

Jan. 22, 1963

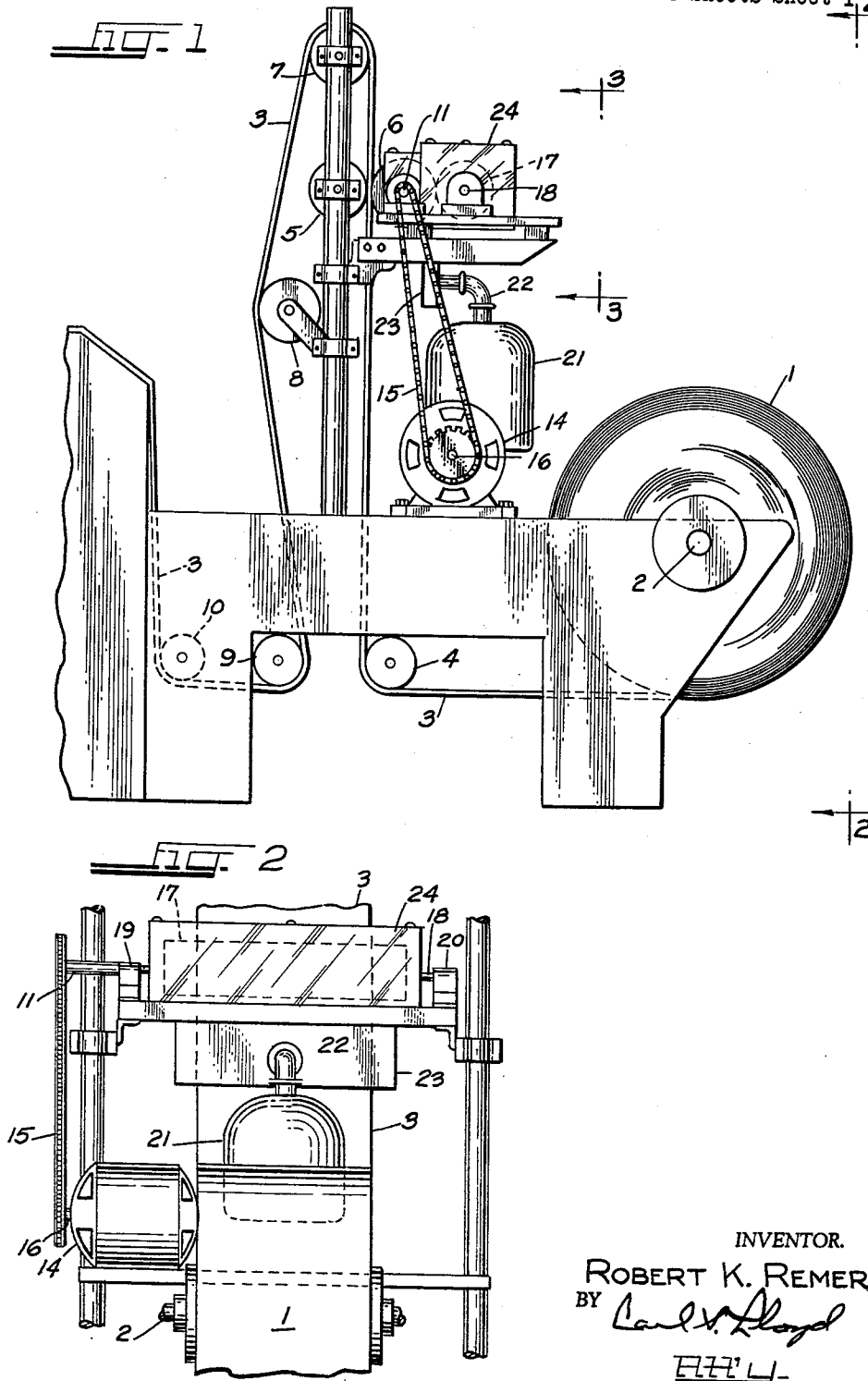
R. K. REMER

3,074,086

APPARATUS FOR REMOVING DUST FROM PAPER WEBS

Filed Feb. 4, 1959

3 Sheets-Sheet 1



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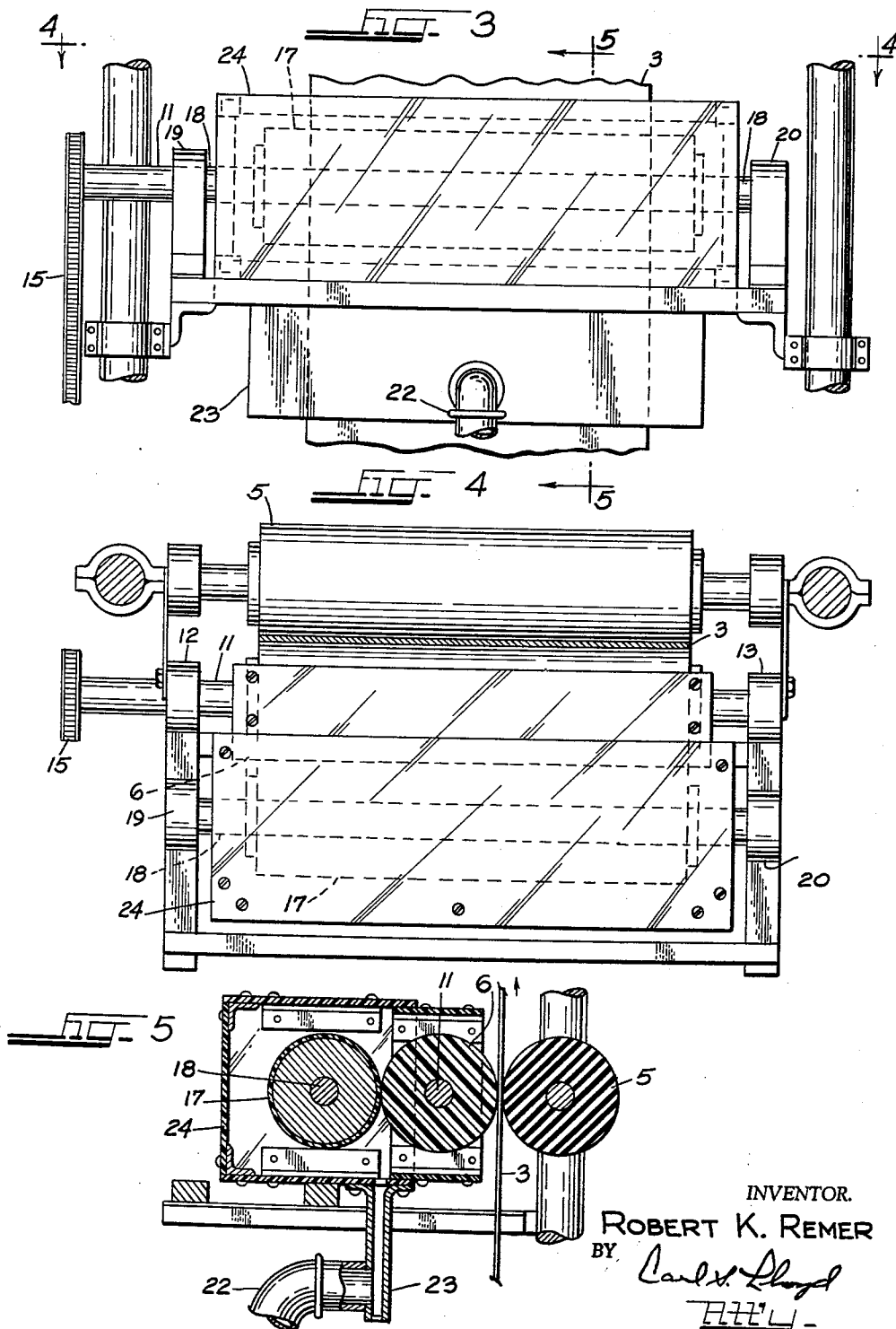
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3 Sheets-Sheet 2



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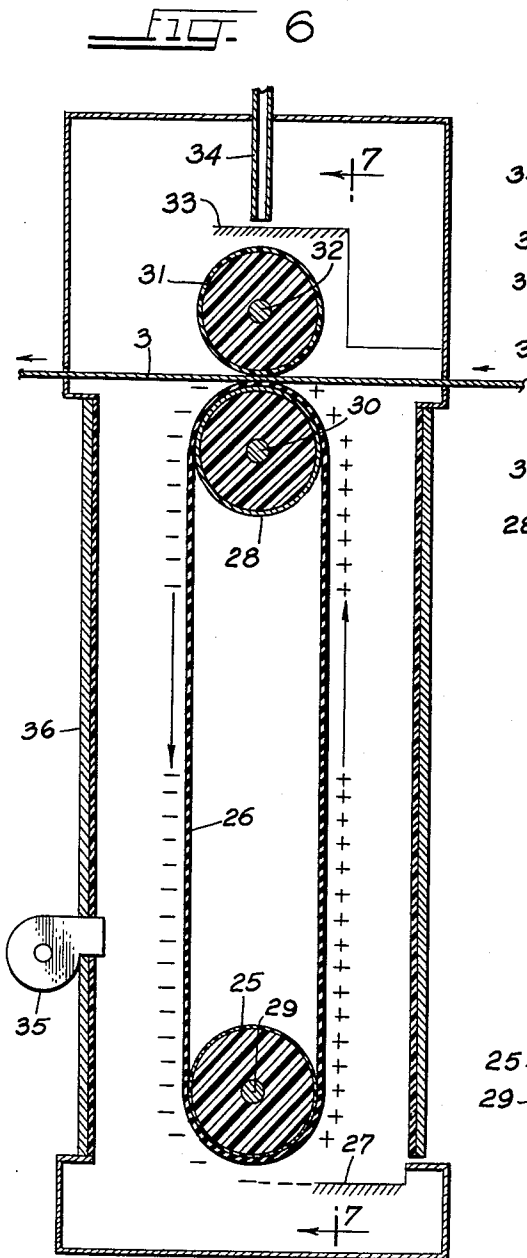
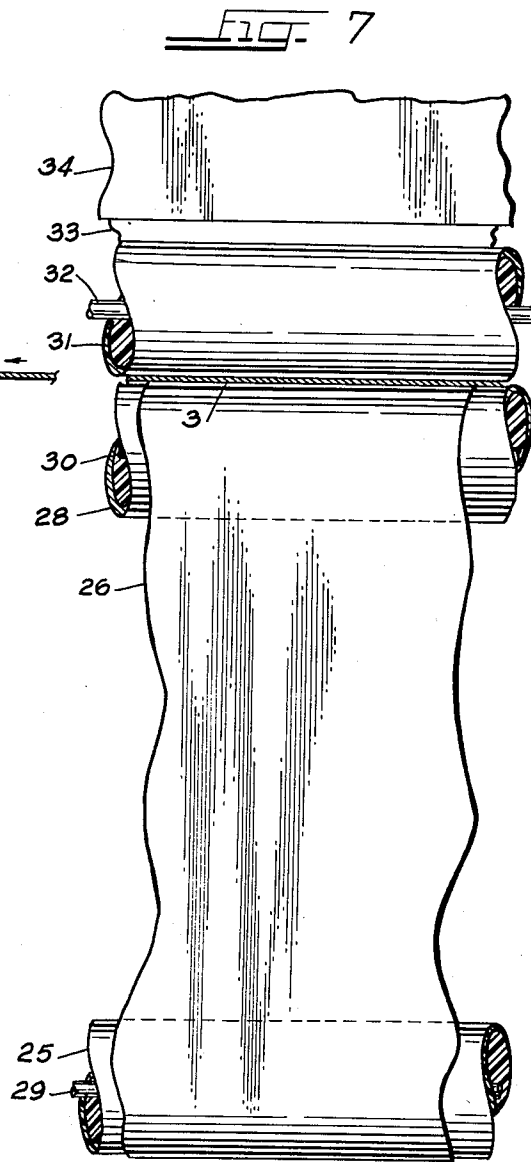
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3 Sheets-Sheet 3



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3,074,086

APPARATUS FOR REMOVING DUST FROM PAPER WEBS

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9 Claims. (Cl. 15—1.5)

This invention relates to apparatus for the removal of dust from paper such as that used for newsprint. More specifically my invention relates to the removal of dust from a paper web by creating an electrostatic charge on a body and passing the paper web over and in contact with the charged body so that the electrostatic charge will attract the dust and thus remove it from the web.

In the processing of paper for use as newsprint a large amount of lint and dust is normally created, particularly in the slitting of the paper web, and such lint and dust deposits itself upon the web in the form of fiber, fuzz, or "whiskers." Such extraneous material often gathers into wads forming what are known as "hickies" on the paper sheet. These dust formations can seriously impair the printed surface, particularly in the case of offset printing, since the "hickies" can be transferred to the blanket and in the printing process the imperfection in the printing resulting therefrom will be repeated on sheet after sheet in the same place. This necessitates frequent cleaning or washing of the blankets, plates and ink rollers, with consequent loss of time and increase in labor.

Some mills use compressed air, a vacuum or a brush to remove the dust and lint from the paper, but due to the high static charge which usually exists on the paper, there is a tendency for dust particles or lint to stick to the surface so that they are not effectively removed by the methods heretofore known. I have provided a method and apparatus for slitting paper webs so as to minimize the formation of lint and dust as set forth in my application, Serial No. 609,215, filed September 11, 1956, now Patent No. 2,989,882, but even when this method is employed it is likely that some dust and lint will be deposited upon the paper during the slitting process. If apparatus of the present invention be used for removing dust from a paper web in conjunction with the invention disclosed in my application referred to above then the amount of dust or lint remaining on the paper at the time the web enters the printing press would be so negligible as not to pose a serious problem. Furthermore even if used alone the present invention would materially alleviate the problem.

One object of this invention is to provide apparatus for removing lint and dust from a paper web so that paper so processed will be suitable for use in offset printing and other printing processes.

Another object of this invention is to provide an apparatus which is particularly well suited for embodying my invention.

Other objects and advantages of my invention will be apparent from the following description of a preferred embodiment thereof, taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a side elevational view of an apparatus embodying the structural features of my invention.

FIG. 2 is an end elevational view of my apparatus taken along the line 2—2 of FIG. 1.

FIG. 3 is an enlarged end elevational view, partly broken away, taken along the line 3—3 of FIG. 1.

FIG. 4 is a top plan view thereof, taken along the line 4—4 of FIG. 3.

FIG. 5 is a sectional view thereof, partly broken away, taken along the line 5—5 of FIG. 3.

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FIG. 6 is a sectional view of an alternative type of apparatus embodying my invention.

FIG. 7 is a fragmentary elevational view taken along the line 7—7 of FIG. 6.

Referring to FIG. 1 a roll of paper 1 is shown mounted on a rotatably supported shaft 2. A web 3 from said roll is conducted over guide roller 4 and upwards so as to pass between a guide roller 5 and an electrostatically charged roller 6. The roller 6 has a positive electrostatic charge on it so that when the web 3 contacts such roller the negatively charged dust particles on the web are drawn from the web and deposited upon this roller. The substantially dust free web is then conducted over guide rollers 7, 8, 9 and 10 after which it is fed directly to the printing press (not shown).

The electrostatic charge on the roller 6 is produced in the following manner. Such roller is supported on a shaft 11 which is rotatably mounted in bearings 12 and 13 (see FIG. 4). The shaft 11 is rotated by a motor 14 (see FIG. 2) through a chain 15 which is connected to the shaft 11 and to the power shaft 16 of the motor 14. Mounted adjacent to the roller 6 is an idler friction roller 17 (see FIGS. 1, 4 and 5) supported by a shaft 18 which is rotatably mounted in bearings 19 and 20. The roller 17 is mounted so as to contact roller 6 so that when the roller 6 is rotated by the motor 14 and chain 15 the roller 17 will be rotated by the roller 6. When the rollers 6 and 17 are in operation corresponding areas on the surfaces of each are continuously coming into contact and separating and it is this cooperation between the rollers 6 and 17 in conjunction with the materials chosen for their respective surfaces which results in the production of a positive electrostatic charge upon the roller 6.

In this preferred embodiment the roller 6 is manufactured from polyethylene and the surface of roller 17 is manufactured from nylon fur. The rubbing of the polyethylene surface against the nylon fur surface will produce a positive electrostatic charge on the former. There are numerous other materials from which the rollers 6 and 17 might be manufactured such that rolling contact between the two would produce a static charge. For example, the rollers 6 and 17 could be manufactured, respectively, from the following materials: asbestos and mica, mica and wool, aluminum and india rubber, or ebonite and brass. Lists of substances arranged in such an order that when any two are rubbed together, the one higher in the list becomes positive with respect to the other material are known as "triboelectric series" and it should be understood that the materials for rollers 6 and 17 are to be chosen from such a list providing that these rollers are made of dissimilar materials and the material chosen for roller 6 which is to be positively charged is higher in the list than the material chosen for roller 17.

It will now be understood that when the rollers 6 and 17 are in motion a positive electrostatic charge is produced upon the rollers 6 and when the web 3 is conducted between rollers 5 and 6 so as to contact roller 6 the lint and dust, deposited upon the web by previous processing operations, being negatively charged, is attracted by the positively charged roller 6 which removes such dust from the web and deposits it upon the roller 17 through its contact with the latter.

Referring to FIGS. 1—5 it will be noted that the rollers 6 and 17 are contained within an enclosure 24 which in this preferred embodiment is manufactured from transparent Plexiglas. This enclosure confines the dust which is removed from the paper web such that it can be removed by a vacuum pump 21 which is connected to the enclosure 24 by a pipe 22 and exhaust dust 23 (see FIG. 5).

FIGS. 6 and 7 illustrate an alternative apparatus embodying my invention. In this alternative embodiment the initial electrostatic charge is produced by conducting a rubber belt 26 around a pulley 25 which may be made of Lucite and which has its surface covered with a material such as polyethylene tape. The passing of the belt 26 around the pulley causes a negative electrostatic charge to be produced upon the pulley 25. The electrostatic charge produced upon pulley 25 will be negative because of the materials chosen for the belt 26 and the pulley 25 respectively. Since unlike charges attract each other the negatively charged pulley 25 tends to attract positive charges through the small wire screen or brush 27 which is mounted near said pulley but separated therefrom by the belt 26. The positive charges attracted by the pulley 25 are thus deposited upon the belt 26.

The belt 26 passes over a second pulley 28 which in the embodiment being described may also be made of Lucite and is covered with a layer of material such as aluminum foil. The pulleys 25 and 28 are supported by the shafts 29 and 30, respectively, and these shafts are rotatably mounted in bearings (not shown). The shaft 29 is rotated by suitable power means (not shown) so that in operation the pulley 25 is rotated counter-clockwise to move the belt 26 upward on the right and downward on the left (as shown in FIG. 6) and so that the pulley 28 through its contact with said belt is also rotated in a counter-clockwise direction.

As the belt 26 rotates and carries the positive electrostatic charge upward the pulley 28 becomes positively charged, due to the fact that portions of said pulley 28 are continuously brought first into intimate contact and then separated from said belt, and because of its attraction for negative charges the pulley 28 causes negative charges to be deposited upon the belt 26 which carries them downward (as shown in FIG. 6). The belt 26 is thus carrying positive charges upward and negative charges downward.

A roller 31, which has a surface of material such as nylon fur, is supported by a shaft 32 which shaft is rotatably mounted in bearings (not shown), and the moving paper web 3 is passed from right to left (as shown in FIG. 6) between the roller 28 and the pulley 31 to a printing press. The excess positive electrons which are carried upward on the belt 26 are transferred through the paper web 3 to the nylon fur roller 31 so that the roller 31 becomes charged with an excess of positive electrons. As the paper web is passed under the roller 31 the negatively charged dust particles are removed from the top of the paper web 3 and deposited upon the roller 31. A small wire screen 33 acts as a ground and discharges successive portions of the roller 31 as they pass directly beneath said screen thus causing the dust to be removed from said portions and drawn out through an exhaust duct 34 by vacuum means (not shown) without affecting the positive charge upon that portion of the roller 31 which is in contact with the moving web 3.

Various materials other than those described above may be used for the rollers 25 and 28. Thus the materials for the roller 25 which is to be negatively charged may be chosen from any triboelectric series such as previously referred to and the material chosen should be lower in said series than the belt material. The material chosen for the roller 28 which is to be positively charged may be chosen from the triboelectric series and this material should be higher in the series than the belt material.

The apparatus described above is contained within an enclosure 36 and a source of warm air is shown at 35 (see FIG. 6) so that the relative humidity within said enclosure can be controlled so as to be approximately 30% or less since higher humidities tend to prevent the formation of the necessary charges at the pulleys.

It should be noted that in both of the embodiments described herein provision is made for removal of lint and dust from only one side of the moving paper web. It should, of course, be understood that a complete dust

removal system would require two oppositely-disposed units with each arranged to clean a different side of the web.

This invention can, of course, be applied in various ways and the present description should, therefore, be regarded as disclosing only an illustrative embodiment of the invention from which no unnecessary limitations should be implied.

I claim:

1. An apparatus for removing the lint and dust from a moving paper web comprising: a pair of rollers made of dissimilar materials chosen from a triboelectric series, said rollers being rotatably mounted on parallel axes so as to be in contact with each other in such manner that rotation of one of said rollers will effect rotation of the other; means for rotating one of said rollers so as to produce rolling contact between said rollers and thus produce electrostatic charges on one of said rollers; and means for bringing a paper web into intimate contact with that roller in the pair which has been positively charged due to said rolling contact whereby any lint and dust adhering to said web will be attracted by said positively charged roller and removed thereby.

2. An apparatus for removing the lint and dust from a moving paper web comprising: a pair of rollers made of dissimilar materials chosen from a triboelectric series, said rollers being rotatably mounted on parallel axes so as to be in contact with each other whereby rotation of one of said rollers will effect rotation of the other; means for rotating one of said rollers so as to produce rolling contact between said rollers; and means for conducting a paper web over and in intimate contact with that roller in the pair which has been positively charged due to said rolling contact so that said web comes into intimate contact with said positively charged roller.

3. An apparatus for removing the lint and dust from a moving paper web comprising: a pair of rollers made of dissimilar materials chosen from a triboelectric series, said rollers being rotatably mounted on parallel axes so as to be in contact with each other whereby rotation of one of said rollers will effect rotation of the other; means for rotating one of said rollers so as to produce rolling contact between said rollers; means for conducting a paper web over that roller in the pair which has been positively charged due to said rolling contact so that said web is brought into intimate contact with said positively charged roller; means which substantially enclose said pair of rollers and yet permit contact between said web and said positively charged roller; an exhaust duct connected with said enclosure; and means for removing the lint and dust collected in said enclosure out through said exhaust duct.

4. An apparatus for removing the lint and dust from a moving paper web comprising: a pair of spaced rollers mounted on parallel axes; a belt mounted on said rollers such that rotation of one of said rollers will cause rotation of the other, said belt, said first roller, and said second roller all being made of dissimilar materials so chosen that contact between said belt and said rollers will produce a negative charge on the first of said rollers and a positive charge upon the second; means for rotating one of said rollers so as to continuously effect first intimate contact and then separation between portions of said first roller and said belt and between portions of said second roller and said belt so as to produce electrostatic charges on said rollers whereby the positive charges attracted to said belt by said first roller are carried towards said second roller by said belt and the negative charges attracted to said belt by said second roller are carried towards said first roller by said belt; a third roller, mounted adjacent to said second roller on an axis parallel to the axis of said second roller, for collecting the positive charges produced by said first and second rollers and said belt; and means for bringing a paper web into intimate contact with said third roller whereby any lint and dust adhering to said

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web will be attracted by said third roller and removed thereby.

5. An apparatus for removing the lint and dust from a moving paper web of the type described in claim 4 comprising: an enclosure which substantially encloses said three rollers and yet permits said web to be conducted over the third roller; means for discharging portions of said third roller without affecting the charge on that portion which is in contact with said web; an exhaust duct connected with said enclosure; means for removing the dust collected by said third roller out through said exhaust duct; and a source of warm air within said enclosure.

6. Apparatus for removing the lint and dust from a paper web comprising: a plurality of rollers rotatably mounted on parallel axes; means for rotating said rollers; means for producing a positive electrostatic charge on one of said rollers, said last-mentioned means comprising a member arranged to frictionally contact said last-mentioned roller and being made of a material dissimilar to the material of such roller, said materials being chosen from a triboelectric series; and means for directing the web between two of said rollers in intimate contact with the one that is positively charged whereby any lint and dust adhering to the web will be attracted to and removed by said positively charged roller.

7. In an apparatus for removing lint and dust from a moving paper web as set forth in claim 4: an enclosure for said third roller; and means for removing from said enclosure the lint and dust collected by said third roller.

8. An apparatus for removing lint and dust from a paper web as it travels to a printing press or the like comprising: a first and second roller between which the web is passed and by which it is engaged; a third roller in

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contact with said second roller, said third and second rollers being made of dissimilar materials chosen from a triboelectric series; and means for rotating said three rollers whereby a positive electrostatic charge is imparted to said second roller by said third roller and lint and dust is collected from the paper web onto said second roller.

9. An apparatus for removing lint and dust from a paper web as it travels to a printing press or the like comprising: a first and second roller between which the web is passed and by which it is engaged; a third roller in contact with said second roller, said third and second rollers being made of dissimilar materials chosen from a triboelectric series; means for rotating said three rollers whereby a positive electrostatic charge is imparted to said second roller by said third roller and lint and dust is collected from the paper web onto said second roller; an enclosure for said second and third rollers; and means for exhausting from said enclosure the lint and dust collected by said second roller.

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