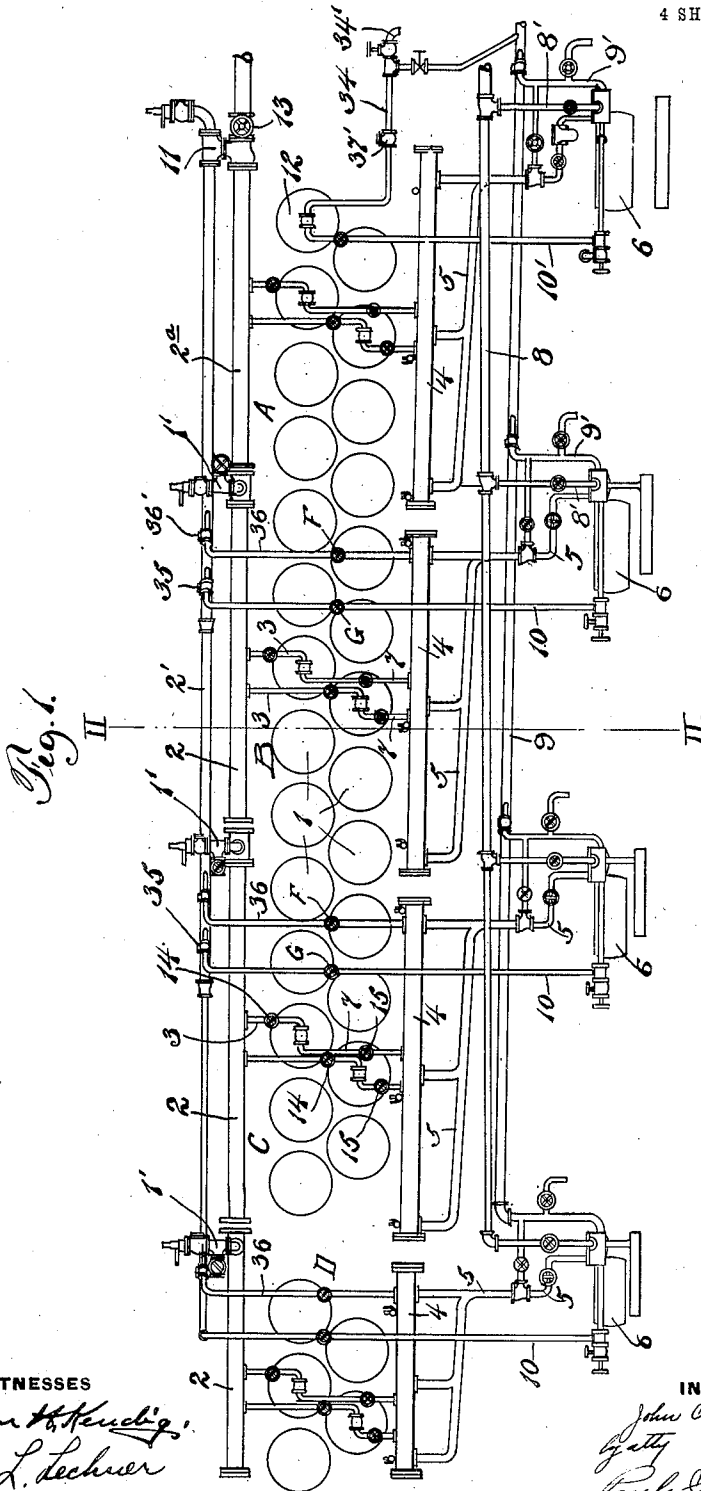


J. O. WOODSOME.
 DRYING MACHINE.
 APPLICATION FILED AUG. 19, 1911.

1,114,215.

Patented Oct. 20, 1914.

4 SHEETS—SHEET 1.



WITNESSES

Julian H. Kuehlig
Harvey L. Lechner

INVENTOR

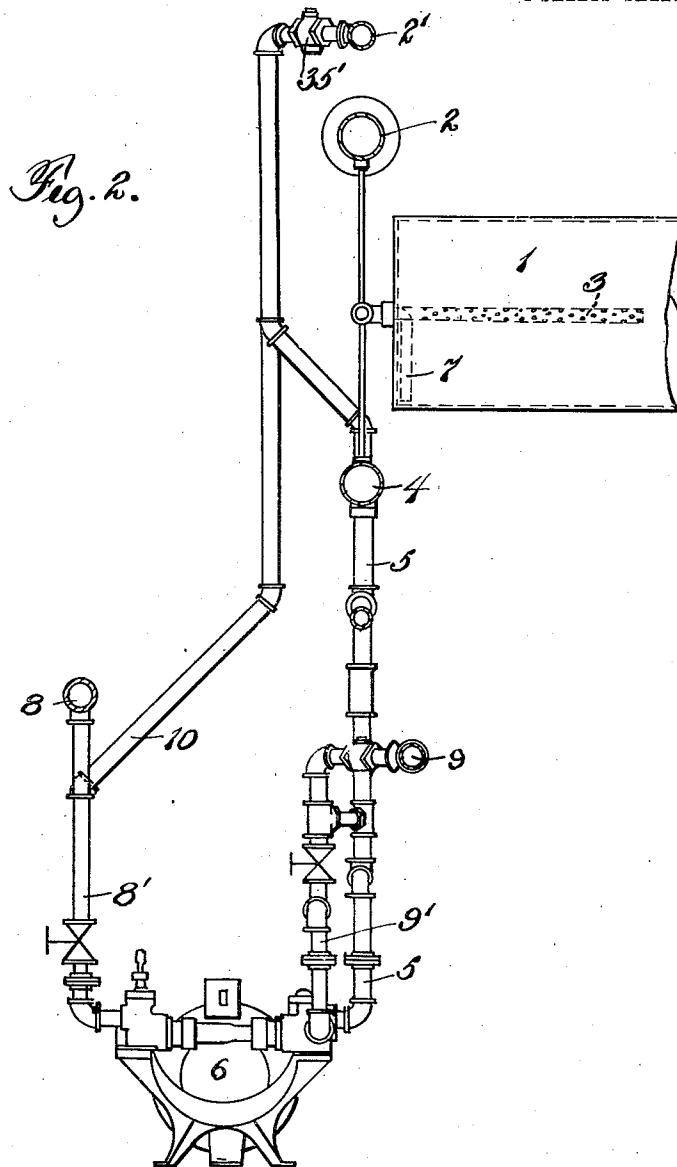
John O. Woodsome
By Atty
Paul Symmes to 200

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4 SHEETS—SHEET 2.



WITNESSES

Gubas H. Handig
Nancy L. Lechner

INVENTOR

John O. Woodsome
By
Paul Symeswood

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4 SHEETS—SHEET 3.

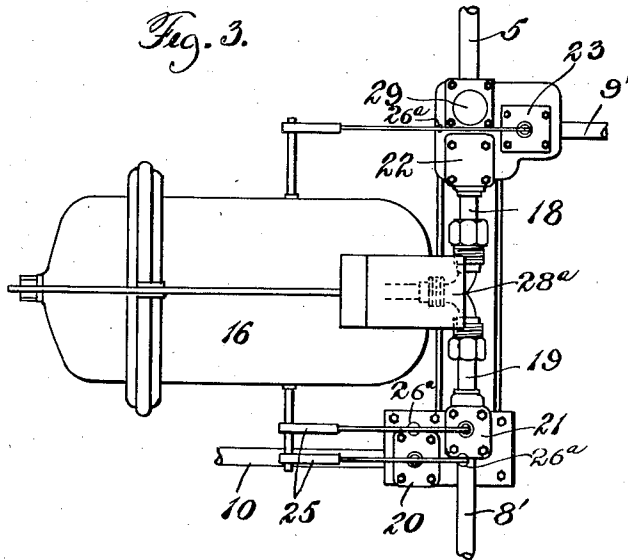
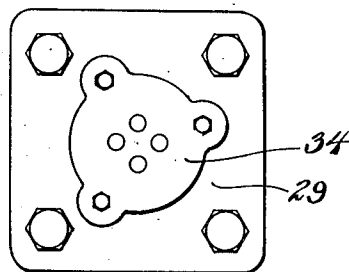


Fig. 6.



WITNESSES

Julian H. Hendig;
Harvey L. Lechner

INVENTOR

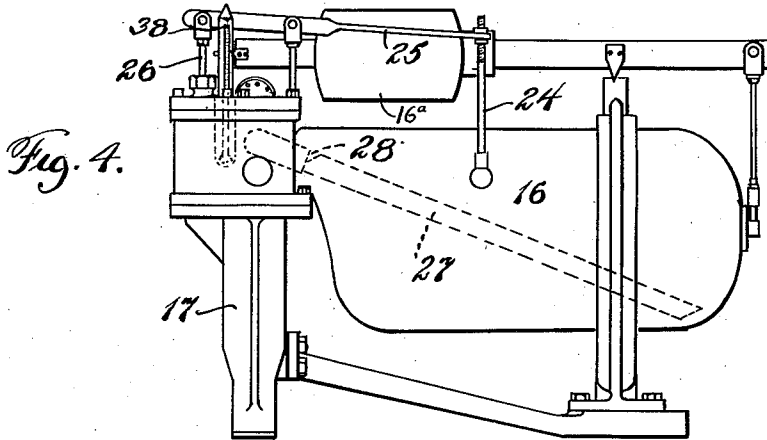
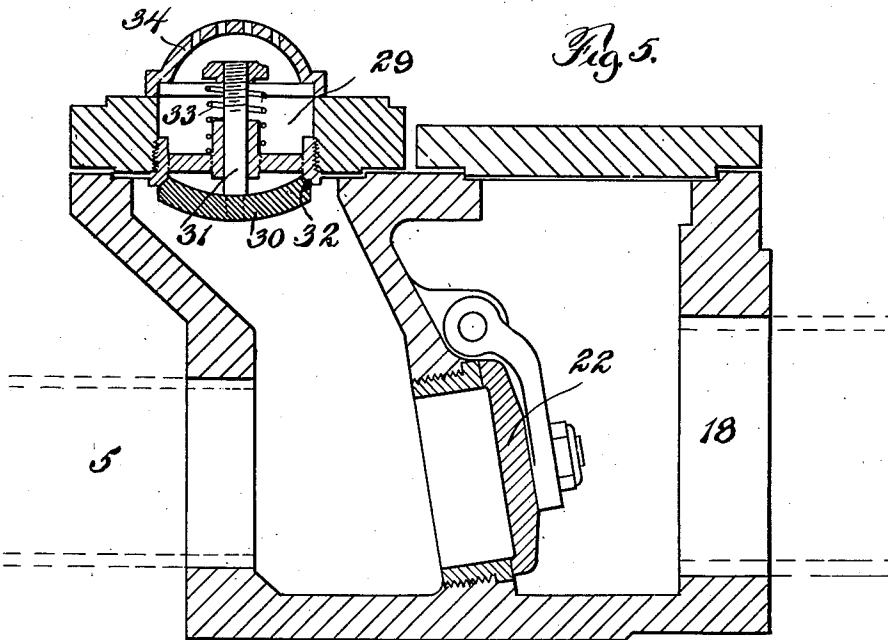
John O. Woodsome
by *Paul Symmesworth*

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4 SHEETS-SHEET 4.



WITNESSES
Julian H. Hendry;
Harvey L. Lechner

INVENTOR
John O. Woodsome
by atty Paul H. Humeatreat

UNITED STATES PATENT OFFICE.

JOHN O. WOODSOME, OF CHICAGO, ILLINOIS, ASSIGNOR TO CRANE COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

DRYING-MACHINE.

1,114,215.

Specification of Letters Patent.

Patented Oct. 20, 1914.

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To all whom it may concern:

Be it known that I, JOHN O. WOODSOME, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have made certain new and useful Improvements in Drying-Machines, of which the following is a specification.

This invention has reference to drying machines, such for example as paper making machines, cloth drying machines and the like, wherein steam is used as a heating or drying agent. It has for its primary objects an improved arrangement of drying machines whereby the greatest possible number of heat units are utilized thereby effecting a great saving in operation; and an increase in efficiency; the provision of improved means for securing proper temperature in the heating or drying cylinders of the apparatus; the provision of improved means for preventing the accumulation of water of condensation in the drying cylinders, and in general the provision of an improved arrangement of drying machine which is simple and very economical, efficient in operation and easily regulated. These together with such other objects as may hereinafter appear, or are incidental to my invention I obtain by means of a construction illustrated in preferred form in the accompanying drawings, wherein—

Figure 1 is a diagrammatic side elevation of a paper machine,

Figure 2 is a section on the line II—II of Figure 1 drawn to an enlarged scale,

Figures 3 and 4 are respectively a plan and side elevation of a detail of my invention,

Figure 5 is a section on an enlarged scale through an improved vacuum breaking apparatus I employ in carrying out my invention, and

Figure 6 is a plan view of another detail of my invention.

In the drawings I have shown my invention applied to a paper making machine, but it will be understood that the invention is equally well applicable to cloth drying machines or other similar drying machines especially where steam is the heating or drying agent employed. In making paper by machines the paper pulp is passed over a large number of heating or drying cylinders. The pulp as it enters the machine contains substantially 50% of water

and leaves the machines in the form of paper with substantially no moisture, the water being gradually dried out or evaporated as the pulp passes over the drying cylinders. In cloth drying machines the moisture is taken out in a similar manner. It is well known to those familiar with this art that the success and efficiency of the machines depends upon the maintenance of proper temperatures in the drying cylinders, any material variation from the correct temperature resulting either in a total loss or an inferior grade of article. In paper making machines if the temperature be too high in the first cylinders the pulp will be blown away from the cylinders or will crack or cockle which necessitates a closing down of the machine and entails a loss of time and labor. Heretofore paper making machines have been usually divided into two sections, in the first of which steam at low pressure is used as the heating agent, and in the second steam at a higher pressure, which gives the second section a higher temperature than the first section. The difficulty in maintaining proper temperatures in these sections arises chiefly from the accumulation of condensation in the drying rolls and from the failure to secure a proper rate of flow of steam from the steam inlet side of the machine to the return or discharge side, and it is one of the chief objects of my invention to provide means for keeping the drying rolls comparatively free from condensation, thereby facilitating proper regulation of temperature.

Referring to the drawings, particularly Figure 1, it will be seen that I have diagrammatically illustrated a paper machine composed of four sections, A, B, C and D, of hollow heating or drying cylinders or rolls 1 of the usual type. Steam is supplied to the sections B, C and D from pipes 1'—1'—1', which lead into supply headers 2—2—2, from which the steam is carried into the drying cylinders 1, by means of the pipes 3—3, a few only of which are indicated. These pipes 3 enter one trunnion of the cylinders in the usual manner (see Figure 2). On the discharge or return side of the machine I have provided a receiving header 4 for each section, these receiving headers being connected to one trunnion of each drying roll by means of the connecting pipes 7—7 in the usual manner. It will be

observed that the receiving headers are of large diameter, the purpose of which will hereinafter be set forth. The receiving headers are connected to controllers 6 by means of the pipes 5, each one of which is connected to the receiving headers at several points. The controllers 6 are provided to receive water of condensation from the apparatus and are connected to a live steam pipe 8 which in turn has communication with a source of steam supply at a point beyond that part of the pipe shown broken away at the right hand of Figure 1, and are also connected by means of the outlet connections 9' to a discharge pipe 9 leading to the boilers or elsewhere. The controllers for the sections B, C and D are also provided with pipes 10—10—10, (hereinafter termed vent pipes) which provide an outlet for the steam from the controller to a pipe 2' which is connected at a point marked 11 with the header 2^a in the section A, for a purpose which will hereinafter appear.

Referring now to Figures 3 and 4 it will be seen that the controller 6 comprises a tilting tank 16 mounted for oscillation in the framework 17 on the trunnions 18 and 19 as is usual. As here shown and referring more specifically to any one of the sections B, C or D, the numeral 5 indicates the pipe leading from the receiving header 4 to the controller; 9' indicates the pipe connecting the controller to the main discharge line 9; 10 is the vent pipe leading from the controller to the pipe 2' which as already stated communicates with the header 2^a for the section A; and 8' is the live steam supply pipe which connects the steam pipe 8 with the controller. These various pipes are controlled by valves in casings which open into the trunnions 18 and 19, the valve 20 controlling the steam outlet or vent pipe 10; the valve 21 the live steam inlet pipe 8'; the check valve 22 controlling the condensation inlet pipe 5; and the valve 23 the discharge or outlet pipe 9'.

The valves 20, 21, and 23 are operated by the tilting of the tank through the rods 24 actuating the stems 26 carried by the levers 25 which are fulcrumed as indicated at 26^a, the parts being so arranged that when the discharge valve 23 and the live steam inlet valve 21 are closed, the vent or steam outlet valve 20 is open and the check valve 22 similarly open so as to permit the condensation to enter the tank. When the tank is depressed to its lower position the steam inlet valve 21 and the discharge outlet valve 23 are opened and the vent valve 20 and the check valve 22 are closed. The said trunnions and valve casings of the controllers are of the type usually employed in steam traps and are further provided with the discharge pipe 27 and the steam opening 28 located in a divided T 28^a which projects into the tank.

From the foregoing it is apparent that when the tank is in raised position and receiving condensation from the pipe 5 through the open check valve 22, reduction of pressure in the tank is effected through the open valve 20 communicating with the vent pipe 10. When filled, the contents of the tank overbalances the weight 16^a thereby depressing the tank and closing the last mentioned valves and simultaneously opening the valves 21 and 23. The live steam from the pipe 8' then passes through the valve 21, trunnion 19, one division of the divided T, and opening 28, forcing the contents of the tank through the pipe 27, the other division of the T, trunnion 18, valve 23 and thence through the pipe 9'. The tank then reverts to its former position through the action of the counter-balancing weight.

Figure 5 is a section through the check valve 22 and the valve 29, which latter is designed to automatically break any vacuum forming in the drying apparatus. This valve comprises a disk 30, stem 31 and seat 32 and is normally held in closed position by means of the spring 33 mounted on the stem 31. A foraminous intake plate 34 is mounted above the stem and permits the entrance of air through the valve into the main valve chamber when any vacuum in the pipe 5 overcomes the pressure of the spring 33 and unseats the disk 30.

Figure 6 is a plan view of the valve and illustrates the intake plate. It will be apparent that the swing check valve 22 not only serves to prevent a back flow into the pipes 5 when pressure is admitted to the controller in order to discharge the collected condensation therefrom, but also prevents any vacuum from drawing condensation from the controller back into the apparatus and permits the operation of the vacuum breaking valve 29.

Referring to the arrangement of the controller and piping for the section A, it will be seen that the vent pipe 10' instead of leading to the pipe or header 2' leads into one of the trunnions of the first drying cylinder 12. A discharge pipe 34 leads from the trunnion and empties into the main discharge or return pipe 9 to the boiler. The pipe 34 may be opened to the atmosphere at the point marked 34', in cases where the discharge pipe 9 leads to a boiler or the like. In cases where the discharge pipe has a free end that is open to the atmosphere it will not be necessary to have the pipe 34 open to the atmosphere. The previous arrangement is the more advantageous in that there is but little waste of steam.

The source of steam supplied to the sections B, C and D has been described and the manner of supplying the section A with steam will now be set forth. From each of the receiving headers 4 a pipe marked 36

leads to the pipe 2'. These pipes 36 are provided with controlling valves F and with check valves 36'. Steam at a temperature above 212° is admitted to the headers 2 for the sections B, C and D through the steam pipes 1' and subject to certain changes in condition takes the following path. The steam enters the drying cylinders of these sections through the pipes 3, passes through the pipes 7 into the receiving headers 4 and thence into the pipes 36. It passes through the pipes 36 into the pipe 2' and from the pipe 2' it enters the header 2^a for the section A at the point marked 11. From the header 2^a it enters the drying cylinders of the section A through the pipes 3. A portion of the steam which enters the sections C and D condenses and, dependent upon the rate of flow of steam through these cylinders, the condensation may remain in suspension in the steam or it may flow into the receivers or headers 4, which have a large area so that this condensation which is at a comparatively high temperature will at least partially turn back into steam at a lower pressure and temperature and be carried through the pipes 36 into the pipe 2'. I have found by tests that there is a comparatively small amount of condensation from the section D which remains in the form of water and passes into the controller 6 for this section. In the section C a larger portion of the condensation remains in the form of water and enters the controller 6. In the section B the same conditions as those described in the sections C and D take place, but not in the same degree. In the sections B, C and D where the steam is supplied at a temperature above 212°, the sensible heat is utilized in drying the paper as it passes over these sections. It enters the section A at substantially 212° and the latent heat contained in the steam is here utilized for heating the drying cylinders. The section A is the section which first receives the pulp and consequently this section must do the bulk of the work in evaporating the moisture from the pulp. I have found that the use of the latent heat units in steam for heating the first section is most effective inasmuch as the latent heat can be absorbed or taken from the steam as fast as it can be supplied. This arrangement is very advantageous in that the bulk of the drying or evaporating of the excessive moisture from the pulp should be done in the first section at a temperature which will not be so high as to cause the formation of steam between the pulp and its conveyer over the cylinders, which formation of steam causes the blowing away of the pulp. The use of the latent heat units gives a large proportion of heat at a comparatively low temperature. When the machine is once in operation the section A acts as a condenser for

the entire apparatus, the steam substantially at 212° in this section condensing so rapidly that it induces a constant flow of large volumes of steam from the heating cylinders of the sections B, C and D through the pipes 36, pipe 2' and header 2^a. This flow of steam from the sections B, C and D to the section A has two important results, first in that it prevents any accumulation of condensation in the drying cylinders of these sections, and second in that it affords a means for regulating the temperature of the sections. The collection of condensation in the drying cylinders B, C, and D has been found to be detrimental because it would cause a variation in the temperature and as previously pointed out, material variations in the temperature of the various drying cylinders result in reducing the efficiency of the machine both in capacity and product. The velocity of the flow of steam from the drying cylinders through the pipes 36 can be regulated by means of the controlling valves F, and the temperature of the sections B, C and D is greatly dependent upon the rate of flow of the steam from the steam supply side to the discharge side. It will be thus seen that by this arrangement a very simple, effective and accurate means for controlling the temperature of the sections is provided. In conjunction with the control afforded by the valves F, the valves G provided in the vent pipes 10 serve to aid in controlling the temperature. The rapid consumption of steam in the section A also induces a flow of steam through the controllers and through the vent pipes 10 which has a tendency to draw the condensation collecting in the cylinders and receivers 4 into the controllers 6 from whence it can be discharged. The rate of flow of condensation from the receivers into the controllers is determined by the flow of steam in the vent pipes 10 just described. This rate of flow is regulated by the valves G. The valves 14 and 15 respectively in the pipes 3 and 7 afford a means for cutting out individual drying cylinders in case of breakage or leakage and the check valves 36' and 35 prevent any back flow into the pipes 36 and vent pipes 10.

In order to secure a flow through the drying cylinders of the sections A, I have provided the following arrangement; the first roll 12 of this section is not connected to the header 2^a, and the vent pipe 10' in this case connects the controller to a trunnion of the cylinder 12. The discharge pipe 34 leading from the cylinder 12 is normally open to the atmosphere at the point marked 34', which permits a flow from the steam inlet side to the discharge side of the cylinders of this section. In this way all the air in the apparatus finds a means of escape. As the condensation in this section which re-

ceives the pulp in its coldest state is so rapid there is but little waste of steam. The other cylinders of this section A discharge their condensation into the controller 6, while the condensation forming in the cylinder 12 is carried into the pipe 34 by the discharge of steam remaining in this controller after tilting. The rapid condensation in the section A and the frequent discharge of its controller 6 also assist in maintaining a flow through the cylinders of the section.

The steam utilized in discharging the condensation from the controllers is at a higher pressure than that supplying the cylinders and consequently passes from the controllers through the vent pipes 10 into the pipe 2' in the case of the sections B, C and D, and in section A it passes through the vent pipe 10' into the cylinder 12. It is in both cases utilized for heating the cylinders and affords a saving.

I have found that by dividing the apparatus into four sections of drying cylinders, a better quality of article is secured and the efficiency of the machine greatly increased, particularly with respect to the amount of production. By supplying each section independently with steam and by providing a receiver for each section, and by using the section A as a condenser for the apparatus, I am enabled to regulate and maintain the temperature of each section at any degree, which is best suited to the particular work in hand. By utilizing the sensible heat units and also the latent heat units in the steam it will be obvious that a great saving is effected in operation in addition to the beneficial results—previously pointed out—which are obtained by using the latent heat units in heating the rolls of the first section. The receiving headers 4 are of large diameter in order that the condensation will collect in the bottom and not interfere with the flow of steam to the pipes 36, besides affording a large area to permit condensation at a high temperature to flash to steam at a lower temperature, which steam passes to the section A of the machine as previously described.

In cloth drying machines the drying cylinders are very thin and the formation of a vacuum will cause a breakage in the cylinders. Vacuums form in the cylinders almost coincident with the shutting off of pressure when the machine is closed down for any purpose. It has also been found that the formation of vacuums following the shutting off of the steam causes the packings of the trunnions of the cylinders to loosen and cut out, entailing quite a loss of time and labor. By my improved arrangement there is no binding in the entire apparatus and the air can reach all parts of the machine so rapidly that but one vacuum breaking valve

is required in each section. This is the valve in the controller marked 29. Heretofore in cloth drying machines each individual roll has been provided with a vacuum breaking valve, and it will be obvious that my improved arrangements effects a great saving in this respect. In order that the precise temperature of the condensation passing through each controller may be definitely ascertained and thereby assist in the regulation of the temperatures of the various sections of the machine, I have provided a thermometer 38 for each controller mounted in such a way that the condensation will flow around it in entering the controllers. It will be observed that the entire arrangement constitutes a practically closed system, the discharge pipe for the first cylinder 12 being the only point normally open to the atmosphere. There is however but a trifling waste of energy, inasmuch as the section A condenses the steam so fast that there is hardly any flow to the cylinder 12 through the controller and vent pipe 10'. That the arrangement is not only economical in this respect, but also in the saving it effects in utilizing the greatest number possible of the heat units contained in the steam will readily be apparent. I have found that by my improved arrangements, the apparatus will operate with great efficiency even when run on steam supplied at low pressure, which also effects a great saving. In addition to the advantages already set forth the securing of a flow of steam through the apparatus is advantageous in that the air which forms in the cylinders during use is carried along with the steam and eventually finds an escape through the pipe 34 of the first cylinder 12. This is a convenient method of taking care of the air in the apparatus and does away with the use of manually operated by-passes which have ordinarily been found necessary in devices of this character. These and other advantages will be readily seen by those familiar with the art.

The receiving pipes 4—4 may be appropriately termed return or discharge pipes, and the section A may likewise be termed a condensing system, as besides serving to dry the material as it passes over the cylinders, it serves as a condenser for the balance of the apparatus in order to induce a proper flow of steam through the other sections as has been previously pointed out.

Having thus described my invention and illustrated its use what I claim as new and desire to secure by Letters Patent is the following:—

1. In an apparatus of the character described, the combination of a set of hollow drying rolls over which the paper stock first passes, a second set of hollow drying rolls over which the paper stock subsequently passes, means for supplying steam to the

second set of rolls, and a tubular connection leading from the second set to the first set of rolls and directly communicating adjacent one end with the outlets of the second set and adjacent the other end with the inlets of the first set of rolls to supply the latter with steam, the first set of rolls constituting a condensing system adapted to cause a rapid flow of steam through the rolls of the second set by condensing the steam and reducing the pressure in the tubular connection, said flow being variable to accommodate the load of the apparatus.

2. In apparatus of the character described the combination of a plurality of drying cylinders arranged in two sections, a steam supply pipe connected to the cylinders of the first section, a controller, a receiving pipe connected to the cylinders of the first section and leading to the controller, a connection from the receiving pipe to the cylinders of the second section, and means for discharging the controller of condensation, the receiving pipe and its connection providing an unobstructed passage for conveying the steam from the cylinders of the inlet side of the first section to the cylinders of the second section.

3. In apparatus of the character described, the combination of a plurality of hollow heating rolls arranged in two sections, a steam supply pipe for the cylinders of the first section, a controller, a receiving pipe connected to the cylinders of the first section and leading to the controller, a connection between the receiving pipe and the cylinders of the second section, for conveying the steam from the cylinders of the first section to the cylinders of the second section, a steam supply pipe for the controller, a discharge pipe for the controller, a vent pipe leading from the controller to the connection between the receiving pipe and the cylinders of the second section, and valve mechanism for governing discharge of the controller.

4. In apparatus of the character described, the combination of a plurality of hollow heating rolls arranged in two sections, a steam supply pipe for the cylinders of the first section, a controller, a receiving pipe connected to the cylinders of the first section and leading to the controller, a connection between the receiving pipe and the cylinders of the second section for conveying the steam from the cylinders of the first section to the cylinders of the second section, a steam supply pipe for the controller, a discharge pipe for the controller, a vent pipe leading from the controller to the connection between the receiving pipe and the cylinders of the second section, a check valve in the vent pipe, and valve mechanism for controlling the discharge of the controller.

5. In an apparatus of the character described, the combination with a plurality of grouped drying cylinders over which a portion of the paper web in its travel is adapted to pass, means for supplying steam thereto, a condensing system having a tubular feed connection leading thereto from the cylinders and constructed to communicate freely with the outlets of the cylinders and the inlet of the system, said condensing system being adapted to direct heat to another portion of the paper web and for condensing the steam whereby to reduce the pressure in the tubular connection adjacent the outlets and cause a rapid flow of used steam from the cylinders to the system, substantially as described.

6. In apparatus of the character described, the combination of two hollow drying cylinders, a steam supply pipe leading to one of the cylinders, a connection from the said cylinder to the other cylinder for conveying the steam from the first mentioned cylinder to the second cylinder, a controller adapted to receive the condensation of the second cylinder, and means for discharging the controller of its contents, the second cylinder condensing the steam it receives thereby causing a flow of steam from the first cylinder to the second.

7. In apparatus of the character described, the combination of two hollow drying cylinders, a steam supply pipe leading to one of the cylinders, a controller, a receiving pipe leading from the said cylinder to the controller adapted to carry the condensation of the said cylinder to the controller, a connection between the receiving pipe and the second cylinder for conveying the steam from the first cylinder to the second cylinder, the second cylinder condensing the steam it receives thereby causing a flow of steam from the first to the second cylinder, a steam supply pipe for the controller, a discharge pipe leading from the controller, a vent pipe leading from the controller to the connection between the receiving pipe and the second cylinder, and means for discharging the second cylinder of condensation.

8. In an apparatus of the character described, the combination with a plurality of drying cylinders over which a portion of the paper web in its travel is adapted to pass, a steam header having branch connections leading to the inlets of the cylinders, a condensing system, and a feed connection leading from the cylinders to the condensing system comprising a return header formed with inlets in its wall communicating directly with the outlets of the cylinders, to equalize the pressure therein, the condensing system being adapted to direct heat to another portion of the paper web and for condensing the steam whereby to cause a rapid

flow of used steam from the outlets of the cylinders and through the said connection to the system.

9. In apparatus of the character described, the combination of two hollow drying cylinders, a steam supply pipe leading to one of the cylinders, a connection from the said cylinder to the other cylinder for conveying the steam from the first mentioned cylinder to the second cylinder, a controller adapted to receive the condensation of the second cylinder, means for discharging the controller of its contents, the second cylinder condensing the steam it receives thereby causing a flow of steam from the first cylinder to the second, and means for controlling the said flow of the steam thereby regulating the temperature of the first cylinder.

10. In apparatus of the character described, the combination of a series of hollow drying cylinders arranged in two sections, a steam supply pipe leading to the cylinders in one section, a return pipe for each section connected to the cylinders of each section, a pipe leading from the return pipe in one of the sections to the cylinders in the other section, a controller connected to each return pipe for receiving the condensation of both sections and means for discharging both controllers.

11. In a sectional drying machine of the character described, the combination of a plurality of sections of drying cylinders, steam supply pipes leading to some of the sections, a return or discharge pipe for each of the sections, connections leading from the return pipes of the steam supplied sections to the cylinders of the remaining sections to convey the steam from the first mentioned sections to the said remaining sections, and means for discharging the return pipes of condensation.

12. In apparatus of the character described, the combination of a hollow drying cylinder, a steam supply pipe leading thereto, a receiving or discharge pipe connected to the cylinder, a condensing system connected to the receiving pipe adapted to cause a flow of steam through the cylinder by condensing the steam and reducing the pressure in the said receiving pipe and means for automatically breaking any vacuum forming in the drying cylinder.

13. In apparatus of the character described, the combination of two hollow drying cylinders, a steam supply pipe leading to one of the cylinders, a connection from the said cylinder to the other cylinder for conveying the steam from the first mentioned cylinder to the second cylinder, a controller adapted to receive the condensation of the second cylinder, means for discharging the controller of its contents, and means in the controller for automatically breaking any vacuum forming in the apparatus, the sec-

ond cylinder condensing the steam it receives thereby causing a flow of steam from the first cylinder to the second.

14. In apparatus of the character described, the combination of a series of hollow drying cylinders arranged in two sections, a steam supply pipe leading to the cylinders in one section, a return pipe for each section connected to the cylinders of each section, a pipe leading from the return pipe in one of the sections to the cylinders in the other sections, a controller connected to each return pipe for receiving the condensation of both sections and valve mechanism in the controllers for automatically breaking any vacuum forming in the apparatus.

15. In apparatus of the character described, the combination of two hollow drying cylinders, a steam supply pipe leading to one of the cylinders, a connection leading from the said cylinder to the other cylinder, a discharge pipe for the second cylinder, the second cylinder condensing the steam it receives from the first cylinder thereby causing a flow of steam from the first cylinder to the second, and a valve in the connection between the two cylinders for controlling the flow of steam between the two cylinders.

16. In apparatus of the character described, in combination of a plurality of drying cylinders arranged in two sections, a steam supply pipe for the cylinders of one section, connections from the cylinders of the first section to the cylinders of the second section for conveying the steam from the first section to the second section, a return pipe for the second section, a controller connected to the return pipe adapted to receive the condensation of the section, a cylinder forming a part of the second section of cylinders, but not connected thereto, a vent pipe leading from the controller to the said cylinder, and a discharge pipe leading from the cylinder.

17. In combination in a fabric making machine, a set of hollow drying rolls over which the fabric first passes, a second set of hollow drying rolls over which the fabric subsequently passes, means for supplying steam to the second set of rolls, means for conducting the steam to the first set of rolls after its passage through the second set, and a controller for disposing of the condensation from the first set of rolls, the said controller constituting the only outlet means from the first set of rolls, so that all of the steam supplied to the first set of rolls is condensed therein.

18. In combination in a fabric making machine, a set of hollow drying rolls over which the fabric passes, means for supplying steam to the rolls, and a controller for disposing of the condensation from the set of rolls, the said controller constituting the only outlet means from the rolls so that all

of the steam supplied to the rolls is condensed therein.

19. In an apparatus of the character described, a plurality of hollow drying rolls over which the fabric passes, means for supplying steam to the rolls, a receiving header for the rolls, and a device connected with said header for breaking any vacuum forming in the rolls.

20. In an apparatus of the character described, a group of steam supplied hollow drying rolls over which the web passes, a receiving header for the rolls, and a means connected with said header for receiving the condensation from the header and for breaking any vacuum forming in said rolls.

21. In an apparatus of the character described, the combination with a plurality of grouped hollow drying cylinders over which a portion of the paper web in its travel is adapted to pass, means for supplying steam thereto, a receiving header formed with inlets connected directly with the outlets of the cylinder and positioned out of the line of paper travel to receive the used steam from the cylinders, and a condensing system connected with the said header and adapted to cause a rapid flow of steam through the outlets of said cylinders by condensing the

steam and reducing the pressure in the said receiving header below that of the cylinders, said system being arranged with reference to the group of cylinders so that the used steam is induced to flow in a direction opposed to that of the travel of the web to heat another portion of the web, substantially as described.

22. In an apparatus of the character described, the combination with a plurality of hollow drying cylinders provided with outlets, means for supplying steam thereto at a given pressure, a condensing system, and a connection between the condensing system and the cylinders adapted to communicate with the outlets of the cylinders, said condensing system forming a part of the apparatus and adapted to condense the used steam received from the cylinders whereby to induce a rapid flow of steam through the outlets without substantially differentiating the pressures in the cylinders.

In testimony whereof I have hereunto signed my name in the presence of the two subscribed witnesses.

JOHN O. WOODSOME.

Witnesses:

C. J. SCHIPPLOCK,
L. GLEISER.