

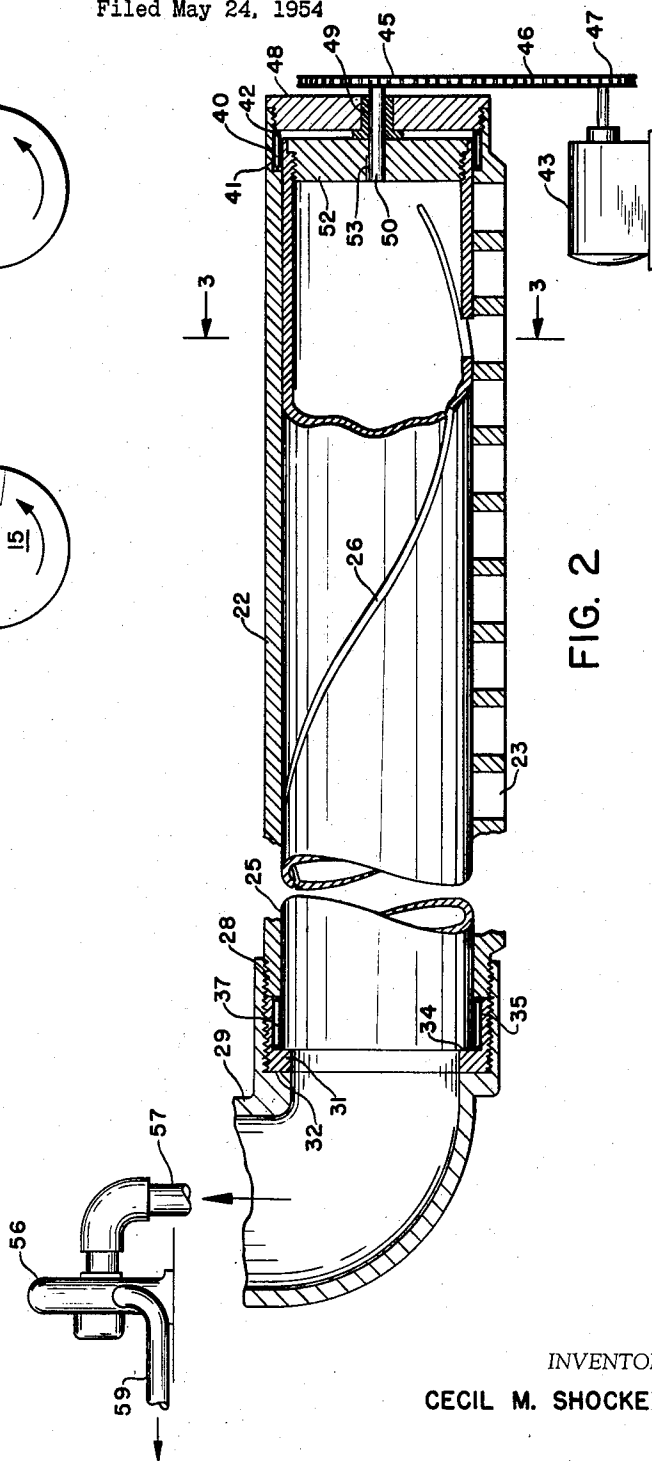
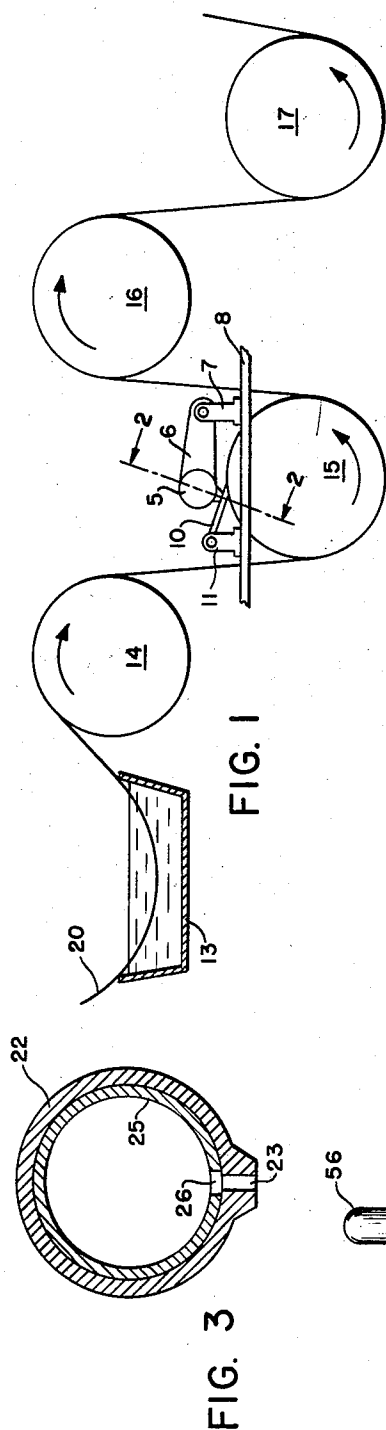
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C. M. SHOCKEY

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SUCTION CLEANER FOR DOCTOR BLADES FOR DRYING ROLLERS

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INVENTOR
CECIL M. SHOCKEY

BY *Pennie, Edmonds, Morton, Barrows & Taylor*
ATTORNEY

1

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SUCTION CLEANER FOR DOCTOR BLADES FOR DRYING ROLLERS

Cecil M. Shockey, Urbana, Ohio

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6 Claims. (Cl. 34—85)

This invention relates to machinery for processing paper and like sheet material, and provides a suction device suitable for use in removing the material scraped from the processing rollers by doctor blades. More particularly, the invention provides a suction device which efficiently and continually removes material from a doctor blade through a plurality of suction ports arranged in longitudinal alignment adjacent the doctor blade by concentrating the vacuum progressively from port to port, thereby minimizing the total suction requirement and reducing the capacity requirements for pumping equipment.

In the manufacture of paper, and in other analogous industries, sheets of material are continuously processed through tubs or vats containing processing materials and then over drying rolls. In such processes, some of the processing materials are usually transferred to the rolls from the sheets. Removal of this material from the rolls is effected by means of doctor blades in engagement with exposed areas of the roll surfaces. Particles scraped by the doctor blades from the rolls must be efficiently and continually removed from the doctor blades; otherwise, such particles will collect and drop onto the sheet. This is undesirable. In the manufacture of bond, ledger and mimeograph papers, for example, lint, fibers and starch particles dropping from the doctor blade onto a sheet will impair the quality and performance of the paper.

I have found suction to be the most advantageous way of cleaning the doctor blade. Unfortunately, in removing excess materials from the doctor blade by suction, the maintenance of a vacuum over the entire length of the doctor blade requires high capacity pumping equipment to provide an effective vacuum along the entire doctor blade.

My invention provides a suction device which eliminates the necessity for high capacity pumping equipment in the provision of means for localizing or concentrating the vacuum at only a small port area near the doctor blade at any given instance and moving the area progressively along the doctor blade. My device comprises an exterior tube having a plurality of separate suction ports in longitudinal alignment thereon and adapted to be located adjacent the doctor blade. An inner tube is rotatably mounted within the exterior tube, which tube has a helical slot extending longitudinally along the length thereof. The inner tube has a cylindrical outer surface complementary to and evenly engaging the inner surface of the exterior tube, providing face-to-face contact. On rotation of the inner tube the helical slot is brought progressively into register with the suction ports so that the vacuum is applied only to one port at a time and an effective vacuum is thus applied with a relatively low power requirement and vacuum capacity. Means are provided at the ends of the exterior tube journaling the inner tube for rotation in pressure-tight relation to the exterior tube. Other means are provided which drive the inner tube at one of its journaled connections with

2

the exterior tube. Means are further provided which include a source of suction communicating with the interior of the inner tube for withdrawing material collecting on the doctor blade through the suction ports in the exterior tube. The inner tube serves as a valve member progressively opening one port after another, the concentration of the vacuum moving progressively along the exterior tube near the doctor blade, which action is repeated continuously. As a result, material collecting on the doctor blade is sucked therefrom without substantial losses in vacuum, by reason of the vacuum being concentrated at a small area. The ports of the exterior tube are preferably arranged in a longitudinal projecting nozzle that can be positioned close to the doctor blade.

In the drawings:

Fig. 1 is a schematic elevational illustration partly in section of a typical assembly of apparatus for the processing of paper showing one embodiment of the invention;

Fig. 2 is an enlarged view on line 2—2 of Fig. 1 showing the device of the invention partially in section and partially in elevation; and

Fig. 3 is a transverse sectional view on line 3—3 in Fig. 2.

Referring to Fig. 1, the suction device of the present invention, shown generally at 5, is pivotally mounted through arms 6, one being at the opposite end also, and a bracket 7 on the frame 8 for the assembly of rollers. The suction device 5 overlies a suitable doctor blade 10 journaled on a bracket 11 which is also mounted on the frame 8. It is to be understood that a doctor blade may be arranged to clean each roll, in which case a vacuum device of the invention may be installed to remove the scrapings from each blade.

The assembly shown for the sake of illustration includes a starch tub 13 and a number of rotating drying rolls 14, 15, 16, and 17. A continuous sheet of paper such as bond, ledger, or other highly finished paper 20 is immersed in the starch tub 13 and is pulled over and around these drying rolls. Particles of starch and paper fibers carried from the starch bath 13 by the continuous sheet of paper are deposited on the rolls. By way of example, the material deposited on the drying roll 15 is scraped off by the doctor blade 10 and collects thereon. This loose material is continually removed by the suction device 5, as will be hereinafter described.

Referring to Figs. 2 and 3, the suction device essentially comprises a cylindrical exterior tube 22 having a plurality of elongated projecting transverse suction ports 23 arranged in longitudinal alignment thereon and adapted to be located adjacent the doctor blade 10 as shown in Fig. 1. An inner tube 25 is mounted within the exterior tube 22 and has its cylindrical outer surface substantially complementary and evenly engaging the inner surface of the exterior tube. This inner tube 25 has a narrow helical slot 26 which spirals gradually along its entire length, preferably making a single revolution of 360°. This helical slot from end to end embraces the entire length of ports 23. The outer and inner tubes 22 and 25, as well as the slot 26, extend the full length of the doctor blade.

The outer tube 22 is externally threaded, as at 28, at one of its extremities to an internally threaded elbow pipe section 29. The free end of the tube 22 abuts longitudinally against a bushing 31 threaded within the pipe section 29. The bushing 31, in turn, abuts against a shoulder portion 32 of the pipe section 29. The bushing 31 has an inwardly extending annular flange 34 and a cylindrical inner surface 35 greater in diameter than the outer cylindrical surface of the inner tube 25. This inner tube 25 is rotatably mounted at one end within the exterior tube 22 by a needle bearing 37 provided in the annular space defined by the annular flange 34, the cylin-

3

dricl surface 35 of the bushing 31, and the end of the exterior tube 22. Another set of needle bearings 40 is seated within a cylindrical recessed surface 41 at the end of the outer tube 22 by a snap ring 42. This second set of needle bearings 40 also serves to rotatably mount the inner tube 25 within the outer tube 22.

The inner tube 25 is driven at its opposite end within the exterior tube 22 by motor 43 which drives sprockets 45 and 46 through chain 47. A plug 48 is threaded to the extremity of the outer tube 22 and has a centrally positioned packing gland 49 for journaling the drive shaft 50 passing through the plug 48. A second plug 52 is threaded to the end of the tube 25 within the confines of the first plug 48 and the outer tube 22, and the shaft 50 to which the sprocket 45 is connected is suitably keyed at 53 to plug 52 for driving the inner tube 25.

A vacuum pump 56 communicates through a pipe 57 and the pipe section 29 with the interior of the inner tube 25, providing the necessary low pressure or vacuum within the inner tube.

Advantageously, both of the plugs 48 and 52 may be gasketed in any well known manner and the abutting faces of the outer tube 22, the bushing 31, and the pipe section 29 are also gasketed. For sake of clarity, such gaskets are omitted from the drawings. It is evident, however, that the joints provided at the opposite extremities of the first tube 22 and the inner second tube 25 can be sealed sufficiently to provide a high degree of suction from the pump 56.

In use, the doctor blade 10 is brought into engagement with the roll 15 for scraping off the particles collecting thereon, and the suction device 5 is positioned above the doctor blade with the longitudinal row of ports 23 held close to the doctor blade. The chain 46 is connected to the sprockets 45 and 47. The driving motor 43 is started, and the inner tube 25 is driven within the stationary exterior tube 22 at any desired rate. The vacuum pump simultaneously started to provide the necessary vacuum within the tube 25.

As the inner tube 25 is driven coaxially within the outer tube 22 and in close contact therewith on their respective cylindrical surfaces, different sections of the helical narrow slot 26 move into registry with different suction ports 23 for the outer tube 22. The narrow slot 26 proceeds sufficiently gradually about and along the inner tube 25 such that but one of the elongated suction ports 23 registers with a section of the narrow slot 26 during any period of rotation of the inner tube 25. In this way, all but one of the elongated suction ports are closed and out of communication with the source of suction, thereby substantially reducing the vacuum demand that would exist if all of the ports 23 were open at the same time. Correspondingly, suction at individual suction ports 23 is substantially high as each port registers with the slot of the revolving inner tube 25, and particles collecting on the doctor blade 10 are efficiently withdrawn through the suction ports and the narrow slot 26 to the discharge pipe 59.

Although the suction device of my invention is shown herein mounted near a rotating drying roll, it is clear that the device can be mounted for cooperation with any type of moving element wherein the problem of continually removing unwanted materials by vacuum is encountered. Thus, the suction device may be mounted proximate a doctor blade which scrapes particles from a plane moving element rather than a cylindrical drying roll. Whatever the manner of mounting practiced, however, the suction device functions equally well as each suction port 23 is instantaneously placed under suction from the pump 56, while the remaining ports are closed for each revolution of the inner tube 25.

I claim:

1. In apparatus for processing paper and similar material in which a moving surface contacts the paper and a doctor blade engages the moving surface to clean the

4

same between contacts with the paper, a suction device for removing material collected on the doctor blade which comprises an exterior tube having inlet means extending longitudinally thereof, means mounting said exterior tube with the inlet thereof close to the upper surface of the doctor blade, an inner tube having helically-arranged inlet means extending along its length, the inner tube being rotatably mounted within the exterior tube in sealing relation, means for driving the inner tube for rotation with respect to the exterior tube to progressively bring portions of the helical inlet means of the inner tube into registry with the longitudinally extending inlet means of the exterior tube, and means for inducing a suction within the inner tube for withdrawing material collected on the doctor blade through the registered portions of the inlet means of the exterior and inner tubes as the latter is rotated.

2. Apparatus according to claim 1 in which the inlet means are in a projecting elongated nozzle which extends lengthwise of the doctor blade.

3. In apparatus for processing paper and similar material in which a moving surface contacts the paper and a doctor blade engages the moving surface to clean the same between contacts with the paper, a suction device for removing material collecting on the doctor blade which comprises an exterior tube having a plurality of suction ports in longitudinal alignment therein, said exterior tube being mounted with the suction ports close to the upper surface of the doctor blade, an inner tube having a 360° helical slot along its length, the inner tube being rotatably mounted within the exterior tube in sealing relation, means for driving the inner tube for rotation with respect to the exterior tube, and means for inducing a suction within the inner tube for withdrawing the material collecting on said doctor blade through the suction ports in the exterior tube and helical slot of the inner tube as the latter is rotated.

4. In apparatus for processing paper and similar material in which a moving surface contacts the paper and a doctor blade engages the moving surface to clean the same between contacts with the paper, a suction device for removing material collecting on the doctor blade which comprises an exterior tube having a plurality of suction ports, means mounting said exterior tube with the suction ports close to the upper surface of the doctor blade, an inner tube having a helical slot spiraling longitudinally along its length, the inner tube being rotatably mounted within and complementary to the exterior tube in pressure-tight relation, means for driving the inner tube for rotation with respect to the exterior tube, and a vacuum pump for inducing a vacuum in the inner tube for withdrawing material collecting on the doctor blade through the suction ports progressively from port to port as the inner tube rotates and the helical slot is brought into register with the ports.

5. Apparatus according to claim 4 in which the suction ports extend the length of the doctor blade and the helical slot makes at least one complete revolution of the inner tube and is also the length of the doctor blade.

6. In apparatus for processing paper and similar material in which a moving surface contacts the paper and a doctor blade engages the moving surface to clean the same between contacts with the paper, a suction device for removing material collecting on the doctor blade which comprises an exterior tube having a plurality of suction ports arranged in longitudinal alignment thereof, means mounting said exterior tube with the suction ports close to the upper surface of the doctor blade, an inner tube having a helical slot spiraling longitudinally along its length, the inner tube being provided within the exterior tube and having a cylindrical outer surface complementary to and evenly engaging the inner surface of the exterior tube, means journaling the inner tube for rotation in pressure-tight relation to the exterior tube, means for driving the inner tube for rotation with respect

to the exterior tube, and a vacuum pump for inducing a vacuum in the inner tube, whereby the helical slot opens the suction ports progressively one after the other from end to end of the exterior tube and thereby concentrates the suction over but a short section of the doctor blade and effectively removes the material collected on the doctor blade.

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