To all whom it may concern:

Be it known that I, John D. Tompkins, a citizen of the United States, a resident of Valatie, in the county of Columbia and State of New York, have invented certain new and useful Methods and Machines for Making Paper, of which the following is a specification.

The invention has for an object to enable a high grade paper to be produced by means of a machine of relatively simple and inexpensive construction, particularly by operating upon the newly formed paper web, and the felt aprons associated therewith, to extract from the same a relatively high proportion of the water carried thereby, to the end that plain press rolls may be employed in a machine when the paper web and felt aprons run through the press rolls at a high rate of speed, without danger of galling or curdling of the web at the press rolls; in other words, the extraction of a relatively large fraction of the water carried by the paper web and felt aprons, in advance of the press rolls, restores the absorptive qualities of the felt aprons to such a degree that they are capable of taking up and carrying off substantially all of the water which can be squeezed out at the press rolls, thus eliminating galling of the paper web at the press rolls which otherwise would take place.

Further objects and advantages of the invention will be in part obvious and in part specifically pointed out in the description hereinafter contained which, taken in connection with the accompanying drawings, discloses a preferred embodiment of the invention; such embodiment, however, is to be considered merely as illustrative of its principle. In the drawings:

The single figure is a diagrammatic vertical longitudinal section of a paper making machine adapted to operate in accordance with the invention.

If press rolls of the suction type be employed in a paper making machine, the pinch of such rolls is relatively weak owing to the uneven surface of the suction rolls, and the machine becomes expensive owing to the more complicated structure of rolls of this type; furthermore, the power required to drive a press roll of the suction type is about twenty per cent. greater than is necessary in the case of plain press rolls owing to the suction which must be overcome in turning the same. Or if a plurality of successive sets of press rolls are employed to remove the water more gradually, the pores of the felt apron tend to close by repeated pressure, thus obstructing the free passage of water into the felts, and the cost of the machine is also correspondingly increased.

In accordance with the present invention, the paper web after being formed upon a forming wire or the like, is conducted against a felt apron, preferably the upper felt apron, and the above two members are subjected to the action of an air blast, preferably in conjunction with suction, to remove a relatively large fraction of the water carried thereby: after the above members have been partially dried as above described, a further felt apron is led into contact with the exposed side of the paper web, and both felt aprons are subjected to the action of a further air blast, preferably also in conjunction with suction, to remove a second large fraction of the water therefrom.

The web and felt aprons are then led through a pair of plain press rolls, which are relatively cheaper and simpler to manufacture and act more efficiently to pinch the paper and felt aprons to expel moisture therefrom, than would be the case with press rolls of the suction type. Thus the paper web and felt aprons are squeezed relatively highly by the plain press rolls and the absorptive condition of the felt aprons at this time enables them to pick up and carry off substantially all the water squeezed out at the press rolls, even though the machine be operated at high speed.

Referring to the drawing, the particular type of paper making machine illustrated, embodies a paper web forming means comprising forming wire 1 running over a plurality of small rolls 2 and around a lower couch roll 3. The newly formed paper web 4 is carried in the first instance upon forming wire 1 and is transferred therefrom to a felt apron 5, in the present instance the upper felt apron, which latter is pressed into engagement with the paper web 4 by means of an upper couch roll 6; the upper felt apron passes between upper and lower press rolls 7 and 8 respectively, and as shown also serves to carry the paper web from the press rolls to the first roll 9 of a series of dryers by passing around a roller 10 which presses against roll 9. A lower felt apron

11 passes over a roller 12 and between press rolls 7 and 8, and thus as the paper web is fed to the press rolls it is held between felt aprons 5 and 11.

According to the present invention I subject the paper web to the action of an air blast, preferably in conjunction with suction upon corresponding parts of the web, and at a time when the latter is still carried by the forming wire 1. As shown, a couch roll of the suction type, and an air blast pipe 16 is positioned beneath the forming wire 1 adjacent the couch roll, whereby the newly formed paper web and upper felt apron 5 are subjected to the combined action of an air blast and suction, at a time when only the relatively large interstices of forming wire 1 are interposed between the web and air blast. The blast preferably is of dry air heated to a temperature in the neighborhood of 100° F. I have discovered that in this way it is possible to remove a relatively large percentage of the water contained in the felt apron 5 and paper web 4.

After the lower felt apron 11 is led into contact with the exposed surface of paper web 4, both of the felt aprons and the web 4 are subjected to the action of a further air blast of the type previously mentioned, preferably also combined with suction. As shown, the roll 12 is of the suction type, and an air blast pipe 15 disposed above the felt aprons and directed toward roll 12.

In this way it is possible to extract a further substantial fraction of the water carried by both felt aprons and the paper web, with the result that after these members leave roll 12, the absorptive qualities of the felt aprons are restored to a high degree. Thus the step of providing further special devices to take up the water squeezed out at the former rolls 7 and 8 is made unnecessary since the felt aprons alone will serve to perform this function. Thus the press rolls 7 and 8 may be made plain, whereby they will serve to squeeze out the water more effectually, and but one set of press rolls need be employed; the upper press roll 7, however, I prefer to provide with a cover of semihard rubber to make its pressure more effectual and to prolong the life of the felt aprons.

The subject matter of this application is disclosed in my prior application Serial No. 551,678, filed April 11, 1922, entitled Paper making machine.

While a specific embodiment of the invention has been described, it will be obvious that many changes may be made therein without departing from its principle, as defined in the appended claims.

I claim:

1. A paper making machine comprising a paper web forming member, a felt apron adapted to receive the paper web after being formed by said member, means including an air blast for extracting water from said web and felt apron, a second felt apron, a set of plain press rolls co-operating with said felt aprons, and means located in advance of said press rolls for extracting water jointly from both of said felt aprons and from both sides of the paper web.

2. The combination set forth in claim 1, wherein both of said water extracting means comprise a suction roll working in conjunction with an air blast.

3. The combination set forth in claim 1, wherein said first mentioned felt apron is positioned above said forming member, and said air blast is projected through the forming member toward said first mentioned felt apron.

4. A paper making machine comprising a forming wire, a lower couch roll associated therewith, an upper couch roll located in advance of said lower couch roll and positioned to engage the paper web when formed on said forming wire, an upper felt apron passing over said upper couch roll, means for directing an air blast through said forming wire and toward said upper couch roll, a lower felt apron, a set of plain press rolls co-operating with said felt aprons, and means in advance of said press rolls for extracting water from both of said felt aprons.

5. The combination set forth in claim 4, wherein said upper couch roll is of the suction type.

6. The combination set forth in claim 4, wherein said last mentioned water extracting means is constituted by a suction roller supporting both of said felt aprons, and an air blast directed toward said roller.

7. The method of making paper which comprises forming a paper web upon a perforate member, leading a felt apron into contact with the newly formed web, removing water from said web and felt apron, and leading another felt apron into contact with the remaining side of the felt apron, passing air through both of said felt aprons and paper web to extract a sufficient proportion of the water contained therein to enable the aprons to absorb an amount of water such as would be squeezed out by a pair of plain press rolls, and then passing said felt aprons carrying the paper web between them through a single set of plain press rolls.

8. The method set forth in claim 7, wherein in the first mentioned step of removing water from said web and felt apron includes the application of an air blast to one side of the web in conjunction with suction on the other side thereof.

9. The combination set forth in claim 7, wherein said second mentioned step of removing water from both felt aprons and the paper web, includes the application of an air blast to one of said felt aprons in conjunc-
tion with a suction applied to the remaining felt apron.

10. A paper making machine comprising a paper web forming member, a felt apron adapted to receive the paper web after being formed by said member, a second felt apron, a set of plain press rolls cooperating with said felt aprons, means in advance of said press rolls for directing an air blast on to the exposed side of web when carried by said first-mentioned felt apron, and means located in advance of said press rolls for directing an air blast toward the exposed side of said first-mentioned felt apron.

11. The combination set forth in claim 10, wherein means is provided for applying suction in conjunction with each of said air blasts.

In testimony that I claim the foregoing, I have hereunto set my hand this 4th day of 20 August, 1922.

JOHN D. TOMPKINS.