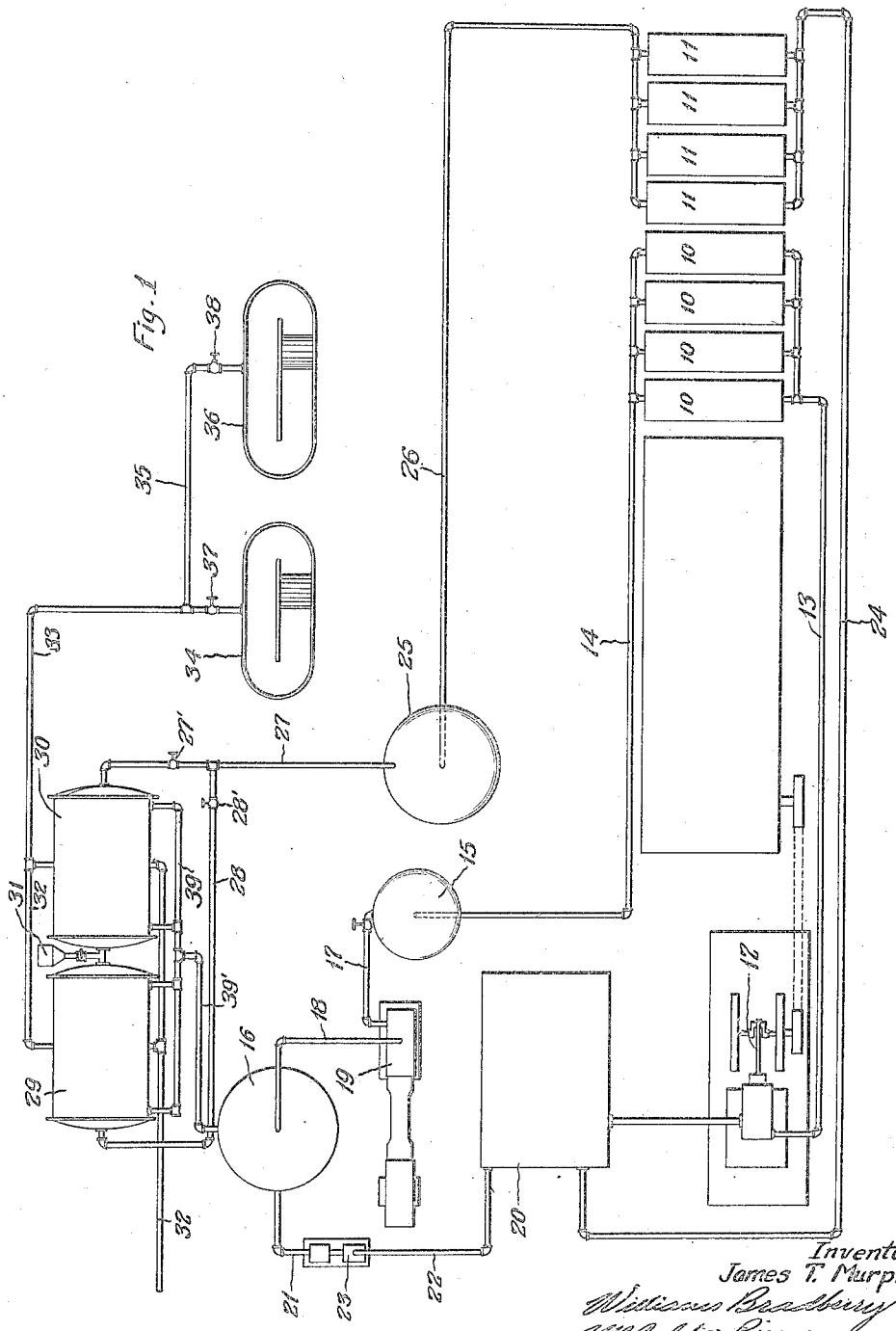
Oct. 12, 1926. 1,602,545

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METHOD OF AND MEANS FOR MAKING PAPER

Filed Nov. 27, 1922 3 Sheets-Sheet 1

Fig. 1



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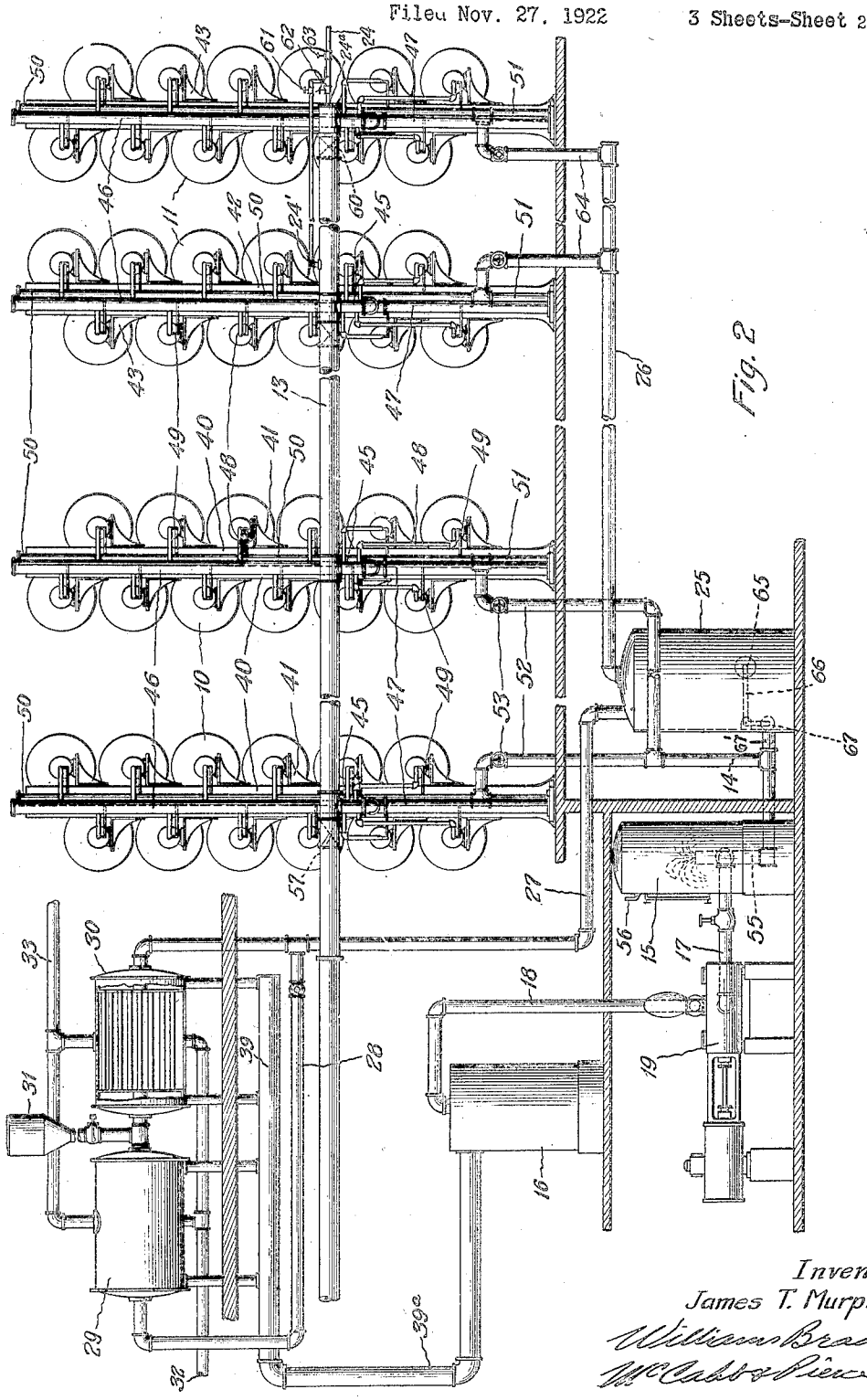


Fig. 2

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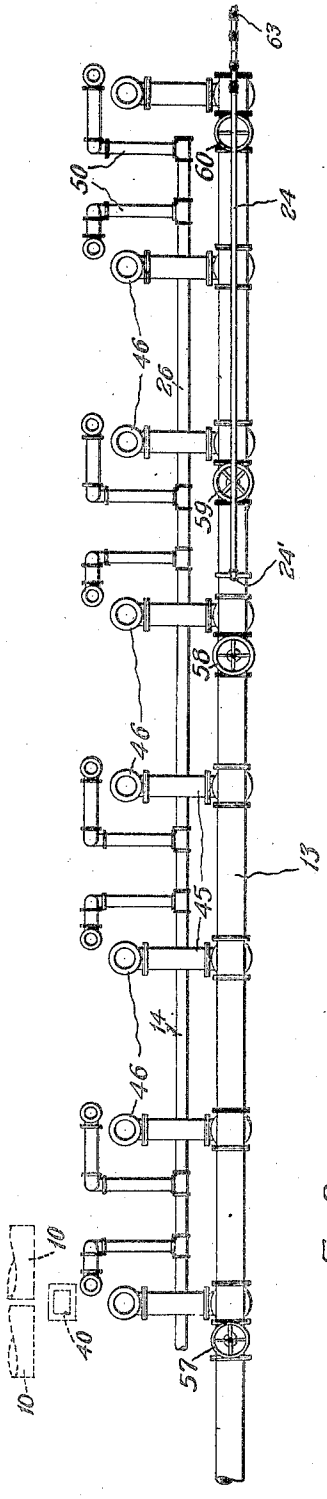


Fig. 3

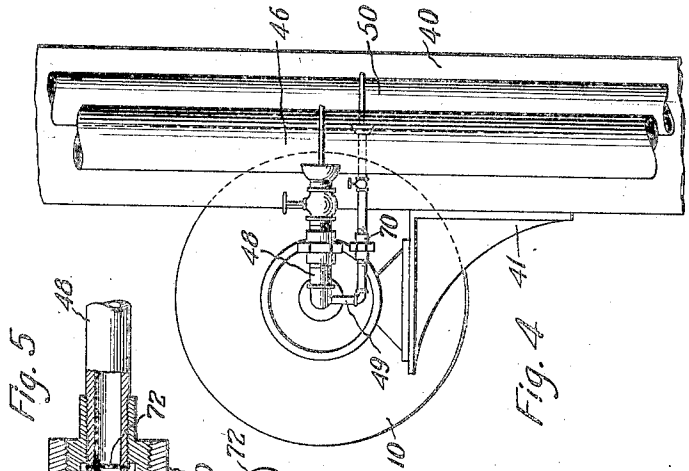


Fig. 4

Fig. 5



Fig. 6

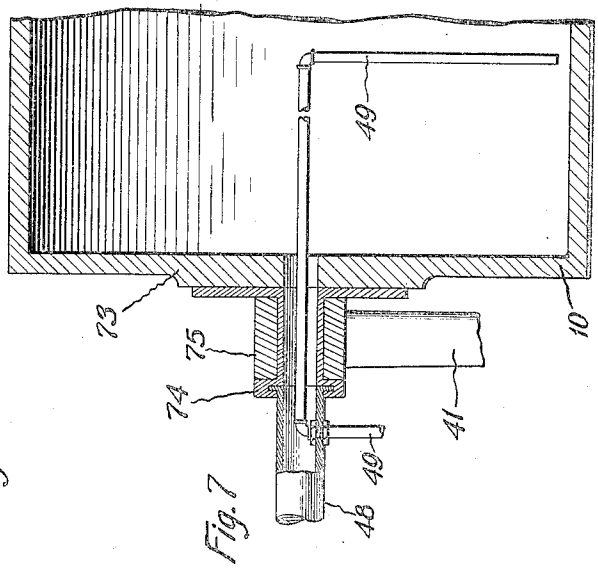


Fig. 7

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UNITED STATES PATENT OFFICE.

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METHOD OF AND MEANS FOR MAKING PAPER.

Application filed November 27, 1922. Serial No. 603,412.

My invention relates to improvements in methods of and means for making paper, and is particularly concerned with the provision of a novel method of and means for drying the paper web as it comes from the paper making machine.

The principal object of my invention is to provide a method and means for more rapidly and economically drying the paper web. More specifically speaking, my invention comprises means whereby heat can be more rapidly transmitted to the drying rolls than is possible with the means and method heretofore employed.

Another object of my invention is to provide means whereby steam can be continuously supplied to and withdrawn from the drying rolls.

A still further object of my invention is to provide means whereby the heat contained in the steam discharged from the dry ing rolls can be efficiently and economically employed in one of the steps of forming the paper pulp from which the paper web to be dried is formed, or devoted to some other useful performance.

A still further object of my invention is to provide means for insuring a continuous but restricted flow of steam through the drying rolls.

Other objects of my invention will appear as this description progresses, reference being had to the accompanying drawings, in which—

Figure 1 is a schematic view of a paper making plant embodying my invention;

Figure 2 is a side elevation of a portion of an apparatus embodied in my plan;

Figure 3 is a plan partially in section;

Figure 4 is a partial end elevation;

Figure 5 is a sectional detail of one of the discharge pipes from a heating roll;

Figure 6 is a plan view of one of the elements embodied in Figure 5; and

Figure 7 is a partial longitudinal section through one of the rolls.

Throughout the several views, similar reference characters will be used for referring to similar parts.

Heretofore, so far as I know, it has been the universal practice to provide the discharge pipes of the rolls of a paper drying machine with steam traps for the purpose of preventing the discharge of steam from the rolls. In such a construction, steam is admitted to the drying rolls at a rate dependent upon the rate of condensation of the steam within the roll. The rate of condensation is in turn dependent to a certain degree upon the capacity of the roll to transmit heat to the paper web and the surrounding atmosphere. Furthermore, since the operation of the steam traps is more or less intermittent, considerable quantities of condensed steam, or water, are trapped in the drying rolls and discharged from time to time. This water which is approximately at a temperature of 212° F. has acted to keep the drying rolls at a lower temperature than it would be possible to maintain them at if the water were not present, or were not present in such large quantities. It has also been found that in practice oil and other impurities in the steam has caused the failure of the steam traps, and ultimately the rolls discharging into such traps have been practically filled with water thereby reducing their effectiveness to a very large degree.

I propose to correct the defects in the systems heretofore in use, referred to above, by providing for a continuous passage of steam through the drying rolls so that the rate of drying is not dependent upon the ability of the paper to absorb the heat from the paper drying rolls, but rather upon the pressure, that is, the temperature of the steam supplied to the drying rolls. By this arrangement, I can supply steam of practically any temperature to the drying rolls and am thus enabled to dry the paper at a much faster rate than has heretofore been considered possible. Where my invention has been embodied in the drying machine, it has been found possible to dry paper at from two to three times as fast as it was possible to dry the paper when the same machine was provided with the steam

traps and other accessories heretofore considered necessary.

Since by the method and means referred to above uncondensed steam is discharged from the drying rolls, I provide means for simply and efficiently utilizing this heat for useful purposes. In the preferred embodiment of my invention, the steam discharged from the high pressure end of the drying machine is utilized for heating the water supply to the beating engines which produce the pulp forming the paper web which is to be dried. The steam and water issuing from the rolls on the low pressure end of the drying machine are used for supplying feed water to the boiler which supplies steam to the engine for driving the paper making machine.

Other features of my invention will appear as the description of my improved apparatus progresses.

Referring for the present to Figure 1 wherein I have shown a paper making machine comprising the low pressure drying rolls 10 and the high pressure drying rolls 11, the former rolls receive the exhaust steam from the engine 12 through the pipe 13, and the steam and condensate discharged from these rolls flows through the pipe 14 to the receiving tank 15 from which it can be pumped to the boiler feed water tank 16 through the pipes 17 and 18 by the pump 19. From the tank 16 the condensate can be returned to the boiler 20 through the pipes 21 and 22 by means of the pump 23.

The steam for the high pressure rolls is supplied from the boiler 20 through the pipe 24 and after passing through the drying rolls flows to the receiving tank 25 through the pipe 26 at which point any water which may be entrained therein is separated from the steam, which continues through the pipes 27 and 28 to suitable heaters 29 and 30, the flow through these heaters being controlled by the valves 27′ and 28′. These heaters are of the usual drum type and discharge to atmosphere through the vent pipe 31. Cold water enters these heaters through the pipe 32 and the heated water is discharged therefrom through the pipe 33 which leads to the beating engine 34 and the pipe 35 which leads to the beating engine 36. Suitable valves 37 and 38 control the supply of heated water to the respective beating engines. The condensate from the heaters 29 and 30 which results from the condensation of the steam supplied thereto through the pipes 27 and 28 returns to the boiler feed water tank 16 through the header 39 and the pipe 39′.

Having thus described in general the arrangement of the elements of my improved paper making plant, I shall now describe in somewhat greater detail the various parts thereof.

Referring for the present to Figures 2 to 4 inclusive, I have illustrated the drying portion of the paper making machine as comprising a plurality of stacks of low pressure rolls 10 supported in the usual staggered relation upon suitable posts 40 by means of the brackets 41, and the high pressure rolls 11 supported in the usual manner upon posts 42 by the brackets 43. The pipe or header 13 is connected by means of the legs 45, which first extend downwardly as shown in Figure 2, and then inwardly, as shown in Figure 3, with the risers 46 which are supported by the pipe sections 47 and which extend upwardly parallel with the adjacent posts 40. A branch pipe 48 connects each roll with the adjacent riser 46 in the manner to be described later on. Each roll is provided with the discharge pipe 49 which connects with the adjacent down-take pipe 50. These down-take pipes are each supported by a short section of pipe 51 and in the case of the low pressure rolls are connected by the pipes 52 having the valves 53 therein with the pipe 14 which leads to the bottom of the receiving tank 15. The pipe 14 connects with the pipe 55 extending upwardly through the bottom of the tank 15 to a point above the bottom thereof where the condensate and steam from the low pressure drying rolls is discharged into the tank. Whatever steam or air may be entrained in the water can discharge through a suitable vent pipe 56 which may, if desired, be provided with a trap. As described above, the condensate from the tank 15 can be returned to the boiler feed water tank through the pipes 17 and 18 by means of the pump 19.

The header 13 is provided with a plurality of valves 57, 58, 59 and 60 whereby it can be divided into sections to vary the number of high and low pressure stacks or rolls. The high pressure steam pipe 24 leading from the boiler connects with the pipe or header 13 at the point 24′, and by closing the valve 58 the right hand portion of the pipe 13 becomes the header for the drying rolls on the high pressure or dry end of the drying machine.

I have also shown a branch pipe 24ª whereby the live steam can be injected directly into the end of the pipe 13.

Suitable valves 61, 62 and 63 may be provided for controlling the supply of live steam to the high pressure rolls.

The steam discharged from the high pressure rolls passes downwardly through the down-take pipes 50 which are supported by the short pipe sections 51 and through the pipes 64 to the pipe or header 26. This pipe 26 discharges into the receiving tank 25 at a point above the bottom of this tank and what little condensate may be entrained therein is separated from the live steam at this point. The live steam passes out of the tank 25 to

the pipe 27 and into the heater 30, or it may pass through the pipe 28 into the heater 29 as heretofore described. It will, of course, be understood that both heaters 29 and 30 may be used simultaneously, if so desired. I have already described how the steam passing through the heaters 29 and 30 heats the water for the beating engines, and further description thereof appears to be unnecessary.

As the level of the condensate in the tank 25 rises, it lifts the float 65 and through the bell crank lever 66 opens the valve 67, thus permitting the condensate in the tank 25 to be discharged through the pipe 67′ into the lower end of the pipe 14 through which it is conducted to the receiving tank 15.

By reference to Figures 4, 5 and 6, it will be noted that each of the exhaust or discharge pipes 49 which conducts the steam and condensate from the heating rolls embodies a two-part coupling or union 70, which is designed to clamp the washer 71 between the adjacent ends of the pipe sections coupled by this union. This washer is provided with a central aperture 72 which affords a free passageway for the flow of steam therethrough, but which is of such size that it, to a certain extent, restricts the flow of steam therethrough so as to create a slight back pressure upon the steam in the drying roll, and thus prevent the steam from blowing straight through the drying roll. In a certain commercial installation, I have found that where steam under approximately twenty pounds per square inch is supplied to the dry end, or high pressure rolls, of the dryer, this opening should be approximately one-eighth of an inch in diameter, and that where exhaust steam under six or eight pounds pressure is supplied to the low pressure rolls, or wet end, of the dryer, this opening should be approximately three-eighths of an inch in diameter. It will, of course, be understood that the diameter of this opening can be varied to suit the conditions under which the entire plant operates.

In Figure 7, wherein I have shown a partial longitudinal section through a heating roll forming a part of my invention, I have shown the heating roll proper 73, one end of which is provided with a hollow trunnion 74 mounted in a suitable elongated bearing 75. One end of a branch pipe 48 is connected with the hollow trunnion by a swivel joint, and the siphon or discharge pipe 49 extends downwardly to a point nearer the wall of the roll than has been the practice heretofore. The discharge pipe 49 passes outwardly through one side of the branch pipe 48.

From the above description, it will be seen that I have provided means which permits a continuous flow of steam to the drying rolls but at the same time have provided means for economically and efficiently utilizing the heat in the steam escaping from the drying rolls. In the particular embodiment of the invention disclosed herein, this heat is utilized for boiler feed water purposes and for heating the water supplied to the beating engines, but it will of course be understood that this heat could be utilized in other ways without departing from the spirit of my invention. By providing an unobstructed discharge pipe for the drying rolls, the continuous flow of steam referred to is made possible. In this manner, much larger amounts of heat can be transferred to the heating rolls and from the heating rolls to the paper than is possible where the steam is trapped in the heating rolls even though in the last case the steam is under considerably greater pressure.

While I have described the details of construction of the preferred embodiment of my invention, it is to be clearly understood that my invention is not limited to these details, but is capable of other adaptations and modifications within the scope of the appended claims.

Having thus described my invention, what I claim is:

1. A paper making plant comprising an engine, a boiler for supplying steam to said engine, a beating engine, and a drying machine driven by said engine, said drying machine comprising a plurality of rolls, means for supplying exhaust steam from said engine to some of said rolls, means for conducting condensate from said last-named rolls to said boiler, means for supplying live steam from said boiler to others of said rolls, a heater for supplying hot water to said beating engine, means for conducting steam from said other rolls to said heater, and means for returning condensate from said heater to said boiler, both of said conducting means comprising means for causing a continuous but restricted flow of the fluids therethrough.

2. A paper making plant comprising a boiler, a beating engine, and a drying machine, said drying machine comprising a plurality of rolls, means for supplying live steam from said boiler to said rolls, a heater for supplying hot water to said beating engine, and means for conducting steam from said rolls to said heater, said conducting means comprising means for causing a continuous but restricted flow of the fluids therethrough.

3. A paper making plant comprising a boiler, a beating engine, and a drying machine, said drying machine comprising a plurality of rolls, means for supplying live steam from said boiler to said rolls, a heater for supplying hot water to said beating engine, and means for conducting steam from

said rolls to said heater, said conducting means comprising means for causing a continuous flow of the fluids therethrough.

4. A drying machine comprising a drying roll, a steam supply conduit connecting with said roll, a steam outlet conduit having its outlet mouth drawing from a stationary point in the roll during the rotation of the latter, and a permanently open restriction in said outlet conduit of predetermined non-variable size for causing a continuous restricted circulation of steam through said roll and through said outlet conduit with minimum condensation in each.

5. In combination, a drying machine comprising a drying roll, a steam supply conduit opening into said roll, a steam outlet conduit having its outlet mouth drawing from a stationary point in the roll during the rotation of the latter, a receiving tank receiving the exhaust from said steam outlet conduit, steam consuming means connected with said receiving tank for utilizing the exhaust steam, and restricting means in said outlet conduit of substantially predetermined size for producing a continuous restricted circulation of steam through said roll and through said outlet conduit to said receiving tank with minimum condensation in said roll and said outlet conduit.

6. In a drying machine, the combination of a drying roll, a supply pipe supplying steam to said roll, an exhaust pipe for conducting steam from said roll, a valve for shutting off flow through said exhaust pipe and a restriction in said exhaust pipe separate from said valve for creating a back pressure in said drying roll but permitting the discharge of steam therefrom at a sufficiently rapid rate to minimize condensation in said roll.

7. In a drying machine, the combination of a drying roll, a supply pipe supplying steam to said roll, an exhaust pipe for conducting steam from said roll, and a restricting member having a calibrated orifice interposed in said exhaust pipe, said restricted member being interchangeable for providing different sized orifices.

8. In a drying machine, the combination of a drying roll, a supply pipe supplying steam to said roll, an exhaust pipe for conducting steam from said roll, a coupling in said exhaust pipe and a member in said coupling having an orifice of substantially predetermined size for controlling the rate of exhaust flow from said roll.

9. In combination, a plurality of drying rolls, a steam manifold connected to said rolls, a low pressure steam pipe connected to said manifold at one point, a high pressure steam pipe connected to said manifold at another point, and valves for subdividing said manifold into different areas of high and low pressure.

10. In paper making apparatus, the combination of a plurality of drying rolls, a steam manifold, branch connections between said manifold and said drying rolls, a steam engine, a first steam pipe connecting the exhaust outlet of said engine with said manifold, a second steam pipe connecting with said manifold for transmitting a different steam pressure thereto, and valves in said manifold for dividing the same into different portions supplied by said first and second steam pipes.

11. In combination, a plurality of drying rolls, a steam manifold for supplying said rolls, first and second steam supply pipes discharging into said manifold, and valves operable to cause different areas of said manifold to be supplied from said first and second supply pipes.

12. A paper making plant comprising a beating engine, means for supplying water to said beating engine, a drying machine for drying paper formed from the pulp produced by said beating engine, means for supplying steam to said drying machine, and means for using the steam discharged from the drying machine for heating the water delivered to the beating engine.

13. The method of making paper which comprises making pulp suspended in water, forming said pulp into a web, drying said web by means of steam, and heating the water used in forming the pulp with the steam previously used for drying.

14. In combination, a plurality of drying rolls, a steam supply manifold having connection with said rolls, a steam supply pipe, and means for admitting steam from said supply pipe to an intermediate portion of said manifold and excluding the steam from said supply pipe from the ends of said manifold.

15. In a drying machine, the combination of a plurality of drying rolls, a manifold having connection with said rolls, valves in said manifold, a steam supply pipe, a branch therefrom connecting with one end of said manifold, a second branch from said supply pipe connecting with said manifold at an intermediate point thereof, and valves in said branches for admitting steam to said intermediate portion of the manifold without admitting steam to said end of the manifold.

16. In a drying machine, the combination of high pressure drying rolls, low pressure drying rolls, a first exhaust pipe for said low pressure drying rolls, a second exhaust pipe for said high pressure drying rolls, separate receiving tanks into which said exhaust pipes discharge, means for withdrawing condensate from one of said tanks, a connection between said tanks, and float mechanism in one of said tanks controlling said connection.

17. In a drying machine, the combination of a drying roll, a steam supply pipe discharging into said drying roll, an exhaust pipe leading from said roll, and means in said exhaust pipe comprising an opening of predetermined size for maintaining a continuous circulation of steam through said roll and through said exhaust pipe, said opening ranging from 1/8" in diameter for steam under approximately twenty pounds pressure to 3/8" in diameter for steam under approximately six or eight pounds pressure.

In witness whereof, I hereunto subscribe my name this 24th day of November, 1922.

JAMES T. MURPHY.