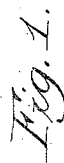


F. A. HEADSON.
PAPER MAKING MACHINE.
APPLICATION FILED JUNE 27, 1910.

3 SHEETS—SHEET 1.



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Att'y.

1,018,903.

3 SHEETS—SHEET 2.

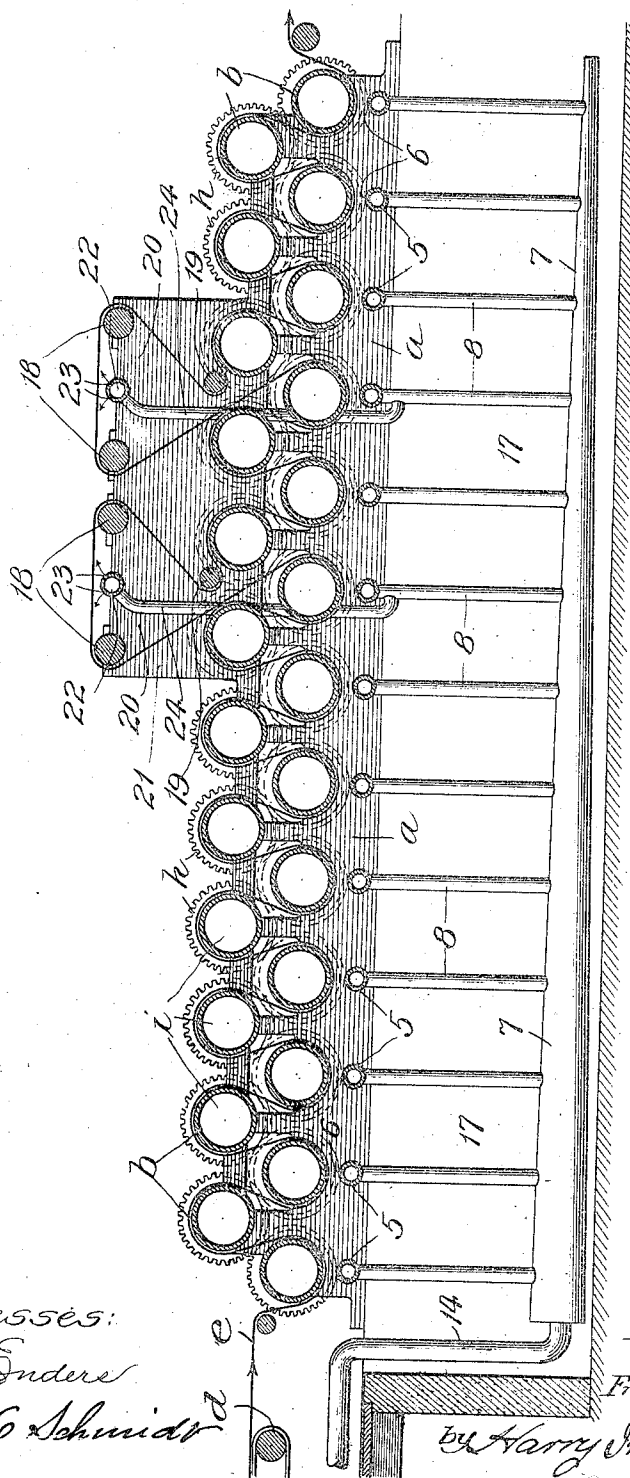


Fig. 2.

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 3 SHEETS—SHEET 3.

Fig. 3.

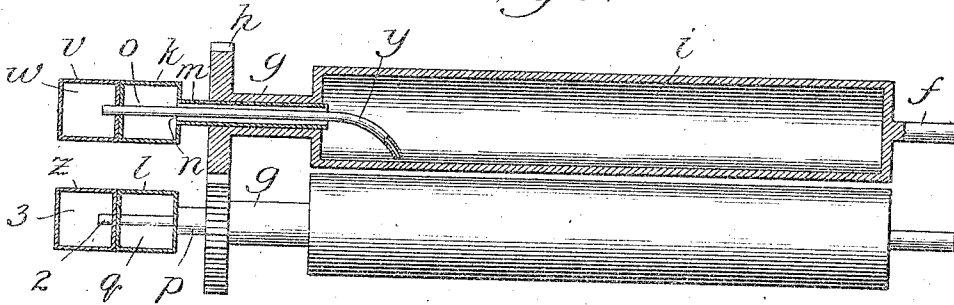


Fig. 4.

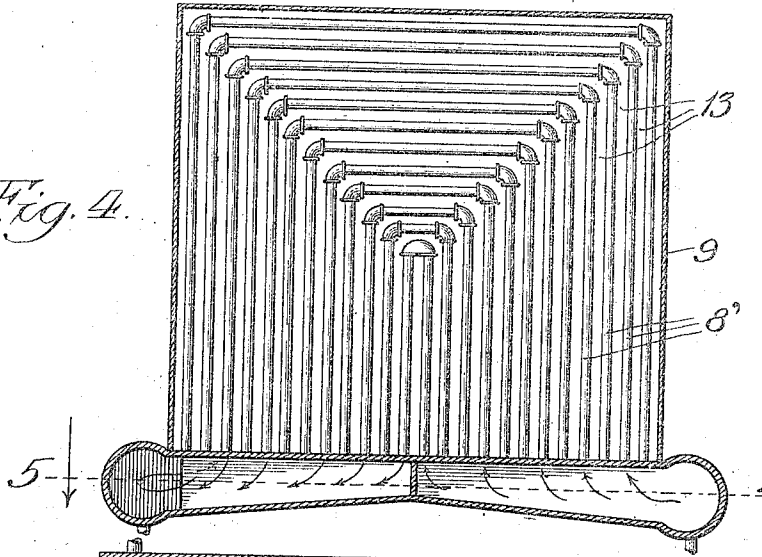
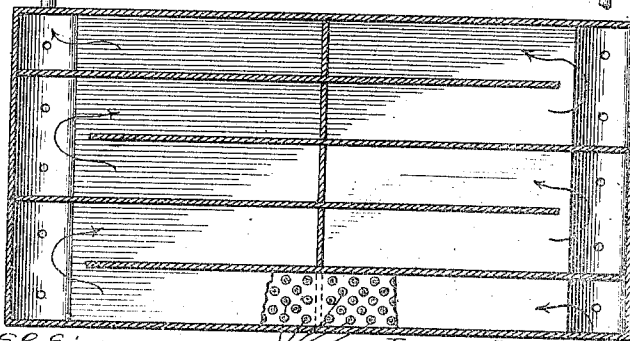


Fig. 5.



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UNITED STATES PATENT OFFICE.

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PAPER-MAKING MACHINE.

1,018,903.

Specification of Letters Patent. Patented Feb. 27, 1912.

Application filed June 27, 1910. Serial No. 569,117.

To all whom it may concern:

Be it known that I, FRANK A. HEADSON, a citizen of the United States, residing in Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented certain new and useful Improvements in Paper-Making Machines, of which the following is a specification.

This invention relates to that class of paper making machines having a series of drier rolls or cylinders over or between which the paper passes in the process of being dried, and having means for heating the rolls, and means for subjecting the paper to the action of a current of air or a series of currents or jets of hot dry air or similar drying fluid applied directly to the paper.

The principal object of the invention is to provide a simple, economical and efficient paper making machine.

Further objects of the invention are to provide a paper making machine having a series of drying rolls or cylinders, with means for introducing steam into the cylinders or rolls for heating them and thereby drying the paper to be operated upon, and means for heating and drying air and applying it directly to the paper for drying the latter; to provide a paper making machine having a minimum number of drying rolls or cylinders, or drying rolls having a minimum area of drying surface, and means for drying and applying dry hot air directly to the paper passing over or through the drying rolls, so constructed and arranged that a maximum quantity of paper can be dried in a given length of time without heating the rolls to such a high temperature as to blister or injure the paper in order that the machine may have the required drying capacity; to provide means whereby exhaust steam may be employed for heating and drying the air to be applied directly to the paper and also for heating the rolls, and whereby the expense of heating the rolls and air and drying the paper is reduced to a minimum, and the overheating of the rolls and blistering and injury of the paper is avoided without reducing the drying capacity of the machine and without the necessity of increasing the number of rolls and thereby increasing the liability of breaking the paper.

A further object of the invention is to provide a machine having the maximum

drying capacity and adapted to occupy the minimum of space, and to provide means whereby the use of an apron of felt for supporting the paper as it passes through the drying rolls may be dispensed with without increasing the liability to break the paper in the process of drying it.

Other and further objects of the invention will appear from an examination of the drawings and the following description and claims.

The invention consists in the features, combinations, and details of construction herein described and claimed.

In the accompanying drawings, Figure 1 70 is a plan view of a paper making machine provided with my improvements, with parts omitted; Fig. 2, a view in vertical section taken on line 2 of Fig. 1, looking in the direction of the arrow, and showing the paper 75 passing over or through the rolls, and the means for applying air directly to the paper; Fig. 3, an enlarged detail view of an upper drying roll and a lower drying roll, and the manifolds for supplying steam for 80 heating the rolls and for removing water resulting from condensation from the rolls, the top roll and manifolds being shown in section; Fig. 4, an enlarged view in vertical 85 elevation of the steam coil and the casing for heating the air, taken on line 4 of Fig. 1 looking in the direction of the arrow; and Fig. 5, a horizontal sectional view of the device shown in Fig. 4, taken on line 5 of said figure. 90

In constructing a paper making machine in accordance with my invention I provide a frame *a* which may be of any desired, ordinary, or well known form. A set or series of hollow metallic drying rolls or 95 cylinders, *b* are rotatably mounted in parallel relation in suitable journal bearings *c* in the main frame *a*. These rolls are in staggered relation with their axes parallel and lying transversely with respect to the 100 direction of movement of the paper to be operated upon, and are a sufficient distance from one another to provide spaces therebetween adapted to admit and permit the passage of the paper in the form of a continuous web from the felt apron *d*, at the 105 so called "wet end" at the receiving end of the series of drying rolls, to the discharge end of the same. The web of paper *e* is so wound upon and between the drying rolls 110

that it passes over each upper roll and beneath each lower roll of the entire series in the order in which the rolls are arranged, or beneath lower rolls and over upper rolls alternately, as shown in Fig. 1. The rolls *b* (both upper and lower) are provided with stub shafts or journals *f* at one end, and hollow shafts *g* operatively connected by means of gear wheels *h* at the opposite ends of said rolls respectively. The upper gear wheels are in toothed engagement with the next adjacent lower gear wheels in the order of their arrangement, so that the direction of rotation of the gears and the respective rolls corresponds with the direction of movement of the web of paper passing through the rolls from lower to upper rolls alternately. Each of the rolls *b* is hollow and forms a chamber *i* adapted to receive steam or similar heating fluid for heating the roll and thereby heating and drying the paper.

In the art to which this invention relates it is well known that the use of an excessive number of drying rolls results in the paper being frequently broken and greatly increases both the expense of construction and the expense of operation; that the heating of the rolls to too high a temperature in order to obtain the maximum capacity with the minimum number or a given number of rolls results in blistering and injuring the paper, and necessitates or implies the use of live steam or a heating fluid kept at a high temperature which in turn implies a greatly increased expense in operation as compared with the use of exhaust steam in accordance with this invention, for the purpose of heating the rolls and for the purpose of heating and drying air and applying the air thus heated and dried directly to the paper for the purpose of drying the latter. It will also be readily understood by those skilled in the art that by using heated air applied directly to the paper on the outside of the rolls, and using exhaust steam for heating the air and also upon the inside of the rolls for heating them and thereby cooperating with the dry air in drying the paper, the number and the area of heating surface of the rolls may be reduced to a minimum and all of the accompanying advantages of non-breakage of paper and economy of construction and of operation obtained without increasing the temperature of the rolls to an undesirable extent or to any extent for the purpose of obtaining the said advantages, and that, at the same time or by the employment of the herein described means and method of drying the paper the blistering or injury to the paper by overheating or by breaking the web is prevented. In order to overcome these difficulties and disadvantages and to accomplish these desirable objects and provide a simple and compact machine which will occupy the minimum

of space in proportion to the capacity required, I provide a manifold *k* for the upper series of rolls *b*, and a manifold *l*, which may be of identical construction with said manifold *k*, for the lower series of rolls. A series of pipes or tubes *m* form passages *n* which lead into the interiors or chambers *i* of the respective upper rolls *b* through the hollow shafts *g*, and each of which passages *n* communicates with the interior or chamber *o* of said manifold *k*. The lower manifold *l* is provided with a series of hollow tubes or pipes *p* which are of identical construction with the pipes *m*, and form passages which connect the interior or chamber *q* of the lower manifold *l* with the lower rolls *b* through the hollow shafts *g* of said lower rolls, thereby forming passages leading from said lower manifold into the interior of the respective lower rolls *b*. The manifolds *k* and *l* are connected with a source of steam supply by means of inlet pipes *r* and *s* which are by preference connected with an exhaust port or pipe *t* of an engine by means of an interposed pump *u* adapted to force exhaust steam through the pipes *s* and *r* and manifolds *k* and *l* into the interior of the rolls *b*. An upper manifold *v* forms a chamber *w* and is provided with a series of pipes *y* each of which leads through a tube *m* and hollow shaft *g* and into the inner chamber *i* of an upper roll *b*, the inner ends of the tubes *y* being bent downward inside of the rolls *b*, as shown in Fig. 3 so as to form an outlet for water from each of said rolls, whereby water resulting from condensation of steam in the rolls is forced from the rolls and into the manifold by the pressure of the steam. A lower manifold *z*, which may be of identical construction with the manifold *v* is provided with a series of pipes *2*, which are of the same construction as the pipes *y*, and each of which leads into a lower roll *b* through a pipe *p* and communicates with the chamber *3* formed by said manifold *z*. The manifolds *v* and *z* communicate with a suitable outlet pipe *4* through which the water from the interior of the rolls *b* is discharged.

In order to provide means for heating and applying air directly to the paper, a series of pipes *5*, each having an opening preferably in the form of a longitudinal peripheral slot *6* are mounted adjacent to and preferably below the paper with the slots or discharge openings directed toward the paper. I prefer to so arrange these air pipes that they, and the discharge openings *6* are disposed transversely with respect to the paper, and to provide a sufficient number of said pipes so that there will be one for each of the lower heating and drying rolls *b*. By mounting a pipe *5* beneath each bottom roll *b* and in substantially parallel

relation thereto the jets of air discharged from the spouts or slots 6 come in contact with the under side of the paper, or the side adjacent to the slots and pass upward between the bottom rolls *b* and between the laps of paper between said rolls and are deflected back and forth in the space between the laps of the paper in such a manner as to thoroughly dry the paper, and particularly the side of the paper which is away from the bottom drying rolls. These slotted pipes or elongated nozzles 5 are all connected with the interior chamber or air supply passage formed by a hollow manifold 7 by means of pipes 8, the upper ends of which are connected or integral with the corresponding slotted pipes or nozzles 5, and the lower ends of which open into the manifold or main air supply pipe 7.

A steam coil 8', in a casing 9, and having a steam supply pipe 10 connected with a source of steam supply—preferably the exhaust port of an engine, which may be the engine which operates the drying rolls—is provided with a fan or blower 11 having an air inlet 12 which communicates with the spaces 13 inside of the casing 9 and between the coils or steam pipes 8. The discharge pipe 14 of the fan or blower is connected with the manifold 7, and with the fan, forms a passage leading from the steam coil and the casing in which the steam coil is mounted, into said manifold. The fan or blower is provided with a driving shaft 15 upon which is mounted a driving pulley or wheel 16 by means of which the fan or blower is adapted to be connected with a suitable source of power, such, for instance as the engine which drives the drying rolls and which may furnish the exhaust steam for heating the drying rolls and for heating and drying the air which is applied to the paper by the fan and the pipes which lead therefrom. For convenience, the manifold 7 and pipes 8 are located in a pit 17 beneath the main frame of the machine and beneath the drying rolls.

The rolls *b* are operatively connected with a suitable source of power by means of a shaft 18' having a spur gear 19' thereon in toothed engagement with one of the connected gear wheels *h*, and having a belt pulley 20', adapted to be connected with the engine which supplies the steam for heating the rolls and the air for drying the paper, or with any desired source of power. The connection of the wheels *h* with the source of power may be made in any desired, ordinary or known manner.

Rolls 18, arranged in pairs at suitable intervals parallel with and above the upper series of rolls *b*, and each pair having a roll 19 below the level thereof and adjacent to the rolls between which a lap of the web of paper passes upward and over the pairs

of rolls 18 and then down to the corresponding roll 19 and onto upper rolls *b* in such a manner as to form a triangular space 20 between laps of the paper, are journaled in suitable supports or frame portions 21. In each triangular space 20 and inside of the laps of the paper thus formed above the rolls *b* is arranged a pipe 22 having preferably a plurality of slots or peripheral openings 23, similar to the openings or slots 6 in the pipes 5, in position to discharge heated air from said pipes 22 against the top lap of the paper and at an oblique angle thereto at a point between the rolls 18. The pipes 22 are each connected with the manifold or air supply pipe 7 by means of a pipe 24, the lower ends of which may be connected with the main air supply pipe by means of pipes 8, as shown in Fig. 2.

By the use of the laps or "skips" arranged at suitable intervals above the main series of drying rolls in connection with the means for heating and applying jets of air directly to the paper, thus reducing to a minimum the number of heating rolls necessary in order to obtain the required capacity, the paper is so thoroughly dried without blistering or injury from over heating or from passing over and being subjected to strains from too large a number of rolls, that the use of an apron of felt for supporting the paper as it passes over or through the drying rolls is dispensed with, and the capacity of the machine or of a given number of drying rolls is thus still further increased by dispensing with the felt, which tends to prevent or retard evaporation.

From the foregoing it will be readily seen that, while the blistering of the paper is liable to result from merely maintaining the rolls at too high a temperature, the tendency to blister is increased by the use of an apron of felt or similar material which tends to confine the moisture in the paper which is between the felt and the drying rolls, and that by dispensing with the apron of felt the tendency to blister the paper is greatly reduced and the quality of the paper is improved. When, in addition to dispensing with the felt upon all or any desired number of the drying rolls so as to expose the paper, dry heated air is applied directly to the paper as it passes over or between the drying rolls, the result is not merely the advantage in economy of construction and operation, but there is a marked improvement in the efficiency of the machine in that the quality of the product is materially improved.

I claim:

1. In a machine of the class described, the combination of a series of parallel hollow metallic rolls rotatably mounted and provided with spaces therebetween for receiving a web of paper to be dried, steam pipes

communicating with the interior of the rolls respectively, means for connecting the steam pipes with the exhaust port of an engine, air pipes on the outside of the rolls, 5 provided with discharge openings on the side toward the rolls, means for drying a supply of air for said pipes, and means for forcing dry air through the air pipes and into contact with the paper.

10 2. In a machine of the class described, the combination of a series of parallel hollow metallic rolls rotatably mounted and operatively connected, and provided with spaces therebetween for receiving a web of paper 15 to be dried, steam pipes communicating with the interior of the rolls respectively, means for connecting the steam pipes with the exhaust port of an engine, air pipes on the outside of and in parallel relation to 20 the rolls and provided with discharge openings on the side toward the rolls, a steam coil, means for connecting the steam coil with the exhaust port of an engine, a casing in which the steam coil is mounted, and a 25 fan or blower having its inlet connected with the casing in which the steam coil is located, and its discharge opening communicating with the air pipes.

3. In a machine of the class described, the 30 combination of a series of parallel hollow metallic rolls rotatably mounted and provided with spaces therebetween for receiving a web of paper to be dried, steam pipes

communicating with the interior of said rolls and with a source of steam supply, 31 rolls mounted above and parallel with the series of hollow rolls and on the inside of a lap of the web of paper to be dried, and an air pipe located on the inside of the lap of the web of paper above the hollow rolls and 40 connected with a source of air supply, and provided with lateral openings.

4. In a machine of the class described, the combination of a series of parallel hollow metallic rolls rotatably mounted and pro- 45 vided with spaces therebetween, for receiving a web of paper to be dried, steam pipes communicating with the interior of said hollow rolls respectively and connected with a source of steam supply, air pipes below 50 and in parallel relation to the hollow rolls and provided with discharge openings on the side toward the hollow rolls, paper supporting rolls mounted above and parallel with the hollow rolls and on the inside of a 55 lap of the web of paper to be dried, an air pipe located on the inside of said lap of the web of paper above the hollow rolls and provided with discharge openings adjacent to the web of paper, and means for forcing 60 dry air through said air pipes.

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