July 29, 1958 J. F. KING, JR 2,845,303

AIR NOZZLE

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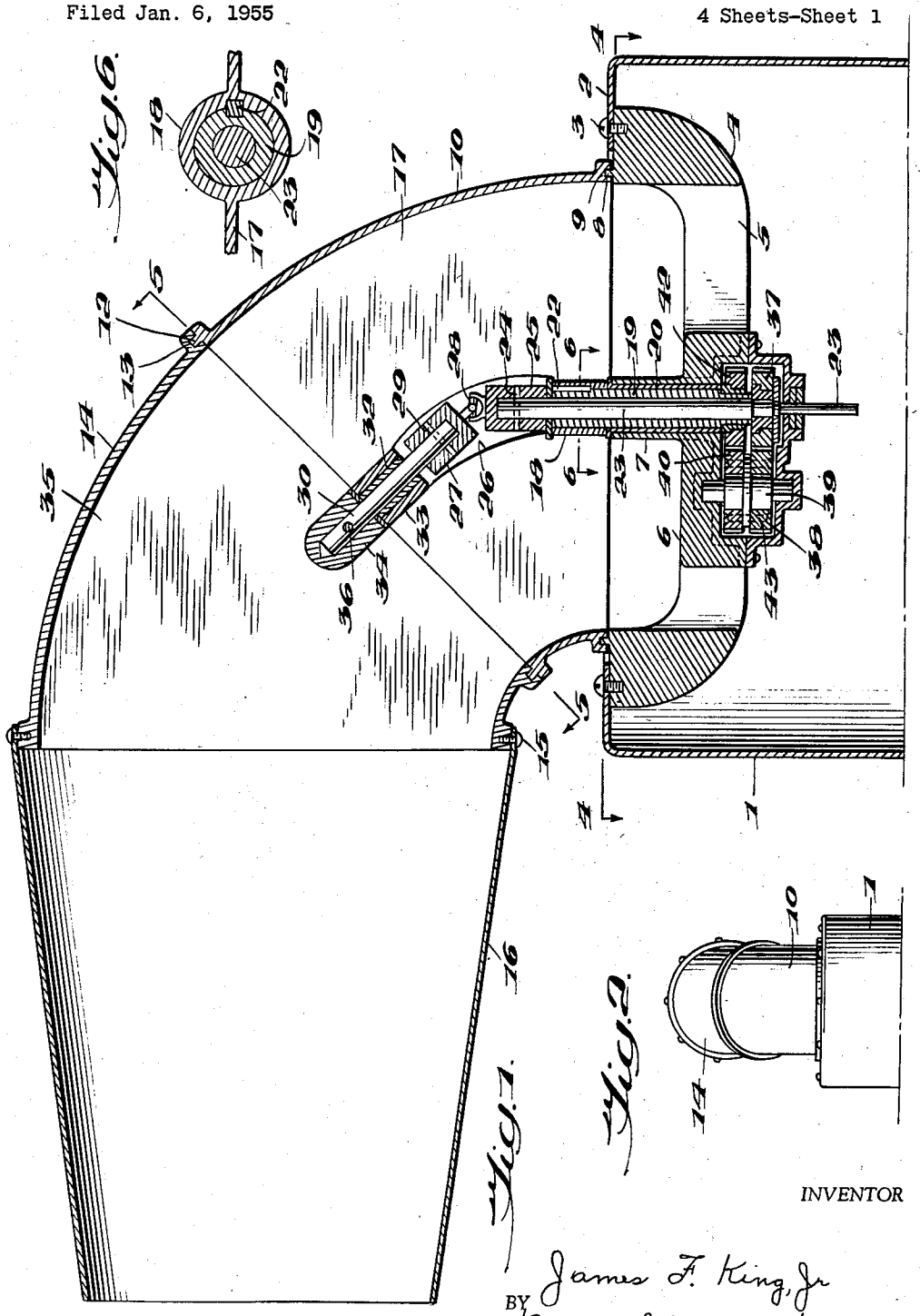


Fig. 1.

Fig. 2.

Fig. 6.

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July 29, 1958 J. F. KING, JR 2,845,303

AIR NOZZLE

Filed Jan. 6, 1955 4 Sheets-Sheet 2

Fig. 4.

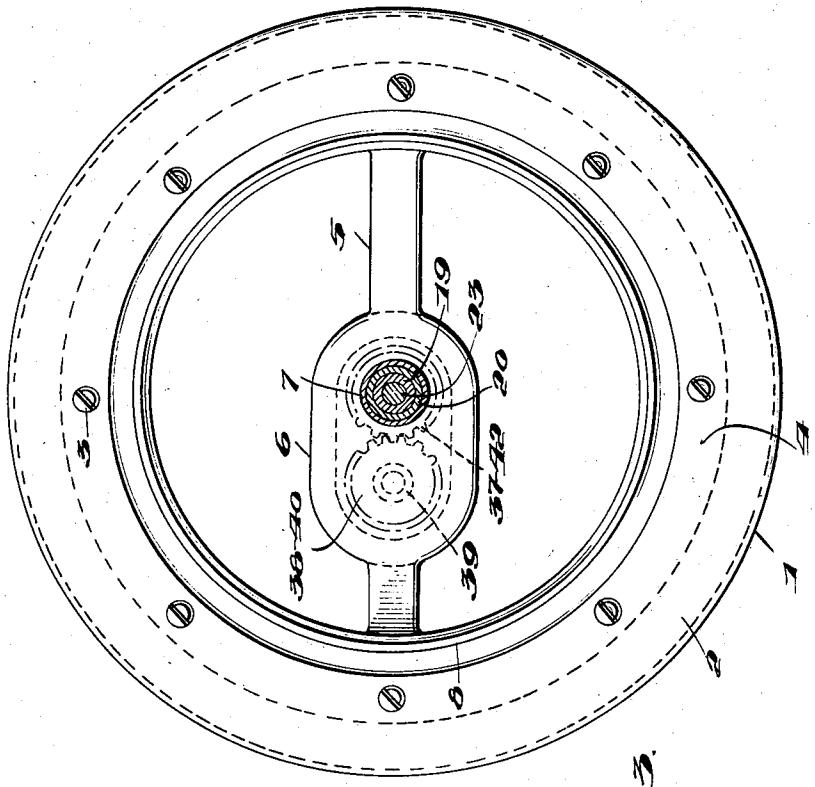


Fig. 5.

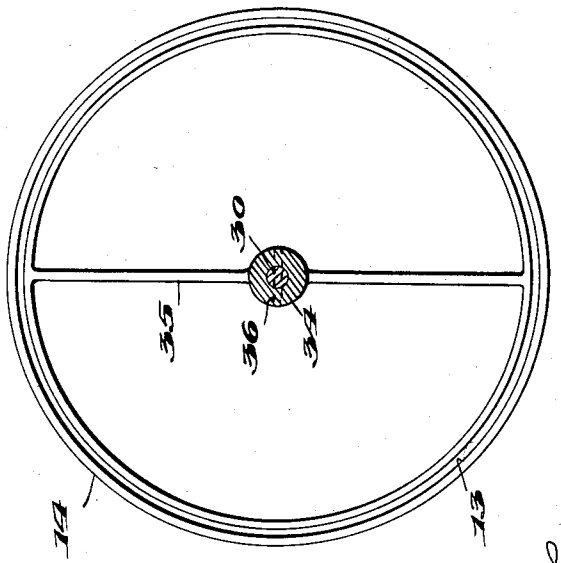
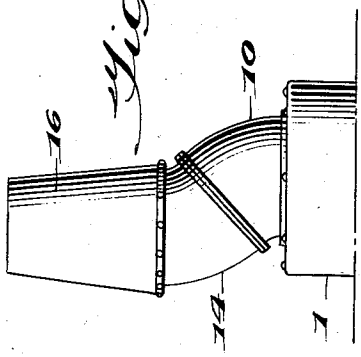


Fig. 3.



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July 29, 1958 J. F. KING, JR 2,845,303

AIR NOZZLE

Filed Jan. 6, 1955 4 Sheets-Sheet 3

Fig. 9.

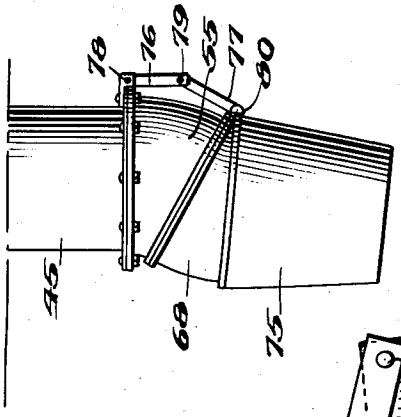


Fig. 8.

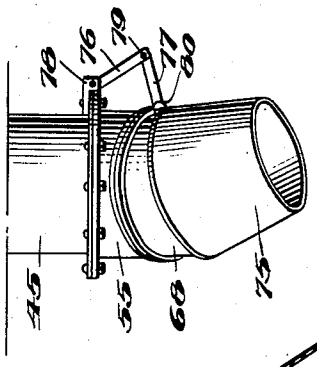
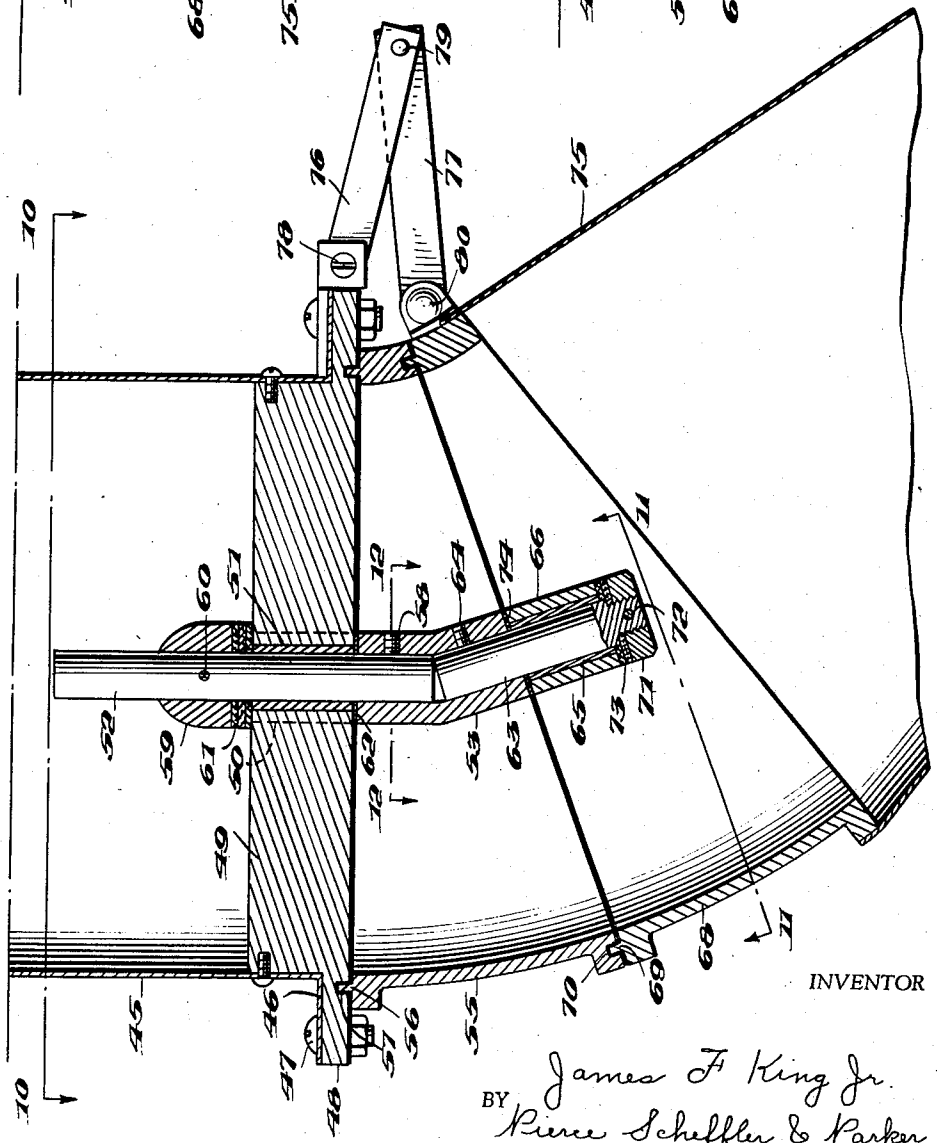


Fig. 7.



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July 29, 1958 J. F. KING, JR 2,845,303

AIR NOZZLE

Filed Jan. 6, 1955 4 Sheets-Sheet 4

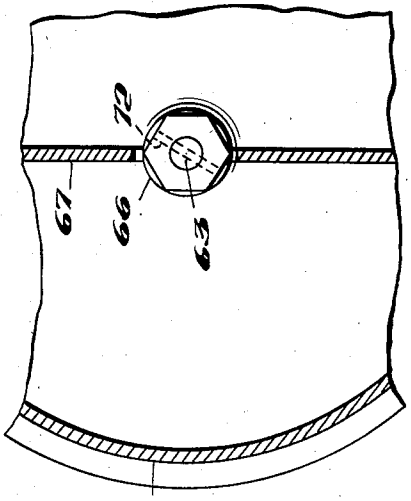


Fig. 11.

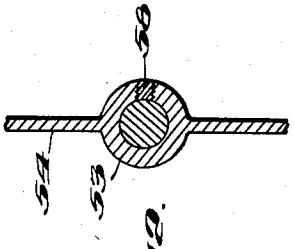


Fig. 12.

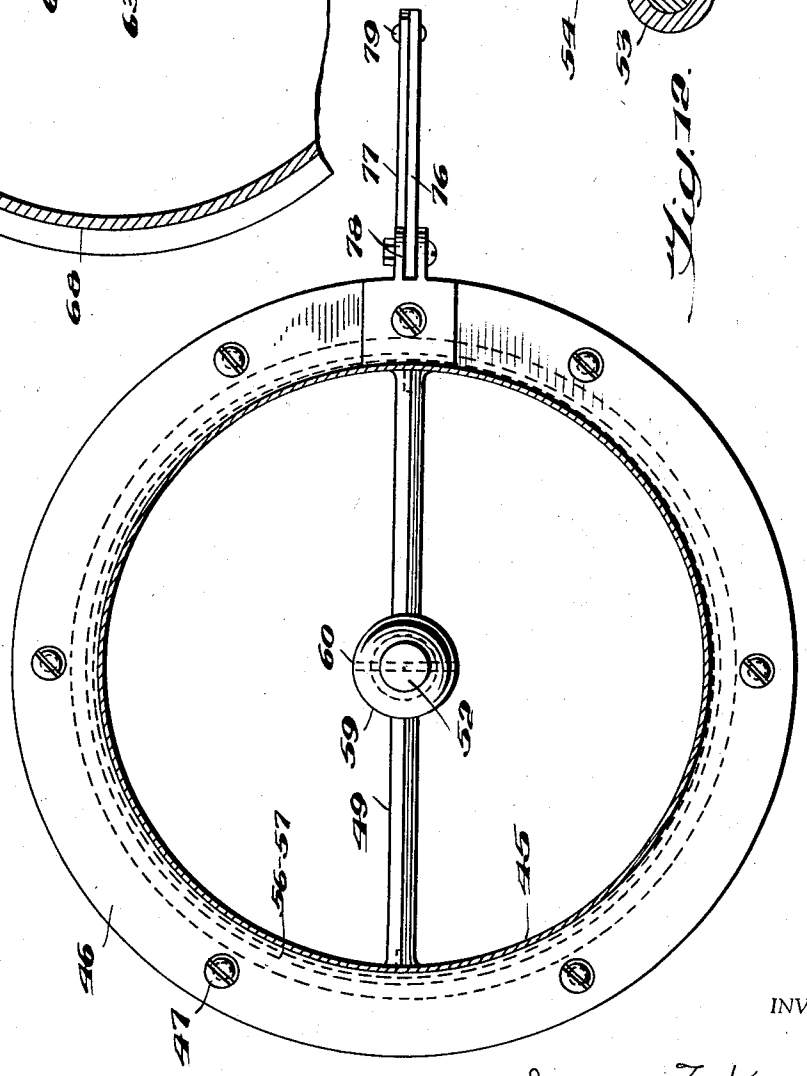


Fig. 10.

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AIR NOZZLE

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Application January 6, 1955, Serial No. 480,224

5 Claims. (Cl. 299—62)

This invention relates to pneumatic cleaners for use in textile rooms particularly, and adapted to prevent lint and other light particles from accumulating on the textile machinery and also upon the walls and ceiling of the room in which the textile machinery is located.

In any textile operation, such as spinning and weaving, there is considerable lint in the air which is carried by the air currents and ultimately deposited upon almost every surface in the room. Much of it clings to the walls and ceiling and a considerable quantity deposits upon and clings to the surfaces of the machinery itself. The lint does not blow off easily and, if allowed to accumulate, there is always the possibility that it will impair the operation of the machinery and also cause defects to appear in the textile itself which is being worked upon. The latter is particularly true with respect to looms wherein the yarns being woven lie close together in a horizontal plane which make it most receptive to falling lint.

The principal object of the present invention is to provide an improved blower nozzle capable of discharging a blast of air at a velocity high enough to break the lint and other particles loose from whatever surface they may be clinging to, the nozzle being so constructed as to continuously change the direction at which the air blast is delivered thereby effectively covering a rather wide area of the walls or ceiling of the room or the machinery itself.

A more specific object is to provide a rotating nozzle which directs the blow-off air at high velocity throughout progressively changing angles in such manner as will cover all surface areas in a hemisphere, the nozzle being considered as being at the center thereof.

Another specific object is to provide a novel construction for a nozzle capable of delivering a blast of air which sweeps through an orbital path over an area to be cleaned.

Still another specific object is to provide a novel construction for a blow-off nozzle comprising an elbow conduit divided transversely into two or more sections and wherein one of the sections is rotated relative to the other thereby causing the blast of air delivered by the nozzle to be swept at a continuously changing angle over a predetermined area.

Yet another object is to provide a blow-off nozzle comprising an elbow conduit divided transversely into two rotatable sections and wherein each section is rotated about its base, and preferably at different speeds. In this manner the blast of air passing out of the discharge end of the elbow will be caused to change direction continuously and will cover all unit areas in a spherical surface such as, for example, a hemisphere, the nozzle being considered as located at the center thereof. Moreover, the motion of the nozzle is preferably such as to avoid repetition of a set pattern of coverage for an extremely long period of time. This embodiment of the invention is particularly well adapted for cleaning off the ceiling and walls of a textile room when built as a traveling cleaner

movable along an elevated track around the room above the machinery.

Still another object is to provide a blow-off nozzle comprising an elbow conduit divided transversely into two sections and wherein means are provided for rotating the base section, i. e. the section into which the air is delivered from the source such as a centrifugal blower, while the other section, i. e. the one from which the blast of air is discharged, is held against rotation. As will become more apparent from the detailed description of a particular embodiment thereof, this arrangement causes the air discharge section of the elbow to sweep from side to side in a wobbly manner. This embodiment of the invention is particularly well adapted to the cleaning off of a loom and the floor around it when built as a traveling cleaner movable along a track elevated above the loom, the track extending transversely and centrally of the loom and the nozzle sweeping between limits from the center line of the loom to the front and rear thereof.

The foregoing as well as other objects and advantages inherent in the invention will become more apparent from the following typical embodiments thereof to be described and the accompanying drawings.

In the drawings:

Fig. 1 is a vertical, central section of an embodiment of the invention wherein each of the two sections of the elbow nozzle is adapted to be rotated, the instant position of the nozzle sections depicted being such that the discharge end of the outlet section is directed horizontally;

Fig. 2 is an elevation at a reduced scale showing the nozzle in the position illustrated in Fig. 1;

Fig. 3 is also an elevation showing another instant position of the nozzle sections wherein the discharge end of the outlet section is directed vertically;

Fig. 4 is a section on line 4—4 of Fig. 1;

Fig. 5 is a section on line 5—5 of Fig. 1; and

Fig. 6 is a section on line 6—6 of Fig. 1;

Fig. 7 is a vertical central section of a modified construction wherein the base or inlet section of the elbow nozzle is rotated and the outlet section is restrained against rotation, the instant position of the nozzle sections being such that the discharge end of the outlet section faces angularly downward and forward to the right in the plane of the drawing;

Fig. 8 is an elevation at a reduced scale showing another instant position of the nozzle sections with the inlet section rotated 90° from the position shown in Fig. 7 and wherein the discharge end of the outlet section is now directed angularly downward and forward but at a lesser angle and to one side of the plane of the drawing;

Fig. 9 is also an elevation at a reduced scale showing still another instant position of the nozzle sections with the inlet section rotated 180° from the position shown in Fig. 7 and wherein the discharge end of the outlet section is directed vertically downward in the plane of the drawing;

Fig. 10 is a section on line 10—10 of Fig. 7;

Fig. 11 is a section on line 11—11 of Fig. 7; and

Fig. 12 is a section on line 12—12 of Fig. 7.

With reference now to the drawings and in particular to the embodiment illustrated in Figs. 1–6, it should first be made clear that the invention is deemed to reside primarily in the nozzle structure. Consequently, the track and the blower mounted thereon for travelling about the room over the textile machinery, the nozzle being of course connected to the discharge of the blower, have not been illustrated in the drawing. With this understanding, the conduit 1 in Fig. 1 is intended to represent the discharge end of a centrifugal blower, or other source of pressure air. Also, since the embodiment of Figs. 1–6 is particularly well adapted to the blowing off

of ceiling and wall areas it will be assumed that the outlet conduit **1** extends in a generally upward direction. Conduit **1** may be of any configuration in cross-section but has been illustrated as cylindrical since this is a most practical configuration for the purpose intended. The upper end of conduit **1** is seen to terminate in an inturned flange **2** having connected to the underside thereof by circumferentially spaced screws **3** a circular frame **4**. This frame, which can be made as a casting, includes a diametral web **5** which is enlarged at the central portion thereof to establish a housing portion **6** for gearing and a tubular hub portion **7** constituting a sleeve bearing for mounting two concentric drive shafts to be later described.

The upper face of the circular frame **4** is provided with a circular rib **8** concentric with the hub portion **7** and which fits into a complementary configured groove **9** formed in the base of the lower or air inlet section **10** of an elbow nozzle. Section **10** extends through an angle of 45° and the upper edge thereof is provided with a circular rib **12** which fits into a complementary configured groove **13** formed in the base of the upper or air outlet nozzle elbow section **14** which also extends over an angle of 45°. Fixedly attached to the outlet end of nozzle section **14** by screws **15** is an extension **16** which tapers convergingly in the direction of air flow therethrough. However, it is to be understood that nozzle section **14** and its extension **16** can be made integral, or the extension **16** eliminated altogether if final tapering of the discharge end of the nozzle is not essential for a particular application of the nozzle.

It will thus be evident that the two 45° elbow nozzle sections make up a 90° elbow when in the positions shown in Fig. 1 and hence turn the pressure air issuing upwardly at high velocity through conduit **1** through 90° so as to be discharged horizontally through nozzle sections **14** and **16**.

As previously explained, each of the nozzle sections **10** and **14** is arranged for separate rotation about its base line, and preferably at different speeds. To this end it will be seen that the interior of the lower nozzle section **10** is divided longitudinally by a diametral septum or partition **17** which is enlarged centrally of the section to establish a tubular hub **18** coaxial with the hub portion **7** of frame **4**. An outer, hollow shaft **19** is mounted for rotation in a bearing sleeve **20** in the hub **7**, the shaft **19** extending upwardly through hub portion **18** of the nozzle section **10** and being secured thereto by any suitable means such as the keyed connection **22**. Thus as shaft **19** is rotated so also will be rotated the nozzle section **10**, the latter being guided in its rotation by the rib and groove connection **8**, **9** between the nozzle section **10** and circular frame **4**.

Journalled for rotation within the outer, hollow shaft **19** is an inner shaft **23** which extends downwardly through the bottom of housing **6** for connection to a source of motive power, not illustrated. The drive for shaft **23** may be a motor, or the drive may be constituted by a power takeoff from one of the wheels of the carriage on which the blower and nozzle are mounted and which is propelled along an elevated track above the textile machinery, or the drive for shaft **23** may take the form of a wheel running in frictional contact with the track as the blower carriage is propelled, rotation of the frictionally driven wheel being transmitted through suitable drive shafting coupled to shaft **23**.

The upper end of shaft **23** extends beyond the end of hub portion **18** of the nozzle section **10** and is connected by cross pin **24** to the driving socket **25** of a universal joint, it being noted that the septum **17** in nozzle section **10** is provided with an opening **26** of sufficient size to receive the universal joint and permit the latter to rotate freely. The driven socket **27** of the universal joint connected to the driving socket **25** by universal coupling **28** has secured to it by cross pin **29** a shaft **30** which is

journaled for rotation in a bushing **32** in another enlarged central hub portion **33** formed in the partition **17** at the air discharge end of nozzle section **10**. Shaft **30** extends into a central hub portion **34** formed integrally with a diametral partition **35** in the outlet nozzle section **14** and is secured to the hub portion **34** by means of a cross pin **36**. Consequently as the inner shaft **23** is rotated, rotation will be imparted to shaft **30** through universal coupling **28** and hence also to the upper, outlet nozzle section **14** about its base line, the nozzle section **14** being guided in its rotation by virtue of its rib and groove connection **12**, **13** with the lower nozzle section **10**.

In the present embodiment, rotation of shaft **23** imparts rotation directly to the upper nozzle section **14**, and shaft **19** which rotates the lower nozzle section **10** is coupled to shaft **23** by gearing preferably such that shafts **23** and **19** will rotate in the same direction but at different angular velocities. Although either section of the nozzle can be designed to rotate faster than the other, in the present embodiment, the lower nozzle section **10** rotates faster than the upper section **14**. The gearing in the gear housing **6** is comprised of a drive gear **37** mounted on and secured to drive shaft **23**, an idler gear **38** meshed with gear **37**, gear **38** being mounted on idler shaft **39**, a second idler gear **40** mounted on the idler shaft **39** above gear **38**, and another gear **42** mounted on and secured to shaft **19**, the gear **42** being meshed with idler gear **40**. Gears **38** and **40** are connected together by pins **43** to rotate as one. Consequently as shaft **23** and hence also the upper nozzle section **14** is rotated about its base line, motion is transmitted through gear train **37**, **38**, **40**, **42** to shaft **19** and hence also to the lower nozzle section **10** for rotation about its base line. The end result achieved by rotation of the two nozzle sections is that a high velocity blast of air is discharged through the coned extension **16** at successively different angles to blow off all unit areas in the hemisphere above the nozzle, the nozzle being considered as located at substantially the center of the hemisphere. Figs. 1 and 2 show the nozzle blowing in a horizontal direction and Fig. 3 shows the nozzle when the direction of air blow is vertically upward.

It is preferable to have the air discharge end of nozzle section **14** move through a path such as will avoid repetition of a set blowing pattern for a comparatively long period of time. To achieve this result, the main drive gear **37** is provided with a number of teeth such as will not be evenly divisible by the number of teeth difference, through the gear train, between gears **37** and **42**. If such were not the case, it can be easily seen that a repeat pattern of air discharge from the nozzle would occur every few revolutions of the nozzle. As an example, gears **37** and **40** can have twenty teeth each and gears **38** and **42** nineteen teeth each, thus giving a two tooth difference between gears **37** and **42**. Thus gear **42** will progress two teeth on the rotation of gear **37** for each revolution of the latter.

As previously stated, the nozzle and its blower can be mounted to travel along a track in a textile room at an elevation above the machinery and thus effectively blow off with a high velocity air stream all unit areas of wall and ceiling located within reach of the hemispherical coverage of the nozzle. Alternatively, the blower and nozzle unit may be mounted to travel along the track blowing down on the textile machinery to sweep a downwardly directed hemisphere.

The modified embodiment illustrated in Figs. 7–12 embodies the same basic principle as that illustrated in Figs. 1–6 in that the nozzle is constituted by two elbow sections one of which is rotatable relative to the other. However in this modified embodiment, one of the sections, the air inlet section, is rotated while the other one, the air outlet section, is constrained against rotation. The result is to cause the air discharge end of the outlet section to execute a sort of wobbly motion in a closed path. At one point of the path, which can be called the

0° position, the air stream is discharged angularly downward and straight forward of the nozzle; at another point on the path represented by rotation of the air inlet nozzle section through 180° from the 0° position, the direction of the discharged air stream is substantially vertically downward; at still other points on the path represented by rotation of the air inlet nozzle section through 90° and 270° respectively from the 0° position shown in the drawing, the air stream is discharged angularly downward and to each side respectively as well as somewhat forward. This arrangement makes the nozzle particularly well adapted for use in clearing lint from looms when constructed as a traveling cleaner, the orientation of the track to the loom being such that as the cleaner travels along the track, the blower nozzle will sweep one side and then the other as it travels through its closed path.

With reference now to Figs. 7–12 and Fig. 7 in particular it will be seen that the air inlet conduit **45** to the nozzle depends vertically downward from the pressure air source and, on the assumption that this source is a centrifugal blower, the conduit **45** would constitute the blower discharge. Conduit **45** is preferably circular in configuration and the lower end thereof terminates in an external flange **46** to which is secured by screws **47** a circular frame **48**. Frame **48** is provided with a diametral web **49** having an enlarged tubular hub **50**. Hub **50** contains a bearing sleeve **51** for receiving a drive shaft **52**, this shaft extending through and beyond the hub for connection at its upper end to a source of rotary power, not shown. The lower end of shaft **52** is received within the upper end of a tubular hub **53** formed in a diametral partition **54** that extends transversely through an air inlet nozzle section **55** in the form of an elbow, the latter turning the air through an angle of 20°. The upper or base end of nozzle section **55** is provided with a peripheral rib **56** which fits into a complementary configured groove **57** provided in the lower edge of frame **48**.

Shaft **52** is secured at its lower end in hub **53** by a set screw **58**, and this shaft, together with the nozzle section **55** thus attached is held in the position shown in Fig. 7 by means of a collar **59** attached to the upper end of shaft **52** by pin **60** and which rests upon the hub portion **50** of web **49**. Nylon felt washers **61** can be used as shown between the lower face of collar **59** and hub **50** to enable better rotation of the drive shaft **52** and collar **59**. Another nylon felt washer **62** can be used as shown between hub **53** and hub **50** to establish a slight running clearance for the rib and groove connection **56, 57** between nozzle section **55** and frame **48**.

It will be noted from Fig. 7 that the tubular hub portion **53** of nozzle section **55** is also turned through an angle of 20° at its lower end and contains a shaft **63** secured therein by set screw **64**. The lower end of shaft **63** extends beyond the air discharge end of nozzle section **55** and into a bearing sleeve **65** in hub portion **66** formed on a diametral partition **67** that extends transversely through an air outlet nozzle section **68** in the form of an elbow, the latter also turning the air through an angle of 20°. The upper or base end of nozzle section **68** is provided with a peripheral rib **69** which fits into a complementary configured groove **70** provided in the air discharge end of the other nozzle section **55**.

The lower end of shaft **63** extends beyond the lower end of hub portion **66** and is threaded beyond such end to receive a nut **71**, thus securing the nozzle section **68** upon shaft **63**. Nut **71** can be secured against backing off by means of a pin **72** passing through the nut and shaft **63**. Nylon felt washers **73** can be used between nut **71** and the end face of hub **66** so as to ensure free turning of shaft **63** in bearing sleeve **65**, and another nylon felt washer **74** may be used between the adjoining faces of hubs **53** and **66** of the two nozzle sections to establish running clearance between the rib **69** on nozzle section **68** and the groove **70** in nozzle section **55**.

As in the previously described embodiment, the air outlet nozzle section can be provided with a tapered extension **75**.

To constrain the outlet nozzle section **68** from rotating as the inlet nozzle section **55** is rotated upon application of a rotative force to drive shaft **52**, a pair of links **76, 77** are provided. One end of link **76** is pivotally connected at **78** to one side of frame **48** and the other end of link **76** is pivotally connected at **79** to one end of link **77**. The opposite end of link **77** is connected to the narrow side of nozzle section **68** by means of a ball joint **80**. This linkage thus permits the nozzle section **68** to twist or wobble as the other nozzle section **55** is rotated. The wobble motion is due to the fact that as the drive shaft **52** is rotated thus rotating nozzle section **55**, the extended shaft or stud **63** describes the surface of an imaginary cone but does not rotate about its own axis. The other nozzle section **68** being mounted on the stud **63** in such a manner as to permit relative rotation between these two elements, it is of course possible to restrain nozzle section **68** against rotation which is done in the manner described above by linkage **76, 77**. Since the stud **63** describes a conical path, that motion is then reflected by a wobble motion of the nozzle section **68**.

If it be assumed that the position of the nozzle as shown in Fig. 7 is the 0° position blowing downwardly and forward at an angle of 40° to the vertical, i. e. the sum of the 20° angles of the two nozzle sections, it will be evident that a 90° rotation of nozzle section **55** from the 0° position will cause the other nozzle section **68** to be pointed 20° to one side and 20° forward. This is the position shown in Fig. 8. Rotation of nozzle section **55**, 180° from the 0° position of Fig. 7 will cause the nozzle section **68** to be pointed substantially vertically downward, this position being shown in Fig. 9. Rotation of nozzle section **55** through an angle of 270° will cause nozzle section **68** to be pointed 20° to the opposite side and 20° forward. One complete rotation of nozzle section **55** brings the nozzle section **68** back to the 40° forward position depicted in Fig. 7 and then the pattern repeats. Movement of nozzle section **68** and hence also its tapered extension **75** is thus essentially a wobbly motion, with the air discharge from nozzle extension **75** being delivered at successively different blowing directions to each side of the central forward position shown in Fig. 7 as the nozzle extension moves along its orbital path.

In conclusion, it will be understood that while the embodiments described are to be preferred, various changes may be made in the construction and arrangement of parts without departing from the spirit and scope of the invention as defined in the appended claims.

I claim:

1. An air nozzle comprising air inlet and air outlet tubular sections connected together and forming an elbow for delivery of air therethrough, a first drive shaft arranged internally of and connected to said air inlet section for rotating the same about its base line, and a second drive shaft concentric with said first drive shaft and connected to said air outlet section through a universal joint.

2. An air nozzle comprising air inlet and air outlet tubular elbow sections connected together at their base lines and forming a combined elbow for delivery of air therethrough, a first drive shaft arranged internally of and connected to said air inlet section for rotating the same about its base line, a second drive shaft concentric with said first drive shaft and connected to said air outlet section for rotating the same about its base line and a gear train interconnecting said first and second drive shafts whereby rotary motion imparted to one of said shafts will likewise impart rotary motion to the other shaft.

3. An air nozzle as defined in claim 2 wherein said gear train effects rotation of said shafts in the same direction but at different speeds.

4. An air nozzle comprising air inlet and air outlet tubular sections connected together and forming an elbow for delivery of air therethrough, said sections being mounted one on the other to permit relative rotation therebetween, said inlet and outlet sections each including a transverse web providing a central tubular hub portion, a first drive shaft extending through the hub portion of said inlet section and secured to the drive element of a universal joint, a second drive shaft secured to the driven element of said universal joint and extending into and being secured to the hub portion of said outlet section, a third drive shaft concentric with said first drive shaft and being secured to the hub portion of said inlet section, and a gear train interconnecting said first and third shafts whereby rotative power applied to one of said latter shafts will effect rotation of said inlet and outlet sections about their base lines.

5. An air nozzle as defined in claim 4 wherein said gear train includes gear means effecting rotation of said first and third shafts and hence also said inlet and outlet sections in the same direction but at different speeds.

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