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H. G. CHATAIN
METHOD OF AND APPARATUS FOR SUPPLYING POWER
IN CONNECTION WITH PAPER MANUFACTURE
Filed March 29, 1930

1,851,751

2 Sheets-Sheet 1

Fig. 1.

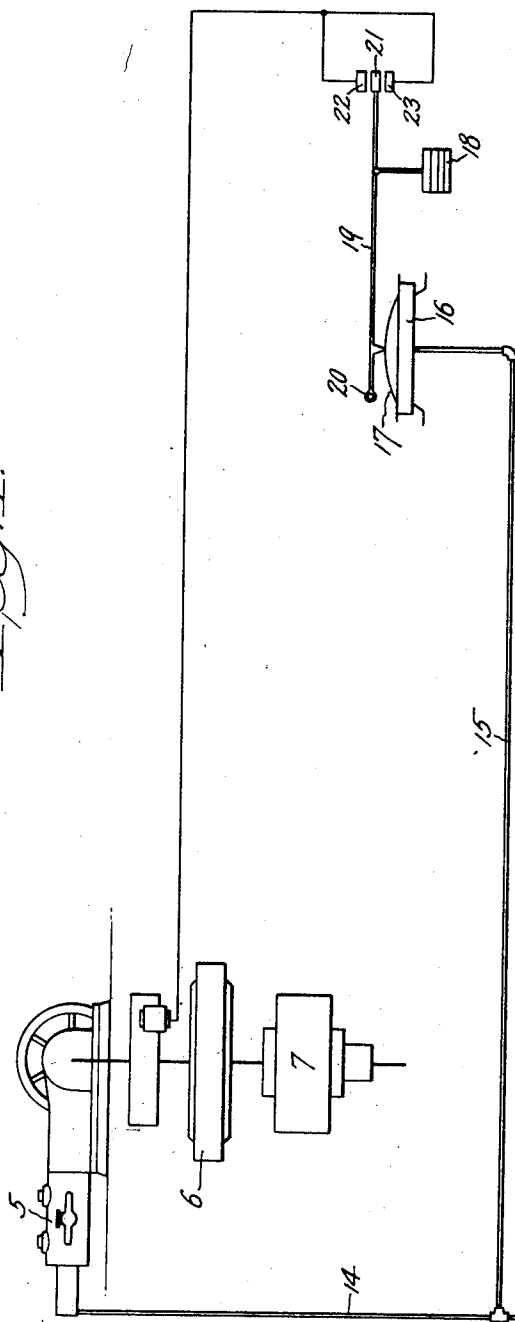
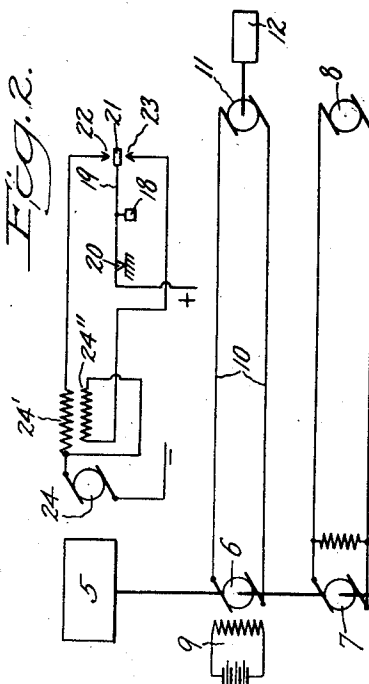


Fig. 2.



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Fig. 3.

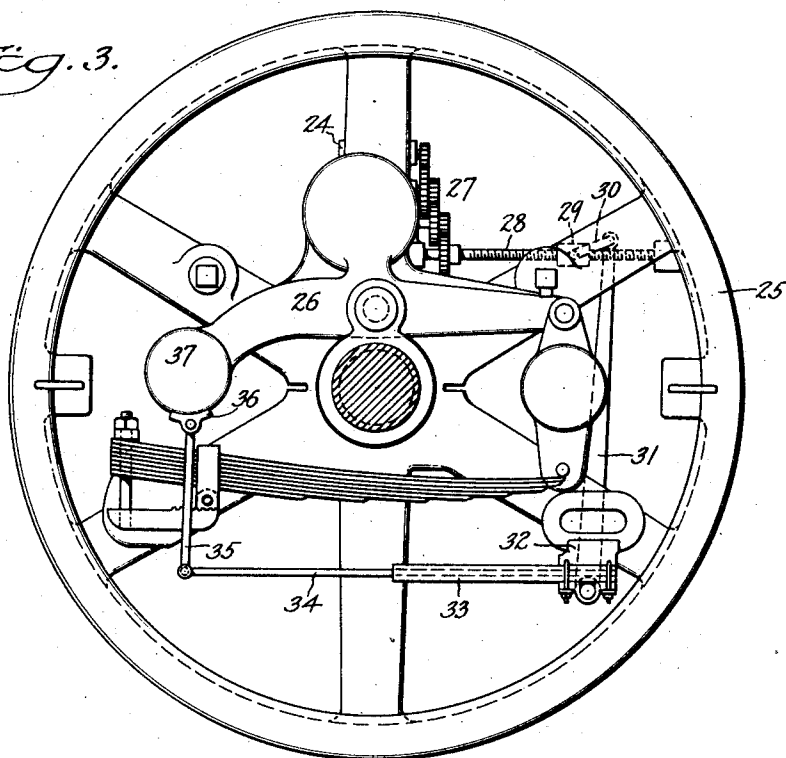
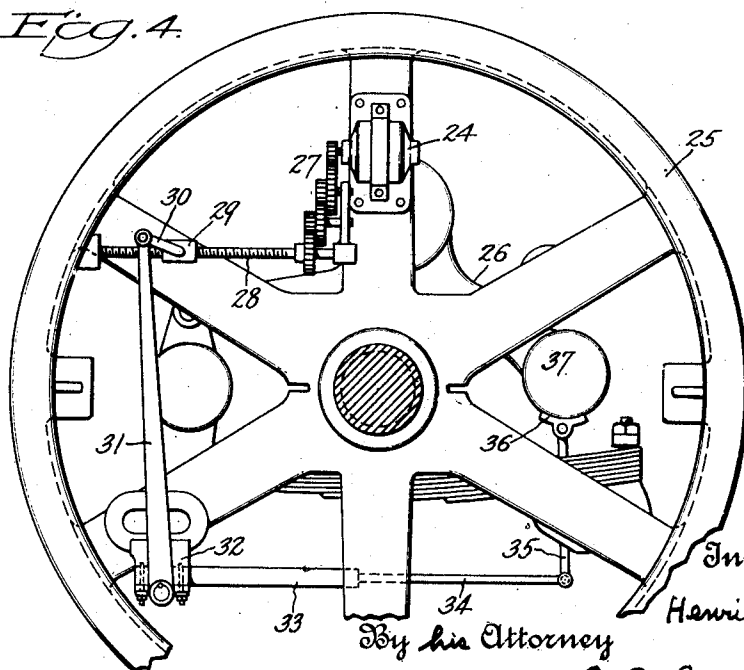


Fig. 4.



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UNITED STATES PATENT OFFICE

HENRI G. CHATAIN, OF ERIE, PENNSYLVANIA, ASSIGNOR TO HAMMERMILL PAPER COMPANY, OF ERIE, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA

METHOD OF AND APPARATUS FOR SUPPLYING POWER IN CONNECTION WITH PAPER MANUFACTURE

Application filed March 29, 1930. Serial No. 439,929.

This invention relates to the manufacture of paper and is particularly concerned with the provision of a system for supplying power with maximum efficiency for paper machine operation. It has heretofore been common practice to drive a paper machine by steam engines, and to pass the exhaust steam from said engines into the drying cylinders for evaporating the moisture in the paper as it passes over the surface of the driers. The steam required for the drying process is usually considerably in excess of that exhausted by the engines, and the requisite additional steam must be supplied to the driers from some other source. This additional steam is "live" as distinguished from exhaust steam. I have devised a system wherein all of the steam required by the driers is supplied as exhaust steam from a prime mover, and wherein the power corresponding to the steam passing thru said prime mover is fully utilized; said power being applied to operating the paper machine and the excess above that required for such operation being supplied to a power line. I shall describe herein an embodiment of my invention and shall point out the novel features thereof in claims.

In the accompanying drawings:

Fig. 1 is a diagrammatic view of an embodiment of the invention.

Fig. 2 is a diagrammatic view illustrating electrical circuits involved.

Fig. 3 is a detail view showing connections for controlling the amount of steam passing through the prime mover.

Fig. 4 is a detail view of the structure of Fig. 3 as viewed from the opposite side.

Referring to the drawings there is indicated at 5 a steam-operated prime mover driving an alternating current generator 6, and a direct current generator 7. The latter supplies current for driving various parts of the paper machinery, one of the motors to which current is supplied by the generator 7 for driving such machinery being indicated at 8 (Fig. 2). The field 9 of the alternating current generator 6 may be supplied with current in any convenient way, as, for example, by a battery, a small generator

driven by the prime mover 5, or in any other suitable manner. The generator 6 is connected to main alternating current power lines 10 to which current is supplied in a power house by generator 11 (Fig. 2), the latter being operated by the customary turbine 12 or other suitable means. The usual driers for the paper are indicated at 13.

According to my invention, the steam supplied to the prime mover 5 is determined by the amount of steam required to dry the paper in the driers 13; and the steam required for such drying is supplied entirely as exhaust steam from said prime mover. Numeral 14 designates a pipe line from the prime mover for supplying said steam to the driers 13. To provide for a flow of steam through the prime mover 5 in accordance with the requirements of the driers a control device such as the following may be employed.

Connected to the exhaust steam line 14 is a pipe 15 which communicates with a chamber 16. A diaphragm 17 forming the top of said chamber is thus exposed to the pressure in the exhaust steam line. Upward movement of said diaphragm caused by the steam pressure is opposed by suitable means such as a weight 18 carried by an arm 19 pivoted at 20. The weight 18 is adjustable along arm 19 to a position corresponding to the exhaust steam pressure which it is desired to maintain. The arm 19 carries at one end thereof a contact 21 which is adapted to engage either one of a pair of contacts 22, 23 on opposite sides thereof. Said contacts 22, 23 are suitably connected for controlling the direction of operation of a motor 24 which in turn is adapted to control the governor of the prime mover 5 for reducing or increasing the steam cut-off thereof. When the steam pressure in the exhaust line 14 increases above that for which the regulator weight 18 is set, contact 21 engages contact 22 and thereby closes a circuit for operating motor 24 in such direction as to cause the governor of the prime mover to reduce the cut-off and thus to reduce the quantity of steam passing through said prime mover to the driers 13. Conversely, if the steam pressure in line 14

drops, contact 21 engages contact 23 and closes a circuit for operating motor 24 in the reverse direction, causing the governor to increase the cut off, and therefore, the quantity of steam passing through the prime mover to the driers.

I have found that a highly efficient prime mover which lends itself effectively for the purposes of my invention is a reciprocating steam engine of the well-known "unaflo" type. In Figs. 3 and 4 I have shown the motor 24 and connections therefrom for controlling the standard governor apparatus commonly employed with this type of engine. Numeral 25 represents the engine fly-wheel, while 26 designates the governor. For enabling the governor to be controlled by the motor 24 there may be employed connections such as the following:

Through a train of gearing 27 the motor 24 is adapted to rotate a threaded shaft 28, said shaft carrying a nut 29 which is connected by a link 30 to a lever 31 pivotally mounted in a suitable supporting bracket 32. Secured to said lever is a sleeve member 33 which has fitted slidably therein a member 34 connected at one end to a vertical arm 35. The latter carries at its upper end a shoe 36 upon which rests one of the weights 37 of the governor 26. Through the shaft 28, nut 29, lever 31, and arms 33, 34, and 35, the governor weight 37 is caused to be raised or lowered, depending upon the direction of operation of the motor 24, and thereby correspondingly varying the amount of steam passing through the engine. Any of a wide variety of connections between the motor 24 and engine governor may obviously be employed in lieu of those above specifically described.

Connections whereby the contacts 22, 23 may control the direction of operation of motor 24 will be evident, but one way in which such control may be accomplished is shown in Fig. 2, wherein engagement of contact 21 with contact 22 causes current to flow in one direction through field winding 24' and the armature of motor 24, while engagement of contact 21 with contact 23 causes current to flow through field winding 24'' in the reverse direction from that in which current flowed in winding 24'.

Upon setting the weight 18 on arm 19 to the position corresponding to the steam pressure which it is desired to maintain in the driers 13, a corresponding quantity of steam will pass through the engine 5. If the power corresponding to that steam is more than that required for driving the paper machinery at the desired rate through the generator 7, the excess power is automatically returned to the alternating current lines 10 by the generator 6. In other words, the power represented by the difference between that corresponding to the quantity of steam passing through the

engine 5 and that required for driving the paper machinery is turned by the alternating current generator 6 into the lines 10. The speed of the engine 5 is substantially constant, so that the direct current generator 7 continuously supplies to the paper machine motors the proper voltage for driving said machinery at the desired rate. In this connection, it may be noted that a substantially constant speed of operation of the engine is assured by the fact that the alternating current generator 6 is connected to the lines 10 in parallel with the generator 11 in the power house. When the steam supplied to the engine 5 is in excess of that required to drive said engine at the appropriate speed, there is a tendency to drive the generator 6 at a faster rate than generator 11, but the speed of said engine 5 and generator 6 nevertheless remains constant, and instead power is delivered into the lines 10 by generator 6. If on the other hand, as may occur during the drying of very thin paper, the steam required by the driers 13 is less than that necessary to the driving of generator 7 at the proper rate, current supplied by the generator 11 is taken by generator 6 and the constant speed of the engine 5 and generators driven thereby is maintained. In short, the generators 6 and 11, connected in parallel to the alternating current lines 10 operate in synchronism, and the speed of the engine 5 is thus maintained constant, so that a constant voltage of the desired value is supplied by generator 7 to the motors which operate the paper machinery. Variation in the amount of steam passing through the engine 5 in accordance with the requirements of the driers 13 does not result in any substantial change in the speed of operation of said engine but results instead in the taking of power from or the returning of power to the lines 10 by generator 6, according to whether the power corresponding to the steam passing thru the engine 5 is less or greater than that required to operate said engine at its appropriate substantially constant speed. The generator 11 in the power house, as has been pointed out, is driven by a turbine or other suitable prime mover and the amount of steam delivered to the latter is controlled, as is well-known standard practice, by the demand for current in the supply line 10.

It will be apparent that my invention is not restricted to use in connection with the drying of any particular form of paper material. Whether the material being dried be pulp in its various forms as employed in paper manufacture or completed paper produced from the pulp, it is manifest that my invention is fully applicable, the quantity of steam supplied to the prime mover being in either event determined by the requirements for the driving of the material present in the driers. Expressions such as "drying of

paper" or "paper drying operations" in the specification and claims are accordingly not to be understood as restricted to paper or its components in any particular form.

- 5 The terms and expressions which I have employed are used as terms of description and not of limitation, and I have no intention, in the use of such terms and expressions, of excluding any mechanical equivalents of the features shown and described or portions thereof, but recognize that various structural modifications are possible within the scope of the invention claimed.

What I claim is:

- 15 1. A method of power supply in conjunction with the manufacture of paper, which comprises so operating a prime mover that it will supply to a drier as exhaust steam, the steam required for paper drying operations, driving paper machinery with power supplied by said prime mover and supplying to a power line the power developed by said prime mover in excess of that applied to driving of said paper machinery.
- 25 2. A method of power supply in connection with the manufacture of paper which comprises so operating a prime mover that it will supply to a drier as exhaust steam the steam required for paper drying operations, driving paper machinery with a part of the power corresponding to the steam passing through said prime mover, and applying to a power line the remainder of said power.
- 35 3. A method of power supply in connection with the manufacture of paper which comprises so operating a prime mover that it will supply to a drier as exhaust steam the steam required for paper drying operations, controlling said steam in accordance with the pressure desired, and driving paper machinery through power developed in said prime mover by the passage of said steam therethrough.
- 45 4. A method of power supply in connection with the manufacture of paper which comprises so operating a prime mover that it will supply to a drier as exhaust steam the steam required for paper drying operations, driving by said prime mover an electric generator, operating paper machinery with power supplied by said generator, driving by said prime mover another electric generator, and supplying to a power line the output of said second mentioned generator.
- 55 5. A method of power supply in connection with the manufacture of paper which comprises so operating a prime mover that it will supply to a drier as exhaust steam the steam required for paper drying operations, driving by said prime mover an electric generator, operating paper machinery with power supplied by said generator, generating alternating current through power developed by said prime mover in excess of that utilized for operating said paper machinery, and introducing said alternating current into power supply lines.
6. A method of power supply in connection with the manufacture of paper, which comprises so operating a prime mover that it will supply to a drier as exhaust steam the steam required for paper drying operations, driving paper machinery by power supplied by said prime mover, generating alternating current through power developed by said prime mover in excess of that utilized for operating said paper machinery and introducing said alternating current into power supply lines.
7. A method of power supply in connection with the manufacture of paper, which comprises operating a prime mover at substantially constant speed, and in such manner that it will supply to a drier as exhaust steam the steam required for paper drying operations, driving paper machinery through power developed in said prime mover by the passage of said steam therethrough, generating electrical energy by the power developed in said prime mover in excess of that utilized for driving said paper machinery, and introducing said electrical energy into a power line.
8. A method of power supply in connection with the manufacture of paper, which comprises operating a prime mover at substantially constant speed, and in such manner that it will supply to a drier as exhaust steam the steam required for paper drying operations, driving by said prime mover an electric generator, operating paper machinery with power supplied by said generator driving by said prime mover another electric generator and supplying to a power line the output of the second mentioned generator.
9. A method of power supply in connection with the manufacture of paper, which comprises operating a prime mover at substantially constant speed, and in such manner as to supply to a drier as exhaust steam the steam required for paper drying operations, driving by said prime mover an electric generator, operating paper machinery by power supplied by said generator, generating alternating current by power developed by said prime mover in excess of that utilized for operating said paper machinery, and introducing said alternating current into power supply mains.
10. In combination, a steam-operated prime mover, a generator driven thereby, a paper machine operated by power supplied by said generator, an alternating current generator driven by said prime mover and connected to alternating current supply means, a drier, and means for causing said prime mover to supply to said drier as exhaust

lized for operating said paper machinery, and introducing said alternating current into power supply lines.

6. A method of power supply in connection with the manufacture of paper, which comprises so operating a prime mover that it will supply to a drier as exhaust steam the steam required for paper drying operations, driving paper machinery by power supplied by said prime mover, generating alternating current through power developed by said prime mover in excess of that utilized for operating said paper machinery and introducing said alternating current into power supply lines.

7. A method of power supply in connection with the manufacture of paper, which comprises operating a prime mover at substantially constant speed, and in such manner that it will supply to a drier as exhaust steam the steam required for paper drying operations, driving paper machinery through power developed in said prime mover by the passage of said steam therethrough, generating electrical energy by the power developed in said prime mover in excess of that utilized for driving said paper machinery, and introducing said electrical energy into a power line.

8. A method of power supply in connection with the manufacture of paper, which comprises operating a prime mover at substantially constant speed, and in such manner that it will supply to a drier as exhaust steam the steam required for paper drying operations, driving by said prime mover an electric generator, operating paper machinery with power supplied by said generator driving by said prime mover another electric generator and supplying to a power line the output of the second mentioned generator.

9. A method of power supply in connection with the manufacture of paper, which comprises operating a prime mover at substantially constant speed, and in such manner as to supply to a drier as exhaust steam the steam required for paper drying operations, driving by said prime mover an electric generator, operating paper machinery by power supplied by said generator, generating alternating current by power developed by said prime mover in excess of that utilized for operating said paper machinery, and introducing said alternating current into power supply mains.

10. In combination, a steam-operated prime mover, a generator driven thereby, a paper machine operated by power supplied by said generator, an alternating current generator driven by said prime mover and connected to alternating current supply means, a drier, and means for causing said prime mover to supply to said drier as exhaust

steam the steam required for paper drying operations.

11. In combination, a steam-operated prime mover, a paper machine, means driven by said prime mover for supplying power to said paper machine, means driven by said prime mover for supplying power to power mains, a drier, and means for causing said prime mover to supply to said drier as exhaust steam the steam required for paper drying operations.

12. In combination, a steam-operated prime mover, a paper machine, means driven by said prime mover supplying power to said paper machine, an alternating current generator driven by said prime mover and connected to alternating current supply means, a drier, and means for causing said prime mover to supply as exhaust steam to said drier the steam required for paper drying operations.

13. In combination, a steam-operated prime mover, a paper machine, means driven by said prime mover for supplying power to said paper machine, a drier, and means for causing said prime mover to supply as exhaust steam to said drier the steam required for paper drying operations.

14. In combination, a reciprocating steam engine, a paper machine, means driven by said engine for supplying power to said paper machine, a drier, and means for causing said engine to supply as exhaust steam to said drier the steam required for paper drying operations.

15. In combination, a reciprocating steam engine, a generator driven thereby, a paper machine driven by power supplied by said generator, an alternating current generator driven by said engine and connected to alternating current supply mains, a drier, and means for causing said engine to supply to said drier as exhaust steam the steam required for paper drying operations.

16. A method of power supply in conjunction with the manufacture of paper, which comprises so operating a prime mover as to supply to a drier as exhaust steam the steam required for the drying of paper, driving paper machinery through power supplied by said prime mover, and applying to operation of said prime mover such additional power from an electrical supply line as may be required for operation of said prime mover at the rate appropriate for driving said machinery at the desired speed.

17. A method of power supply in conjunction with the manufacture of paper, which comprises so operating a prime mover as to supply to a drier as exhaust steam the steam required for the drying of paper, driving paper machinery through power supplied by said prime mover, and driving by said prime mover an alternating current gen-

erator connected to a power line in parallel with another alternating current generator.

In testimony whereof, I have signed my name to this specification this sixth day of March, 1930.

HENRI G. CHATAIN.

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