April 25, 1961 M. S. FAIN 2,981,644

METHOD OF CLEANING LOOMS

Filed April 23, 1956 4 Sheets-Sheet 1

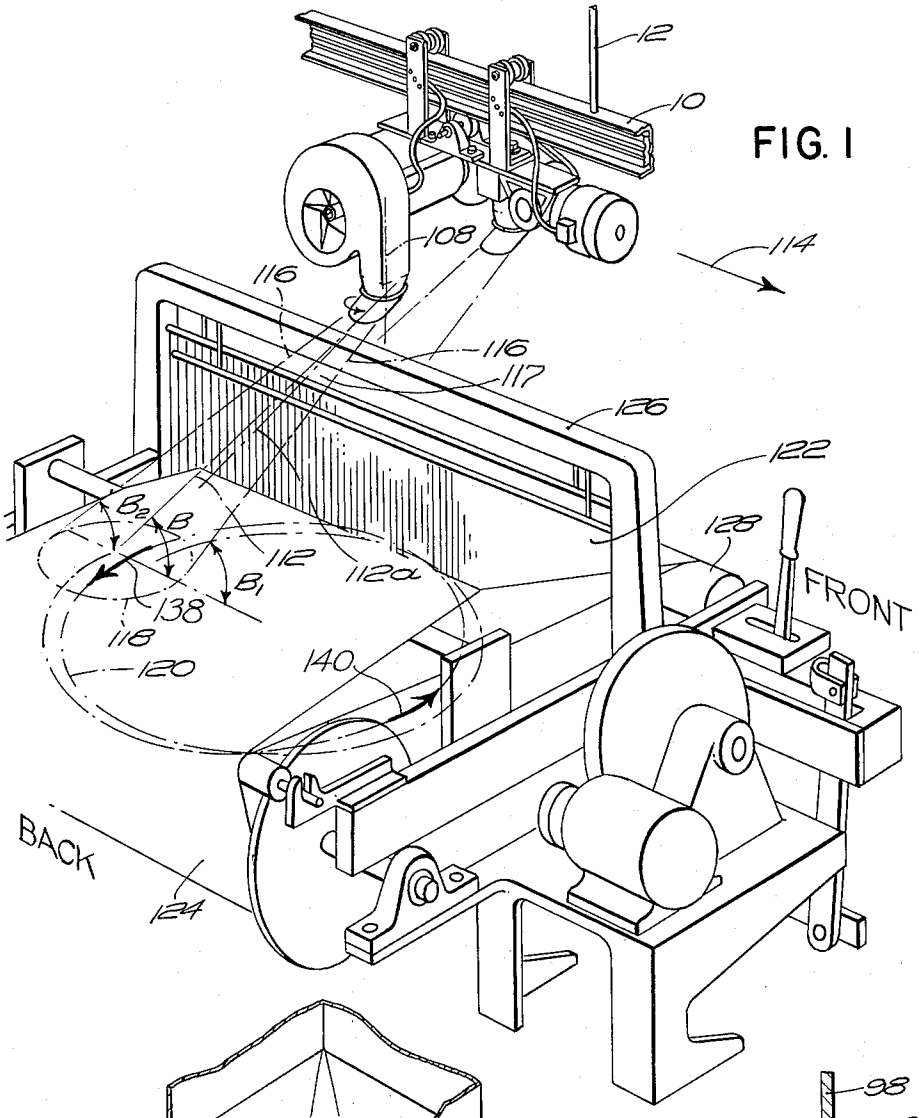

FIG. 1

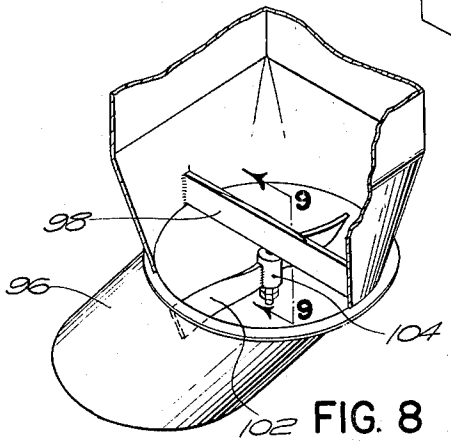

FIG. 8

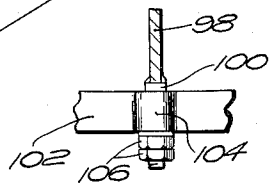

FIG. 9

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METHOD OF CLEANING LOOMS

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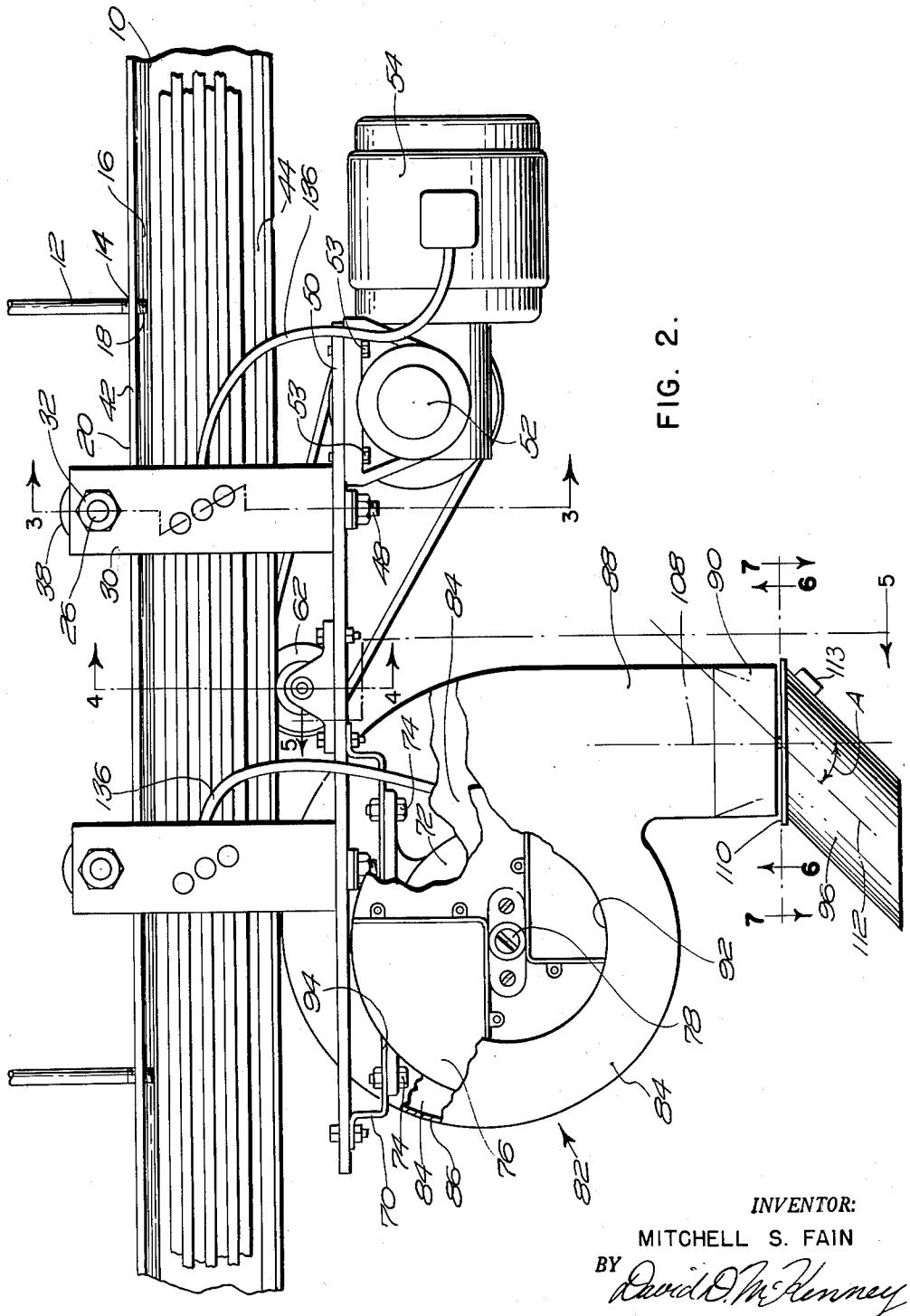

FIG. 2.

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METHOD OF CLEANING LOOMS

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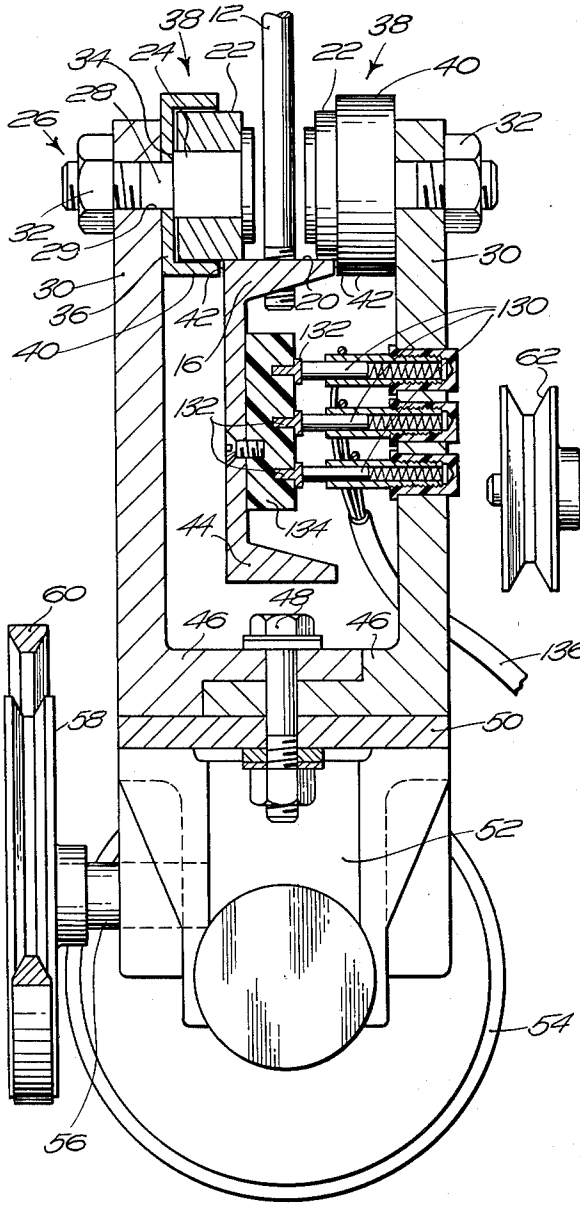

FIG. 3.

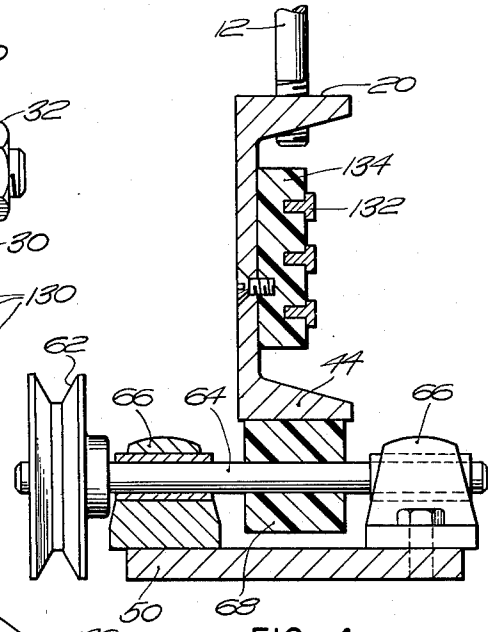

FIG. 4.

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METHOD OF CLEANING LOOMS

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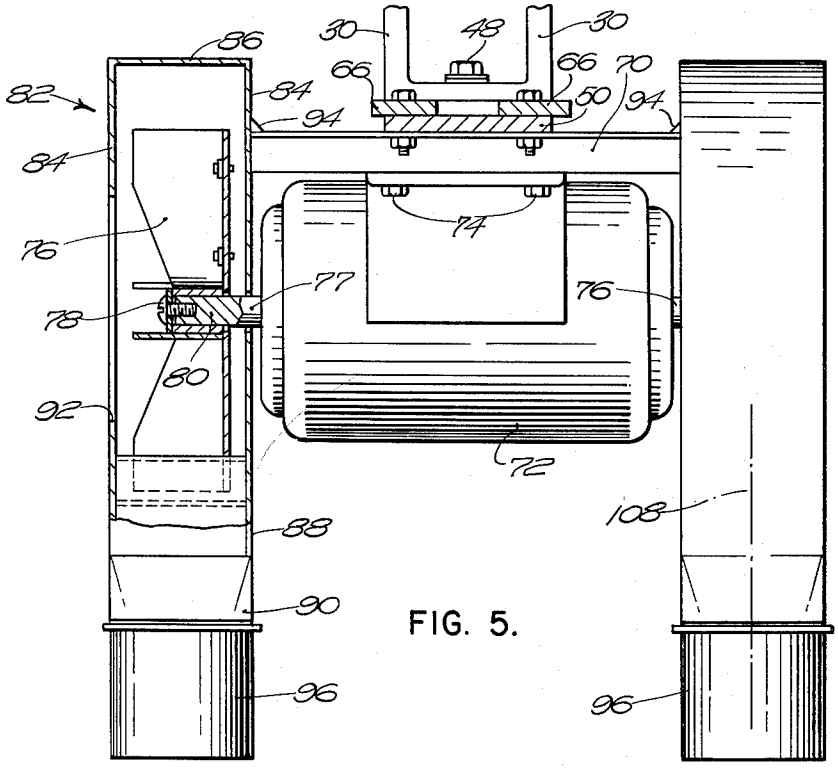

FIG. 5.

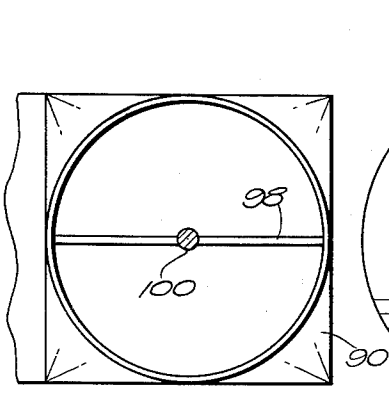

FIG. 6.

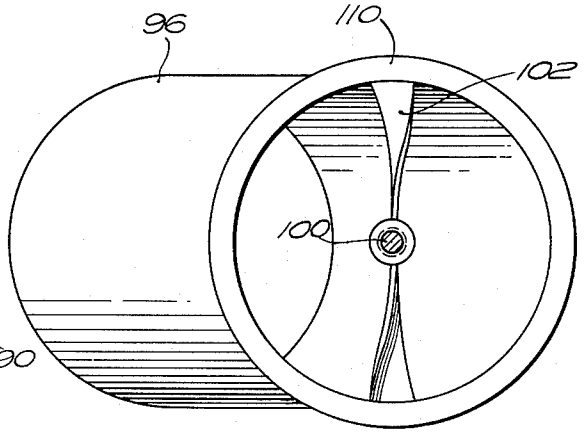

FIG. 7.

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United States Patent Office 2,981,644
Patented Apr. 25, 1961

2,981,644

METHOD OF CLEANING LOOMS

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Filed Apr. 23, 1956, Ser. No. 579,914

2 Claims. (Cl. 134—37)

This invention relates generally to an improved cleaning method for preventing the accumulation of lint, dust and similar airborne matter on machinery and on material being processed thereby. More particularly the invention has to do with a method which preferably utilizes cleaning apparatus adapted to pass over such machinery, and discharge downwardly thereagainst from a nozzle, an air stream of relatively high velocity, while the nozzle is rotated about an axis to move the stream back and forth across the material and machinery transverse to the direction of travel of the apparatus, by directing said stream in a generally circular or elliptical path so that each filament of the central portion of the stream, and primarily the axis of said stream, is directed against the material at an angle to the general plane thereof which is advantageous for cleaning.

It has been found that the removal of lint, fly and the like from certain types of machines and especially from the material being processed thereby may be achieved by overhead travelling cleaning apparatus which discharges a stream of air at high velocity against such machines and material. For example, textile looms, the yarns thereon and the cloth being woven from such yarns are particularly well adapted for cleaning by such a stream to prevent the accumulation of such lint and similar foreign matter which would interfere with proper loom operation and have an adverse effect on the quality and uniformity of the cloth.

It has been known that this air stream should be of relatively high velocity because machinery such as textile looms and especially the woven cloth thereon requires a stronger air blast for proper cleaning than some other types of machines and material in this art, as for example, spinning machines. Furthermore, in the case of looms the air stream must be discharged from a level sufficiently high above the machinery so as not to interfere with operators tending the same. These factors necessitate the high velocity discharge referred to and make it impractical to provide a source of moving air capable of furnishing an air stream which is of this required velocity and at the same time large enough to simultaneously encompass all parts to be cleaned transverse to the path of apparatus travel. As a result a relatively narrow stream of the proper velocity must be used. With such a narrow stream, however, it is further necesssary that it be moved in such a manner across the path of travel of the apparatus that every part of the machinery and material will be swept each time the apparatus passes.

The present invention provides a novel air stream movement in which this necessary coverage motion is accomplished by rotating the stream about an axis and in which this motion is accompanied by the added feature that the air in the stream is discharged at an advantageous angle with respect to the material to be cleaned.

Thus, I have discovered that when this material lies generally in a plane, as suggested above, superior cleaning is achieved by directing the central portion of the

rotating stream against the material at an angle to this plane which is always substantially less than 90°, at least throughout the movement of the stream in one direction transverse to the path of apparatus travel.

In addition I have discovered that when the stream is made to rotate at an inclined angle continuously about an axis in one rotative direction very rapid air stream movement can be achieved and each portion of material and machinery to be cleaned feels a succession of sharp puffs of air as the apparatus passes by, a condition which results in excellent cleaning. Accordingly another object is to provide a novel air movement in which the stream is applied to any given portion of the material and machinery to be cleaned, in the form of a succession of rapid sharp puffs of air, by rapidly and continuously rotating said stream in one rotative direction about an axis.

Further, I have discovered that when the stream being directed toward the material and machinery to be cleaned lies at an inclined angle to the plane of the material of substantially less than 90° the continuously rotating stream may be made to impinge against the material and machinery in substantially every rotative position. Accordingly it is another object to direct said stream at such an angle to said material whereby the axis of the stream if not moving along the machinery defines a hollow cone-like figure in the space between the apparatus and material, and whereby the engagement of the axis of the material by the stream at a given instant follows a path called a curtate cycloid which is defined by the intersection of this moving cone-like figure with the plane of the material, and thus permits the air stream at least two opportunities to clean away a particle of dirt in a single pass of the cleaner.

Another object is to move the cleaning airstream with relation to the general plane of the material to be cleaned, whereby the engagement of this plane by the axis of the stream at a given instant follows a path over such plane substantially in the form of a curtate cycloid, and whereby the angle at which the axis of the air stream engages the plane is substantially less than 90° and remains substantially constant for all rotative positions of the stream about the axis.

Another object is to direct the cleaning airstream so that it always has a horizontal component of force of considerable degree as well as a vertical component, with relation to the plane of the material, before it impinges on the material and machinery and is dispersed thereby.

Still further objects will appear hereinafter.

The best mode in which it has been contemplated applying the principles of the present invention are shown in the accompanying drawings but the latter are to be deemed merely illustrative because it is intended that the patent shall cover by suitable expression in the appended claims whatever features of patentable novelty exist in the invention disclosed.

In the drawings:

Figure 1 is a perspective view showing a preferred form of apparatus mounted on a track in the process of carrying out my novel method of cleaning a textile loom;

Figure 2 is a side elevation view of the cleaning apparatus of Figure 1, with selected portions broken away;

Figures 3 and 4 are cross section end views taken on lines 3—3 and 4—4, respectively of Figure 2;

Figure 5 is a cross section end view of a portion of the apparatus taken on line 5—5 of Figure 2;

Figures 6 and 7 are cross section plan views of a portion of the apparatus taken on lines 6—6 and 7—7, respectively, of Figure 2;

Figure 8 is a perspective view of the nozzle and lower duct end with part of the latter broken away to show more clearly the various parts; and

Figure 9 is a fragmentary view showing the pivotal connection of the nozzle to the duct.

Referring now more particularly to the drawings, Fig. 1 shows, in perspective, a preferred form of the apparatus for carrying out my invention and a textile loom being cleaned thereby. The apparatus of this preferred form is adapted to travel along a track **10** which is supported from above the loom by depending rods **12** having their upper ends secured to fixed overhead structure (not shown). Preferably the track is oriented so that in travelling along it the apparatus moves longitudinally with respect to the loom and at substantially a constant height thereabove.

In the embodiment shown the track **10** is formed of ordinary channel framing having tapped holes **14** (see Fig. 2) in the upper flange **16** to receive the threaded lower ends **18** of the supporting rods **12**. The upper flat surface **20** of this same flange **16** is engaged by the supporting wheels **22** (see Fig. 3) of the travelling apparatus, each of these wheels being rotatable on the enlarged end **24** of a short axle **26**. The other smaller end **28** of each such axle is passed through a hole **29** in the upper end of a frame member **30** and is provided with a nut **32** threaded thereon. The transition of the axle diameter from the enlarged end **24** to the smaller end **28** provides a shoulder **34** which clamps the end wall **36** of an apertured cup member **38** tightly against the frame member **30** when the nut **32** is tightened. The cylindrical side walls **40** of the cup member **38** overlie a portion of the supporting wheel to a point adjacent the edge **42** of flange surface **20**.

By providing the frame members **30** in pairs, with the members **30** in each pair being located on opposite sides of the track, the cup members **38** keep the supporting wheels on the track and prevent them from striking the track supporting rods **12** on the opposite sides of which the wheels pass.

The apparatus shown has two pairs of frame members **30** which extend downward below the lower track flange **44** and turn inward, as at **46**, to form horizontal portions which are dove-tailed and secured together in each pair by a bolt **48**. These bolts also serve to fasten to the frame members a plate **50** carrying at one end on its underside a reduction gear unit **52** secured to the plate **50** by bolts **53**. The gear unit is driven by an electric motor **54** mounted thereon and has a power take-off shaft **56** (see Fig. 3) extending outward beyond one side of the plate **50** at substantially right angles to the track **10**. The shaft **56** is provided with a sheave **58** adapted to drive a V-belt **60** which in turn drives another sheave **62** mounted on a shaft **64** (see Fig. 4) journaled in bearings **66** mounted on the upper surface of plate **50**. Intermediate these bearings and directly below the under surface of the track flange **44** is a rubber or rubber-like drive wheel **68** secured to the shaft **64** and engaging the track flange **44**. By this arrangement the motor **54** propels the apparatus along the track.

At the end of the plate **50** remote from the reduction gear unit **52** and motor **54** a bracket **70** (see Figs. 2 and 5) is bolted to the underside of this plate to provide a mounting for a second electric motor **72** disposed below this bracket and secured thereto by bolts **74**. The shaft **77** of this second motor is oriented at right angles to the track **10** and has both its ends extending outside the motor casing to receive fan members **76** suitably secured on these shaft ends by screws **78** and keys **80** so as to be driven by the motor **72**. Each fan member **76** is housed in a casing **82** having flat side portions **84** positioned close to the fan member on either side thereof and having a curved edge portion **86** positioned close to the periphery of the fan member at the underside of the casing and curving with, but diverging from, the fan periphery eventually to form a downwardly extending tangential duct **88** initially of rectangular cross section, but having its lower end **90** converted to a circular cross section. The outer side portion **84** of each casing is provided with a central opening **92** which serves as an intake for air which is drawn into the casing by the rotating fan member and forced downwardly through duct **88**.

The two casings **82** are secured to the bracket **70** by welds **94** or other suitable means.

The circular lower end **90** of each duct **88** has a nozzle **96** pivotally mounted thereon by the provision of a flat bar member **98** (see Figs. 6, 8 and 9) extending diametrically across the interior duct passage with one edge presented to the downward flow of air therethrough and with a short shaft **100** welded to the opposite edge and extending downwardly therefrom centrally with respect to the circular duct end **90**. Similarly, the upper end of the nozzle **96** is provided with another bar member **102** extending across the nozzle passage with a central apertured hub **104** adapted to loosely receive the shaft **100** and be held thereon by nuts **106** threaded on the shaft end. By this arrangement the nozzle **96** is capable of free rotation with respect to the duct and about the axis **108** thereof.

Such rotation is achieved by providing the bar **102** in the form of a propeller, for example by causing the bar ends to be slightly, but oppositely, twisted substantially as shown. Air driven downwardly in the duct **88** by the fan **76** rotates the nozzle as it passes over the propeller surfaces. As shown in Fig. 2, the nozzle is disposed so that its upper flanged edge **110** is close to the lower edge of the duct thereby preventing any appreciable leakage of air between these members. If it is desired the duct may have an outside diameter slightly smaller than the inside diameter of the upper nozzle end and may extend a short distance into this nozzle end to further prevent such leakage.

In the embodiment shown the portion of the nozzle which lies below the propellor **102** remains circular in cross section taken perpendicular to the axis **108** of the duct, but has its own axis **112** disposed at an angle to this duct axis, whereby the lower nozzle portion is in the form of an elliptical tubular member, when viewed in cross section taken perpendicular to axis **112** open at its lower end and of such length that substantially every part of the moving air entering the nozzle from the duct has its direction changed to a new direction at an angle to the axis **108**. If the nozzle **96** is of sufficient length this new direction may be parallel to the nozzle axis **112**. For short nozzles the new direction may form a somewhat smaller angle with the duct axis **112**, for example, along the line **112***a* (see Fig. 1). A weight **113** (see Fig. 2) is secured to the nozzle to balance it about its pivot.

From the description thus far it will be seen that when the motors **54** and **72** are provided with electric energy the apparatus will be driven along the track, for example in the direction of the arrow **114** in Fig. 1, streams of air will be discharged from the nozzles **96** and these nozzles will be rotated about the duct axes **108** to cause the streams to move over objects below. When these objects lie more or less in a plane which is generally perpendicular to the axis of rotation **108**, as is the case, for example, of the yarns and cloth in the textile loom shown in Fig. 1, the axis of the air stream impinging on this plane moves over the plane in a substantially circular path modified into what will be termed herein a curtate cycloid because of the progression of the apparatus along the track relative to the circuit movement of the airstream. This is illustrated in Fig. 1 where the dotted lines **116** represent the boundaries of the center portion of the air stream **117** having the central axis **112**, and the dotted circle **118** represents the area against which this portion of the stream impinges when the near nozzle is in the position shown. The dotted line **120** represents that path of movement of the center of this area for two nozzle revolutions, tracing the path referred to.

Referring again to the electric motors **54** and **72**, these receive their electric energy from brush contacts **130**

(see Fig. 3) mounted in the frame members **30** and spring loaded against bar conductors **132** which are in turn mounted on an insulator block **134** secured to the web of the channel track **10**. Cables **136** connect the brush contacts to the motors.

With reference to the objects it will be seen from Fig. 1 that each filament in the central portion of the rotating stream, is directed at an angle (for example angles B, B_1 and B_2) to the general plane of the cloth which is substantially less than 90°, both when the stream is moving from front to back of the machine (see arrow **138**) and when the stream is moving from back to front (see arrow **140**). Because of the cone-like figure generated by the rotating stream, it will be appreciated that the axis of rotation need not be exactly perpendicular to the cloth, as shown, as long as the stream engages the cloth throughout the complete extent of such movement at an angle substantially less than 90°. Such engagement assures excellent cleaning.

It will also be seen that very rapid air stream movement can be achieved by continuous rotation of the nozzle in one rotative direction, for example, nozzle speeds up to 1000 r.p.m. At such high speeds the air will impinge as a rapid succession of sharp puffs against any given area as the apparatus passes. This has also been found to result in excellent cleaning.

I claim:

1. The method of removing lint from looms arranged in a row, and from the yarns and material being processed thereby, said yarns and material lying in a substantially horizontal plane, said method comprising the steps of creating a high velocity stream of air from a source, directing said stream downwardly onto said looms at an angle substantially less than 90° to the said plane of the yarns and materials, rotating said stream continuously in one direction so that its axis generates a conical surface of revolution with said axis always being at an angle to said plane, moving said source over and parallel to said row at a rate causing the said airstream to intersect said plane in a closely overlapping circuitous path whose configuration is substantially that of a curtate cycloid and causing said air stream to substantially strike a point on said plane along the path of travel of and beneath said source at least twice, once during movement along the forward portion of its circuitous path and once during movement along the rearward portion of its circuitous path thus impinging said air stream on any given portion of the object being cleaned as a series of sharp rapid puffs having vertical and horizontal components with respect to said plane prior to said impingement.

2. The method of removing lint from looms arranged in a row, and from the yarns and material being processed thereby, said yarns and material lying in a substantially horizontal plane, said method comprising the steps of creating a high velocity stream of air from a source directing said stream downwardly onto said looms at an angle substantially less than 90° to the said plane of the yarns and materials, rotating said stream continuously in one direction while maintaining said angle to said plane constant, moving said source over and parallel to said row at a rate causing the said airstream to intersect said plane in a closely overlapping circuitous path whose configuration is substantially that of a curtate cycloid and causing said air stream to substantially strike a point on said plane along the path of travel of and beneath said source at least twice, once during movement along the forward portion of its circuitous path and once during movement along the rearward portion of its circuitous path thus impinging said air stream on any given portion of the object being cleaned as a series of sharp rapid puffs having constant vertical and horizontal components with respect to said plane prior to said impingement.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 2,981,644 April 25, 1961

Mitchell S. Fain

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 1, line 65, strike out "motion"; column 2, line 27, strike out "axis of the" and insert the same after "the" in line 28, same column 2; column 6, line 10, after "source" insert a comma.

Signed and sealed this 20th day of March 1962.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

DAVID L. LADD
Commissioner of Patents