Nov. 8, 1966 A. P. SCHNYDER 3,283,415

PAPER DRYING APPARATUS

Filed April 14, 1964 2 Sheets-Sheet 1

FIG. 1

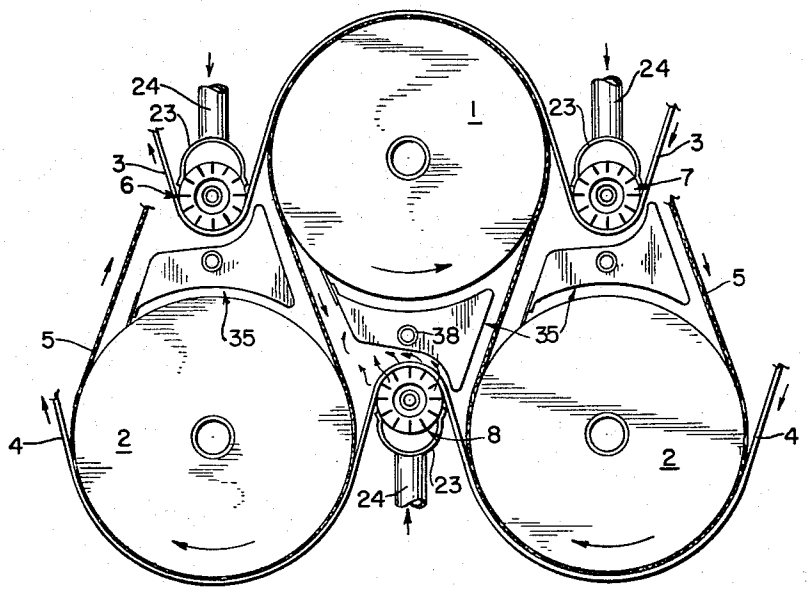
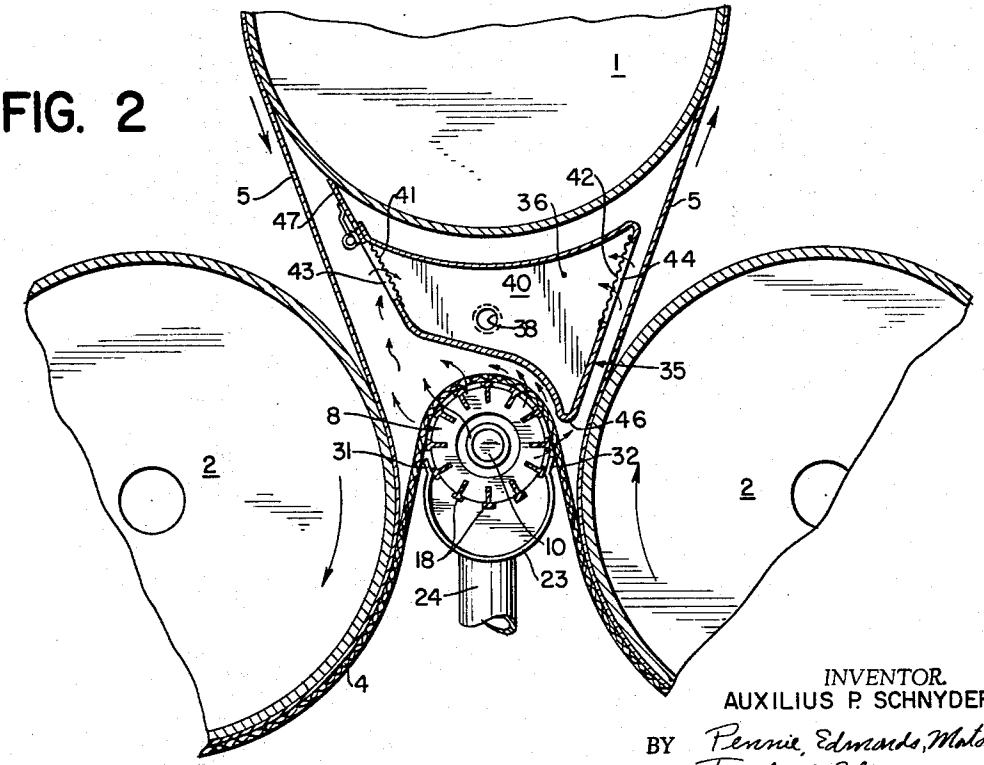


FIG. 2



INVENTOR.
AUXILIUS P. SCHNYDER

BY Pennie, Edmonds, Morton Taylor & Adams

ATTORNEYS

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FIG. 3

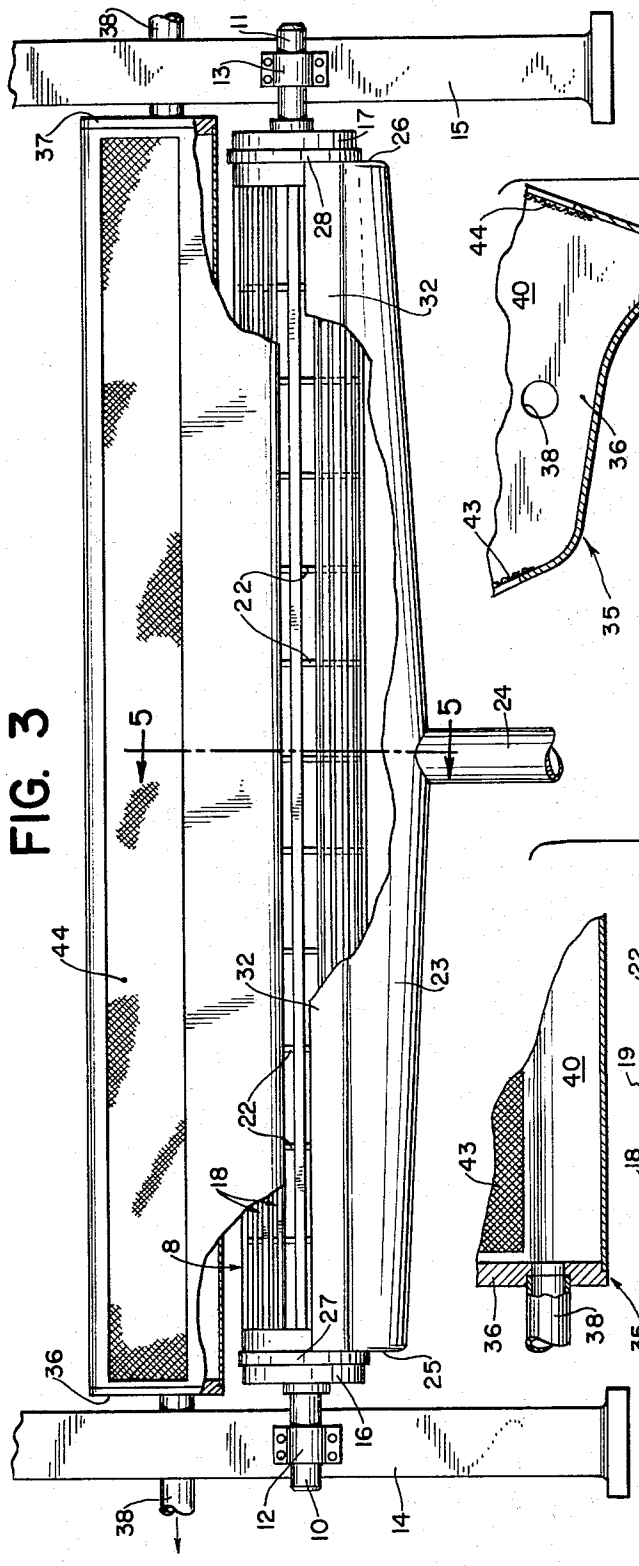


FIG. 5

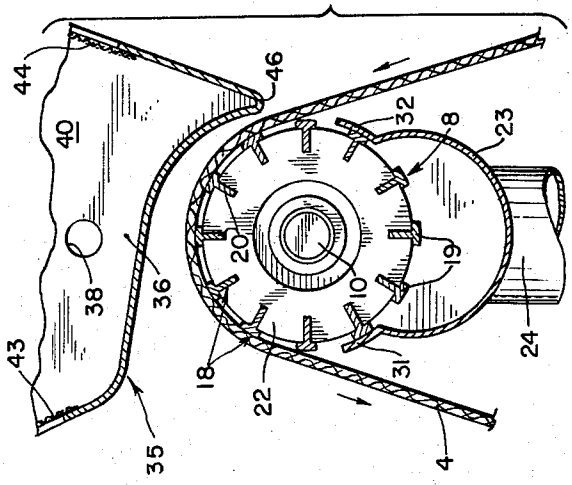
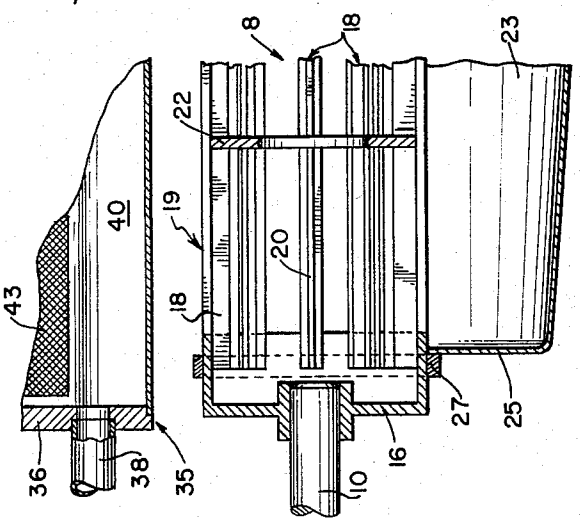


FIG. 4



INVENTOR.
AUXILIUS P. SCHNYDER
BY Pennie Edmonds Morton Taylor & Adams
ATTORNEYS

United States Patent Office

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PAPER DRYING APPARATUS

Auxilius P. Schnyder, 146 Cherry Lane, Teaneck, N.J.

Filed Apr. 14, 1964, Ser. No. 359,682

2 Claims. (Cl. 34—111)

This application is a continuation-in-part of my prior application Serial No. 262,544, filed March 4, 1963, now abandoned.

This invention relates to paper drying apparatus of the type having drying cylinders provided with dryer felt for absorbing moisture from the paper, and provides an improved means to vaporize the moisture in the felt and in the paper, and to remove the moisture from the area of vaporization.

It is customary to dry paper by passing it continuously and at a uniform rate over a multiplicity of heated drying cylinders consisting of upper cylinders mounted in a horizontal plane and lower cylinders also mounted in a horizontal plane. The drying apparatus may be described as including a succession of three cylinder units the axes of which form a triangle, one unit having two cylinders below and one cylinder above and the adjacent unit having one cylinder below and two cylinders above.

The web of paper undergoing drying is passed continuously from one heated cylinder to another and two endless dryer felts are employed in the apparatus, one travels over the paper while it is in contact with each upper cylinder and the other passes over the paper while it is in contact with each lower cylinder. Between each adjacent pair of lower cylinders and each adjacent pair of upper cylinders, a roller is mounted to direct the dryer felt over a substantial area of the paper which is in contact with the cylinders. The paper passes over a lower cylinder, upward over the upper cylinder and downward over the other lower cylinder. An endless web or belt of porous dryer felt which is in contact with the paper on each cylinder absorbs moisture from the paper. It is customary to return the endless webs of dryer felt along direction and tension rollers. Means are usually employed to heat this returning section of the felt web to evaporate the moisture. Duct means have been suggested heretofore for removing moisture vapor from the area of the drying rollers. Perforate felt drying rollers have also been suggested for use between the drying rollers over which the dryer felt passes together with means to suck moisture out of the felt.

This invention provides a duct system for forcing air, preferably dry hot air, into and across new open grillage drying rollers and through the pores or fibers of the overlying dryer felt, and also an exhaust duct system for removing moisture laden air from the felt. The exhaust duct system is preferably constructed and arranged to remove water vapor from an area between the drying cylinders which is evaporated from the surface of the paper, particularly from the free runs of paper passing from one cylinder to the next, and also includes selective provisions which prevent paper being accidentally sucked into the duct system.

The apparatus of the invention comprises a manifold extending along each open grillage roller for forcing hot air into and across the open grillage roller and through the felt overlying the open grillage roller, and an exhaust duct means located along and over the outside of each open grillage roller so as to receive the moisture laden air forced through the felt and sweeping the surface of the paper, and carry it under reduced pressure to an outside vent. There is an appreciable amount of water evaporated directly from the paper and the exhaust duct system is constructed and arranged to remove this additional

water vapor from the area between the two adjacent runs of paper passing from one cylinder to the next cylinder.

Preferably, the apparatus comprises a cap or hood extending lengthwise of each open grillage roller for forcing hot unsaturated drying air through the dryer felt transversely either uniformly or at different controlled rates over the segmental portions making up the entire width of the felt web, and a vapor collecting duct means extending the full width of the open grillage rollers and drying cylinders connected to an exhaust air system operated under reduced pressure which removes the moisture laden air transversely over the entire width of the web of paper. The means of adjusting the rate of air sectionally across the width of the system will make it possible to compensate for any lack of uniformity of absorbing the moisture laden air into the exhaust duct.

The apparatus of the invention effects a more rapid and efficient drying of the paper with a reduced volume of drying air, uniform drying over the width of the paper web, and better control. The drying apparatus can be adjusted to obtain a uniform moisture profile at the exit end, and the protection of the paper from entrained lint and surface dirt.

Each exhaust duct is shaped to divide the air in accordance with the relative needs as the air enters through the felt into the vapor space formed by the free spaces of paper between upper and lower drying cylinders, and between the one paper drying cylinder and the felt covered open grillage roller, one above the other, with the exhaust duct being placed in this vapor space. The major portion of the air is directed toward the oncoming web of paper with its hotter side having broken contact with the heated drying cylinder being exposed so that the air will sweep this side clear of the film of water vapor before being sucked into the exhaust duct. The lesser portion of air is directed to sweep the colder side of the web of paper leaving the processing dryer, and is then sucked into the exhaust duct through open slots on the opposite side of the duct. Both slots extend the full width of the duct. The slots have an open mesh wire covering to prevent occasional shreds of paper from being sucked into the duct and clog the entire exhaust duct system.

The exhaust duct being rigidly framed for spacing the full width of the machine without deflecting serves to support the doctor blade with built-in adjustments for contacting the drying cylinder or backing off.

These and other novel features of the invention will be better understood after considering the following discussion and accompanying drawings in which

FIG. 1 is a vertical end view of one unit of paper drying apparatus embodying the invention;

FIG. 2 is a sectional view of a modification of the apparatus of FIG. 1;

FIG. 3 is a longitudinal side view of a felt drying apparatus of the invention;

FIG. 4 is an enlarged view, partly in section, of the left end portion of FIG. 3, and

FIG. 5 is an enlarged sectional view taken at 5—5 of FIG. 3.

It is understood that a complete paper drying apparatus comprises several upper drying cylinders **1** arranged in a horizontal plane and several lower drying cylinders **2** also arranged in a horizontal plane, and that there is a continuous upper drying felt **3** which passes over the paper on the upper cylinders and a continuous lower drying felt **4** which passes over the paper on the lower cylinders. The felt is made of a porous moisture absorbing material and means are provided to maintain proper tension on the drying felts, all well known in the art. For convenience in describing and claiming the invention, the upper cylinder and the two lower cylinders have been

called a "unit." There are repeating similar units comprising the complete apparatus.

The web of paper **5** passes continuously over the cylinders which are usually heated, as indicated by the arrows and the upper drying felt **3** passes with the paper on the upper cylinder absorbing moisture from the paper and the lower drying felt **4** passes with the paper on the lower cylinders **2** absorbing moisture from the opposite side of the paper. The open grillage rollers **6** and **7** for the upper cylinders and the open grillage rollers **8** for the lower cylinders are located as is usual in this art so as to provide a large peripheral area of contact of the drying felts with the paper on the cylinders. As best shown in FIGS. 3, 4 and 5, each open grillage roller has end shafts **10** and **11** mounted in bearings **12** and **13** which are attached to side portions **14** and **15** of the drying apparatus. The shafts are secured to hubs **16** and **17** to which a plurality of spacer ribs **18** are secured. These ribs have relatively wide bearing surfaces **19** and shanks **20** by means of which they are secured to spacer support rings **22**. The entire open grillage roller is machined to a high degree of uniformity and the exterior surfaces **19** are smooth to prevent injury to the felt.

The means for forcing dry hot air into the open grillage roller and through the felt comprises a hood **23** supported below the open grillage roller **8** as shown in FIGS. 1 and 2. The hot air is supplied to the hood through the duct **24**. The hood has end closures **25** and **26** which bear against rings **27** and **28** on the hubs to prevent a loss of air transversely. As best shown in FIGS. 2 and 5, the longitudinal edges **31** and **32** of the hood are bent for fitting concentrically with the open grillage roller, with a safe minimum clearance between the hood and the roller, and with a sufficient gap between the edges of the hood and the drying felt to prevent wear and tear of either, as is probable with actual contact between the two. The escapement of hot drying air through the gap between felt and hood is minimized by the bent edge of the hood which deflects the air toward the felt, so that substantially all of the air is forced into and through the porous felt. The moisture exhaust conduit **35** of the invention is mounted over and extends the length of the open grillage rollers and is supported at its ends by brackets **36** and **37** attached to the machine support frames **14** and **15**. The brackets are connected to duct **38** which leads to a low pressure system operated by an exhaust fan (not shown). The exhaust conduit comprises a duct **40** having wide slots **41** and **42** which may have perforations or be covered with wire mesh **43** and **44** extending the entire length of the duct. These screened or perforated openings are located so as to remove the moisture laden air from the dryer felt and also the moisture evaporating from the free runs of the paper passing from one cylinder to another. The exhaust conduit not only carries away the moisture laden air from the drying felt and the free runs of the paper but it tends to reduce the pressure in the surrounding area which increases the evaporation rate.

The duct **35** is preferably shaped as shown in cross-section to form a depending baffle or deflector nose **46** which directs the major part of the air towards the left as shown in FIGS. 1 and 2.

The wire mesh coverings over the slotted openings in the ducts offer an elemental protection against the possibility of shreds of paper during start-up and occasional breaks being sucked into the duct with the possibility that such shreds of paper might clog the duct or the following system entirely.

The apparatus illustrated in FIG. 2 provides a pivotal support for doctor blade **47**, which can be made to contact the surface of the upper cylinder **1**, or can be retracted to leave a gap between the blade and the cylinder. The doctor blade **47** removes lint and pulp fibers from the cylinder which are carried away by the exhaust conduit or scrapes off paper while it is threaded into the machine or sticks to the surface of the cylinder due to a snap off, the paper being transferred into the following nip between the drying cylinder and felt.

I claim:

1. In paper drying apparatus having a multiplicity of cylinder units consisting of one upper cylinder, two lower cylinders in a triangular spaced relation with the upper cylinder and with means for passing paper over the cylinders and drying felt over the paper on the cylinders, two open grillage felt drying rollers one on each side of the upper cylinder and an open grillage felt drying roller between the two lower cylinders, the improvement which comprises a hood extending lengthwise of each open grillage roller provided with means to force hot air through the open grillage roller and the overlying felt, an exhaust conduit supported in the space between the two lower cylinders and the upper cylinder and extending lengthwise thereof, said conduit having an opening extending lengthwise for the transverse entry of moisture laden air from the drying felt and moisture laden air from between the adjacent runs of paper web passing adjacent the exhaust conduit, said openings being of a size to prevent shreds of paper being sucked into the conduit, a removable doctor blade bearing on the upper cylinder for scraping off lint and fibers which are removed by the exhaust conduit, and means to operate the exhaust conduit under reduced pressure.

2. In paper drying apparatus having a multiplicity of cylinder units consisting of one upper cylinder, two lower cylinders in a triangular spaced relation with the upper cylinder and with means for passing paper over the cylinders and drying felt over the paper on the cylinders, two open grillage felt drying rollers one on each side of the upper cylinder and an open grillage felt drying roller between the two lower cylinders, the improvement which comprises a hood extending lengthwise of each open grillage roller provided with means to force hot air through the open grillage roller and the overlying felt, an exhaust conduit extending lengthwise of each open grillage roller for removing vapor laden air over the width of the open grillage roller, said conduit having a perforated surface which permits entry of lint and fibers but not pieces of paper, a doctor blade bearing on the upper cylinder arranged so that lint and fibers scraped from the cylinder enter the exhaust conduit, and means to operate the exhaust conduit under reduced pressure.

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JAMES W. WESTHAVER, *Primary Examiner.*