This invention refers to paper-making machines of the single large cylinder or "Yankee" type, sometimes known as M. G. Machines, in which the moist paper web is pressed against a large diameter heated drum or cylinder for drying and glazing purposes.

In order to expedite the drying of the paper, additional drying means has frequently been provided, exterior to the cylinder, and this has usually taken the form of a hood covering the upper half of the cylinder, to which hood is connected an exhaust fan to draw air therethrough and over the paper web. In another case, such additional drying means has taken the form of perforated or slotted pipes extending from a header and placed across and in close proximity to the cylinder, near to the press roll, said pipes being charged with a blast of air from a fan and disposed so that air from the slots or perforations is directed on to the paper.

It has been found in practice, however, that such additional drying means as hitherto proposed, has been inadequate and capable of radical improvement, since there has not been taken into account the fact that on evaporation of the moisture in the paper, a layer of steam or vapour forms immediately above and clings to the surface of the paper, and such means has not provided for the breaking up and displacement of such layer. For instance, when a hood has been provided, the air has been drawn over the said layer of steam and vapour without removing it and without coming in actual contact with the paper. Again when the perforated or slotted pipes have been used they have been disposed only where the paper web first contacts with the cylinder, at which point practically no evaporation has taken place, the said layer of steam forming further round the cylinder, and moreover, a tray or receptacle arranged to cover in the pipes and to collect water of condensation acts as a hood and prevents easy transfer of the air away from the paper. A further drawback to such arrangement has been that insufficient quantities of air were used. It has also been proposed in connection with the relatively small diameter drying cylinders of a paper-making machine to cover in the upper half of a cylinder with a hood, and to supply air to the hood at diametrically opposite points, in sheets adapted to strike the paper web and break up the layer of steam, the air and steam afterwards moving over the surface of the cylinder to the outlet from the hood.

The object of this invention is to provide an improved form and arrangement of external drying means whereby the said layer of steam and vapour is broken up or is prevented from forming, over any part of the web which lies is the cylinder, and whereby the steam and vapour are immediately removed from proximity to the paper, without obstruction. The invention also aims at supplying very large quantities of air to ensure adequate drying of the paper.

According to the invention, air, in comparatively large quantities, is blown on to the paper where it lies on the cylinder, from separate conduits spaced over the parts of the cylinder where evaporation takes place, the air being discharged from the conduits with sufficient force and over local areas so as to penetrate and dislodge the layer of steam and vapour and come in actual contact with the paper, the air, steam and vapour afterwards having unobstructed escape away from the paper, between the conduits.

The air, which may be heated, is supplied by a blower, fan or other means, under a suitable pressure, to a series of pipes arranged parallel to and over say half to three-quarters of the circumferencne of the cylinder and close to the cylinder. The pipes are preferably connected to suitable chambers at each end of the cylinder, though there may be a chamber at one end only, and are made with slots or perforations which direct the air with force on to the paper in the form of jets, either at right angles or at any other suitable angle, the quantity and pressure of the air causing the jets to penetrate the layer of steam or vapour, and by contact with the paper to displace the steam and vapour. The air escapes outwards between the pipes. Each pipe is or can be, supplied with air at both ends to deal with a small proportion of the circumference of the cylinder.

One form of the invention is illustrated in the accompanying drawings, wherein:

Fig. 1 is a side elevation of a machine of the type referred to, with the invention applied, and

Fig. 2 is a plan of the same, but with some of the air pipes and a part of the chambers removed for the sake of clearness.

Fig. 3 is an enlarged sectional view of three of the pipes, and the adjacent part of the drum, illustrating the action of the air in removing the steam.

As shown, the machine comprises the usual drum or cylinder a mounted on the frame b, and the presser roll c. Arranged at each end of the drum is a semi-annular header or chamber d, 110
wider at one end than the other, the two headers being connected by pipes which pass over the drum surface and are equally spaced over the drum. The pipes are each provided with a slot or perforations extending over the full width of the paper and there may be any convenient number of pipes. In the machine illustrated in the drawings, 28 pipes are shown for a cylinder 12 ft. in diameter. The air is supplied by means of a fan or blower and is heated if required, say by a battery of steam-heated heating tubes as shown at i, and passes through the chamber h and thence to the headers d which supply the pipes e with air from both ends. The air is heated when required, to increase its moisture absorbing capacity, more heat being required as the atmosphere is more saturated with moisture and preferably large quantities of air are used, although smaller quantities at higher temperature could also be used. Any other convenient means to heat the air may be adopted. On a dry day it might not be necessary to heat the air at all, whereas on a very damp day the air would be heated to a maximum.

In use the air is blown into the chamber h, from thence to the headers d, and from thence to the pipes e, whence it escapes via the perforations or slits f in the form of strong jets. The air is under a slight pressure, sufficient to cause the jets of air to penetrate the layer of steam and dislodge the steam, which then passes away between the pipes e as shown in Fig. 3. Further, since the air comes in actual contact with the paper, a more rapid and more efficient drying is effected.

With this arrangement of drying means, the vapour is effectively removed, the drying power of the cylinder is increased, and the drying effect of the air is more fully utilized.

Any number of pipes may be employed, provided there is sufficient room between them for the air and steam to get away, and they may be connected to a header at one end only, instead of at both ends.

No exhaust fan is necessary, although such could be applied if desired, especially if any heat economizing apparatus is applied to extract the heat from the outgoing air. Valves may be provided on the individual pipes or otherwise to regulate the air.

These improvements result in a marked increase in efficiency and output.

What I claim is:

1. Apparatus for drying paper in an M. G. or "Yankee" machine, comprising a fan or blower of large capacity, an air heater in the outlet conduit from the fan or blower, a header or headers connected to the outlet end of the conduit, and a plurality of pipes or conduits extending from the header or headers over a considerable portion of that part of the cylinder on which evaporation takes place, the pipes or conduits being close to the paper, having openings to direct air against the paper over local areas so as to penetrate and dislodge any layer of steam and vapour on the paper and to come in actual contact with the paper, and being spaced apart sufficiently to allow free escape of the air between them.

2. A paper-making machine of the single large cylinder or "Yankee" type comprising a large diameter cylinder, a pair of supporting frames for same, a platform carrying an air fan or blower of large capacity, a header connected to the outlet from such fan and extending around at least one half of the cylinder, such header progressively diminishing in cross-section away from the fan, and a series of pipes extending laterally from the header over a considerable portion of the cylinder where evaporation takes place, the pipes being close to the paper, having openings to direct air against the paper over local areas so as to penetrate and dislodge any layer of steam and vapour on the paper and to come in actual contact with the paper, and being spaced apart sufficiently to allow free escape of the air between them.

3. A paper-making machine of the single large cylinder or "Yankee" type comprising a large diameter cylinder, a pair of supporting frames for same, a platform carrying an air fan or blower of large capacity, two headers one at each side of the cylinder, or rectangular cross-section and progressively diminishing in sectional area, a chamber connecting the larger ends of the headers to the outlet from the fan or blower, a battery of steam pipes in the said chamber for heating air supplied from the fan, and a series of pipes extending from header to header over a considerable portion of the parts of the cylinder on which evaporation takes place, the pipes being close to the paper, having openings to direct air against the paper over local areas so as to penetrate and dislodge any layer of steam and vapour on the paper and to come in actual contact with the paper, and being spaced apart sufficiently to allow free escape of the air between them.

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