, the combination with a dynamo-electric machine and a rheostat in circuit therewith having a resistance divided between a plurality of taps, of means for controlling said rheostat to cause it to function to produce resistance values intermediate those corresponding to the taps thereof.

11. In a regulator system, the combination with a dynamo-electric machine having a rheostat in circuit therewith, of continuously oscillating means for controlling said rheostat to cause it to produce resistance values intermediate those corresponding to the contact points thereof.

12. In a speed-regulator system, the combination with a driving member, a constant-power source, differential means connected between said driving member and said source, and a rheostat controlled by said differential means and adapted to govern said driving member, of oscillatory means adapted to cause said rheostat to produce effective resistance values intermediate those corresponding to its contact points.

13. In a regulator system, the combination with a dynamo-electric machine, differential means associated therewith, and a rheostat in circuit with said machine and controlled by said differential means, of oscillatory means also controlling said rheostat to produce effective resistance values intermediate those corresponding to its contact points.

14. In a regulator system, the combination with a dynamo-electric machine having a rheostat in circuit therewith, of means for controlling said rheostat, and continuously operating means adapted to cause said rheostat to produce resistance values intermediate those corresponding to its contact points.

15. In a regulator system, the combination with a dynamo-electric machine having a rheostat in circuit therewith, means for controlling said rheostat, and vibratory means adapted to cause said rheostat to produce resistance values intermediate those corresponding to its contact points.

16. In a speed-regulator system, the combination with a movable member, a propelling motor therefor, a constant-power source, differential means connected between said movable member and said source, and a rheostat in circuit with said motor and controlled by said differential means, of an independently actuated member associated with said rheostat and adapted to cause it to produce an effective resistance value intermediate those corresponding to two of the contact points of said rheostat.

17. In a regulator system, the combination with a dynamo-electric machine having a rheostat in circuit therewith, of means for controlling said rheostat, and a crank actuating said rheostat to produce resistance values intermediate those corresponding to the contact points of said rheostat.

18. In a regulator system, the combination with a dynamo-electric machine, and a rheostat in circuit therewith and having a plurality of movable parts, of a crank actuating a part of said rheostat to produce resistance values intermediate those corresponding to the contact points thereof.

19. In a speed-regulator system, the combination with a dynamo-electric machine having a rheostat in circuit therewith, said rheostat having one portion thereof actuated in accordance with the operation of said machine, of means associated with said rheostat and adapted to produce resistance values intermediate those corresponding to two of the contact points thereof.

20. In a regulator system, the combination with a dynamo-electric machine having a rheostat in circuit therewith, said rheostat having a plurality of movable parts, and means for moving one part thereof, of means for concurrently reversibly moving another part of said rheostat to vary the effective value thereof in said circuit.

21. In a regulator system, the combination with a dynamo-electric machine having a rheostat in circuit therewith, said rheostat having a plurality of movable parts, and means for selectively moving one part thereof, of means for continuously moving another part of said rheostat to prevent hunting action in said regulator system.

22. In a regulator system, the combination with a dynamo-electric machine having a rheostat in circuit therewith, said rheostat having a plurality of movable parts, and

means for selectively moving one part thereof, of vibratory means for controlling another part of said rheostat to vary the effective value thereof in said circuit.

23. In a speed-regulator system, the combination with a dynamo-electric machine having a rheostat in circuit therewith, said rheostat having one portion thereof adapted to be actuated in accordance with the operation of said machine, of a motor-operated crank for concurrently actuating another portion of said rheostat to vary the effective value thereof in said circuit.

24. In a regulator system, the combination with a dynamo-electric machine having a rheostat in circuit therewith, of means for actuating one portion of said rheostat, and an independently operated crank for concurrently actuating another portion of said rheostat to prevent hunting action in said regulator system.

25. In a regulator system, the combination with means to be regulated, and a rheostat in circuit therewith having a plurality of movable parts, of means for selectively moving one part thereof, and means adapted to vibrate another part of said rheostat to vary the effective value thereof in said circuit.

In testimony whereof, I have hereunto subscribed my name this 9th day of August, 1921.

STEPHEN A. STAEGE.