Sept. 27, 1949. C. D. KNOWLTON ET AL 2,482,781

PNEUMATIC DUST REMOVAL MACHINE FOR HIDES OR SKINS

Filed April 10, 1947 7 Sheets-Sheet 1

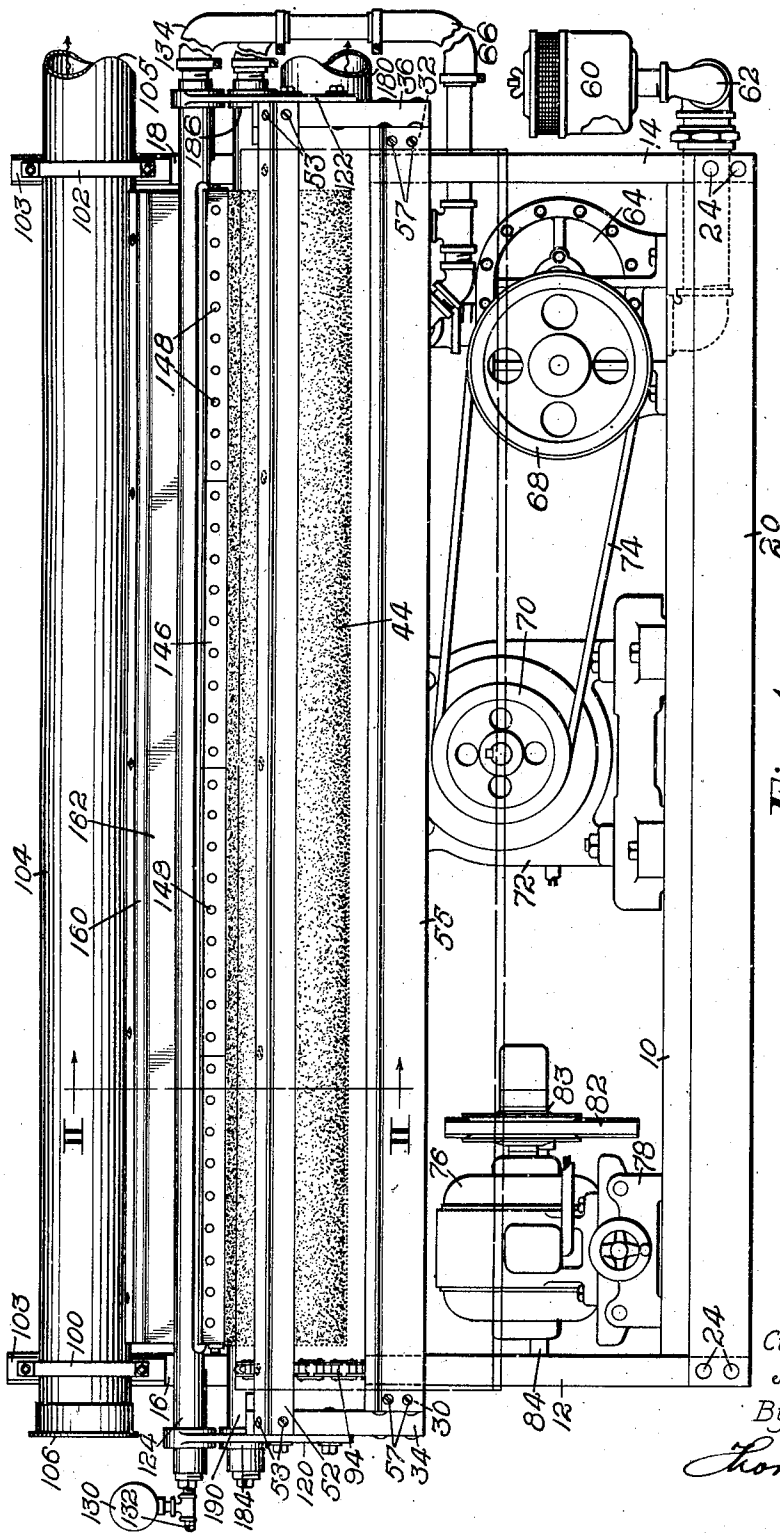


Fig. 1.

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Fig. 3.

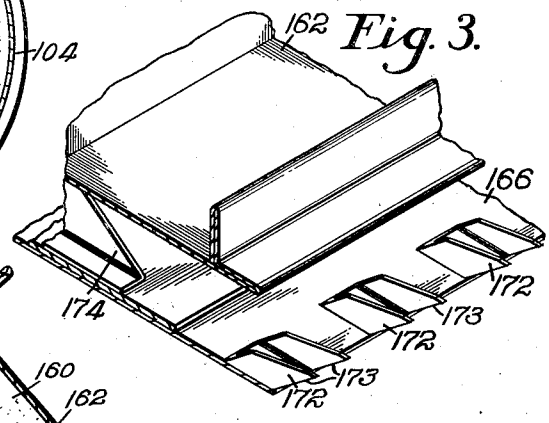


Fig. 2.

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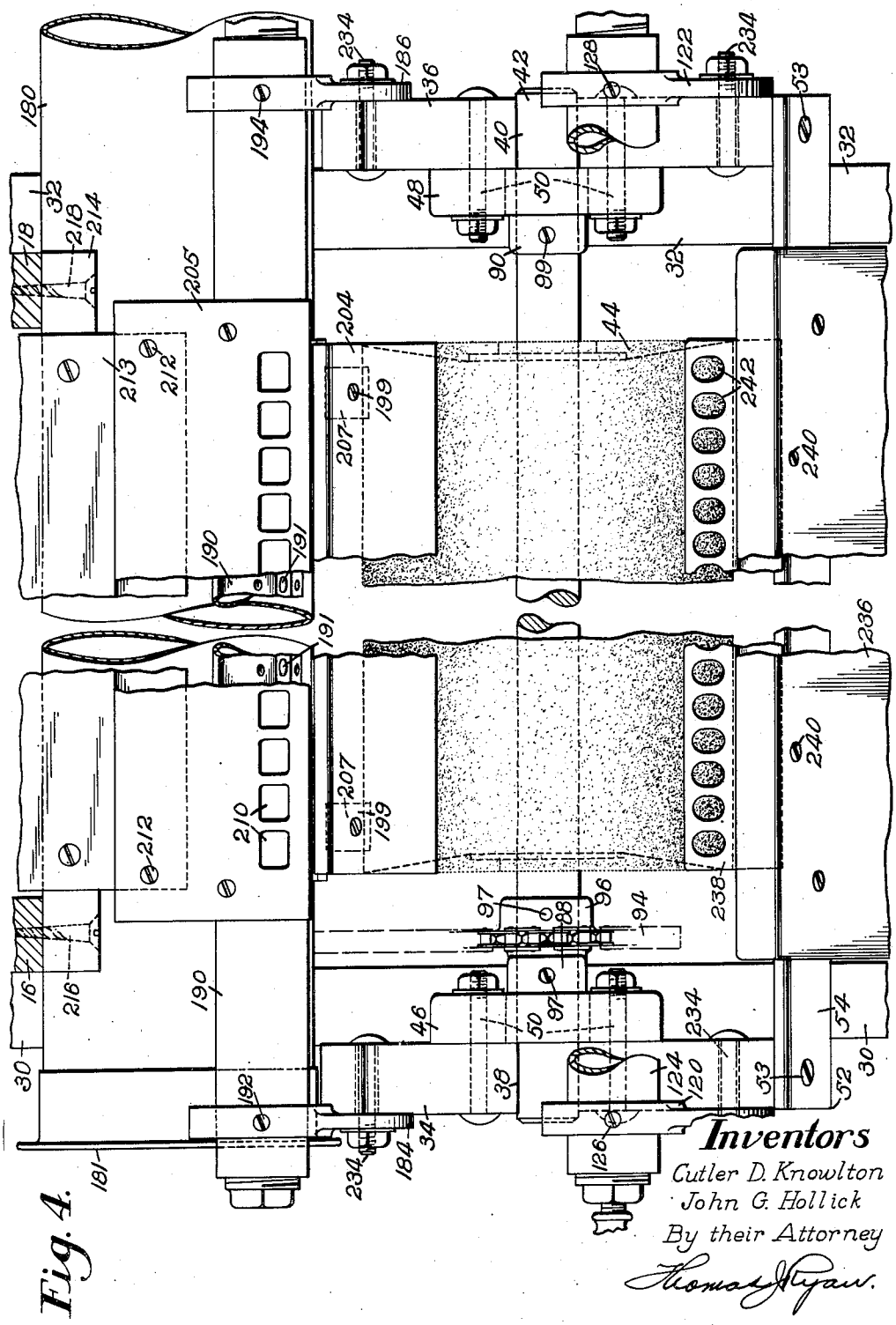


Fig. 4.

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PNEUMATIC DUST REMOVAL MACHINE FOR HIDES OR SKINS

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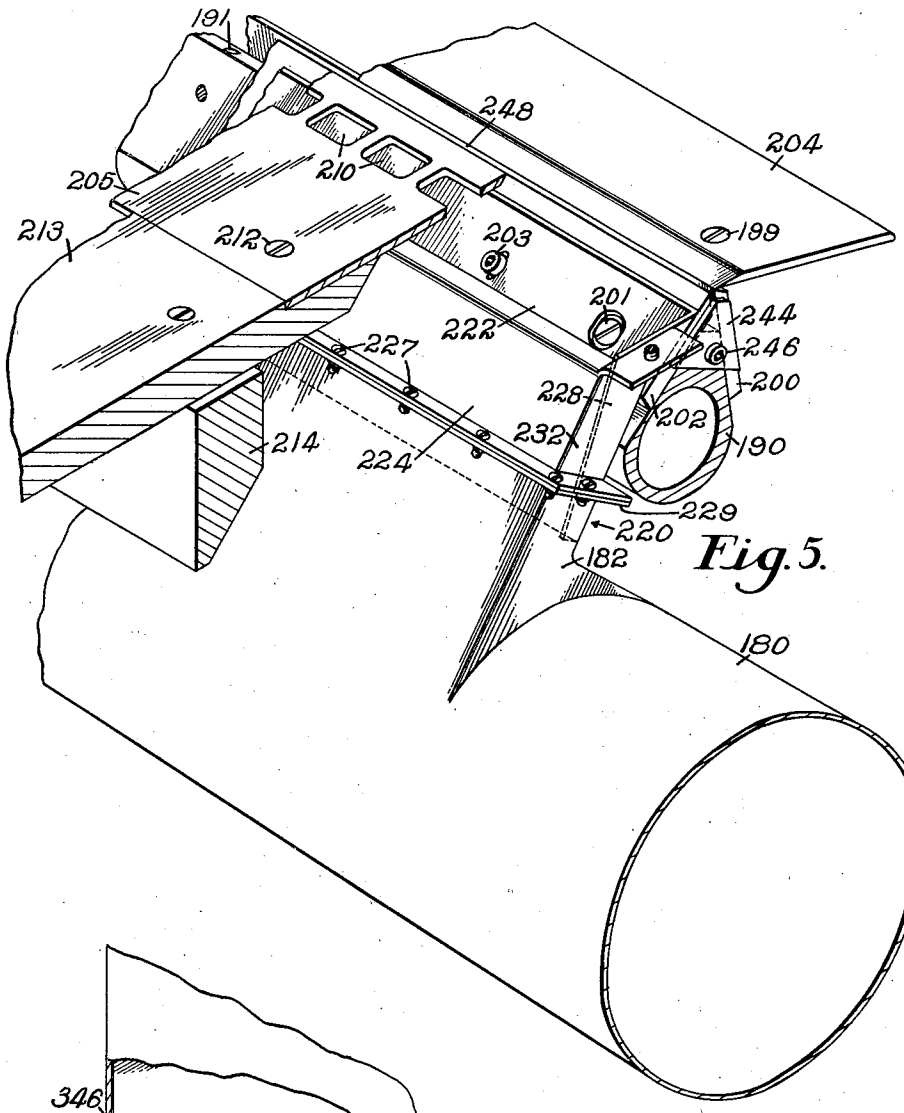


Fig. 5.

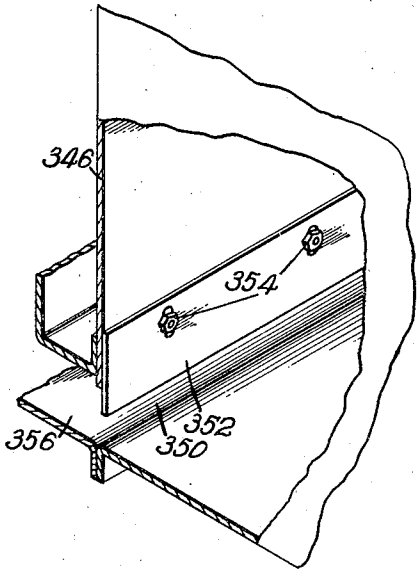


Fig. 10.

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PNEUMATIC DUST REMOVAL MACHINE FOR HIDES OR SKINS

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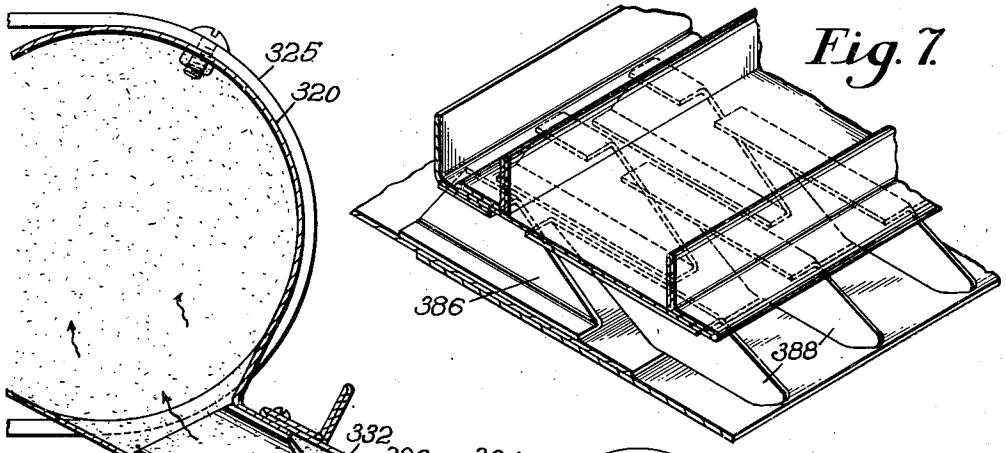


Fig. 7.

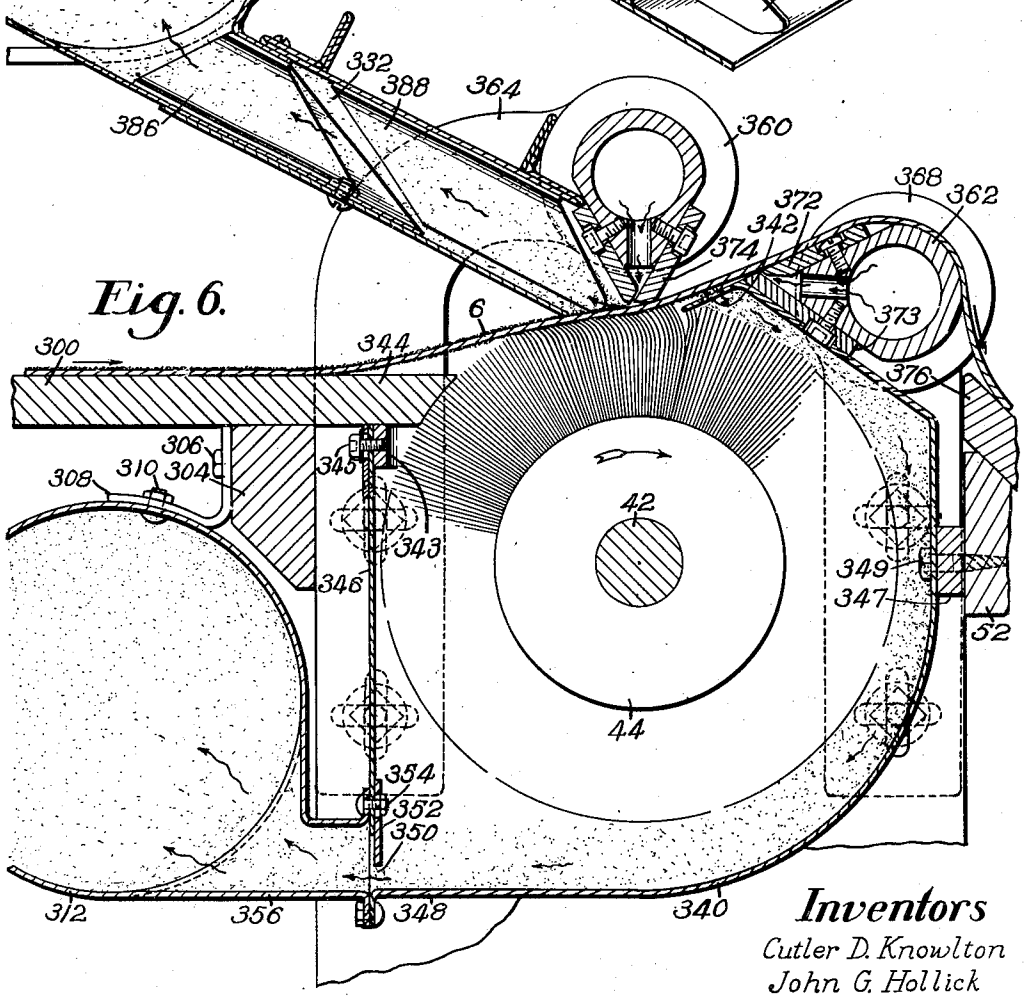


Fig. 6.

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PNEUMATIC DUST REMOVAL MACHINE FOR HIDES OR SKINS

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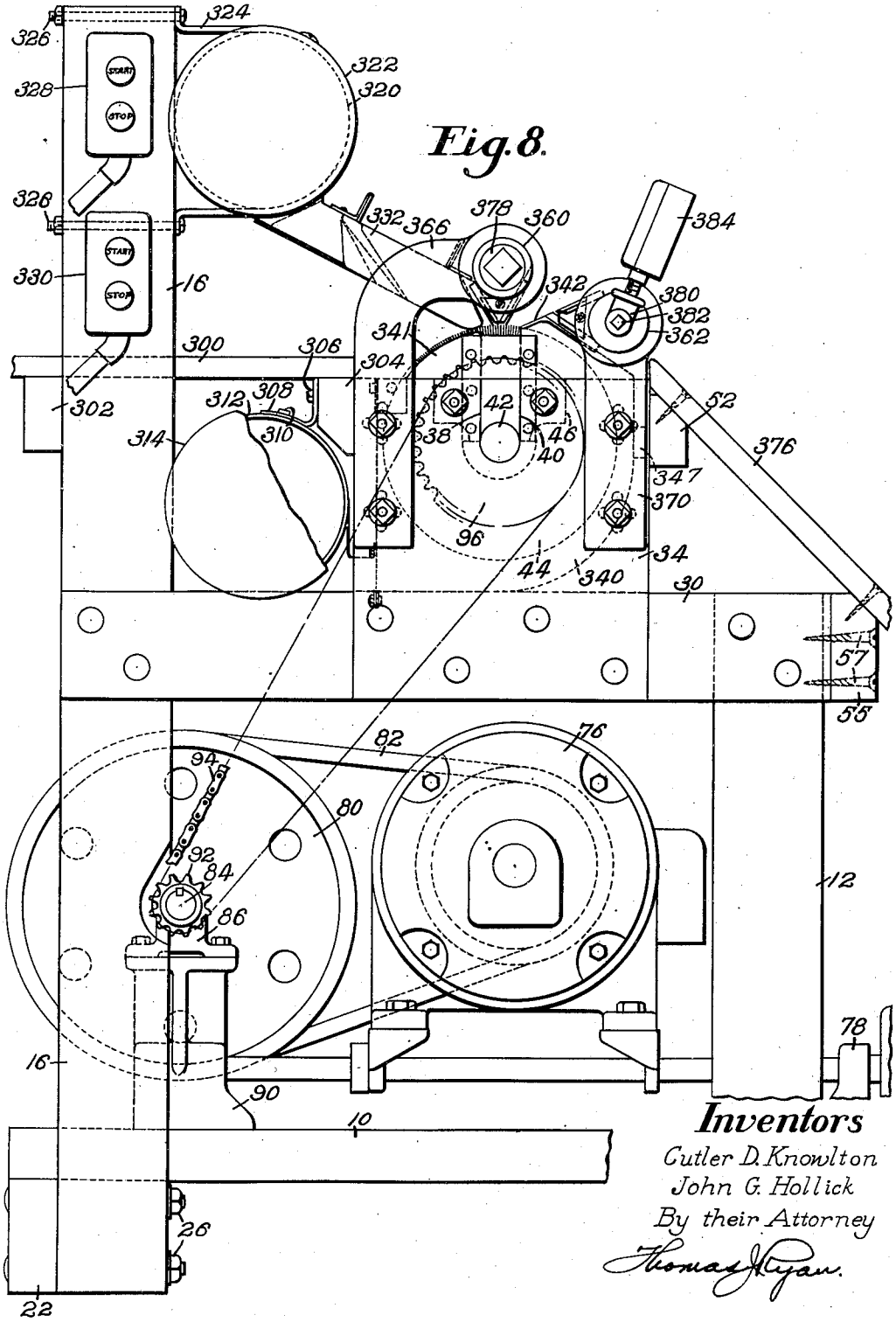


Fig. 8.

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PNEUMATIC DUST REMOVAL MACHINE FOR HIDES OR SKINS

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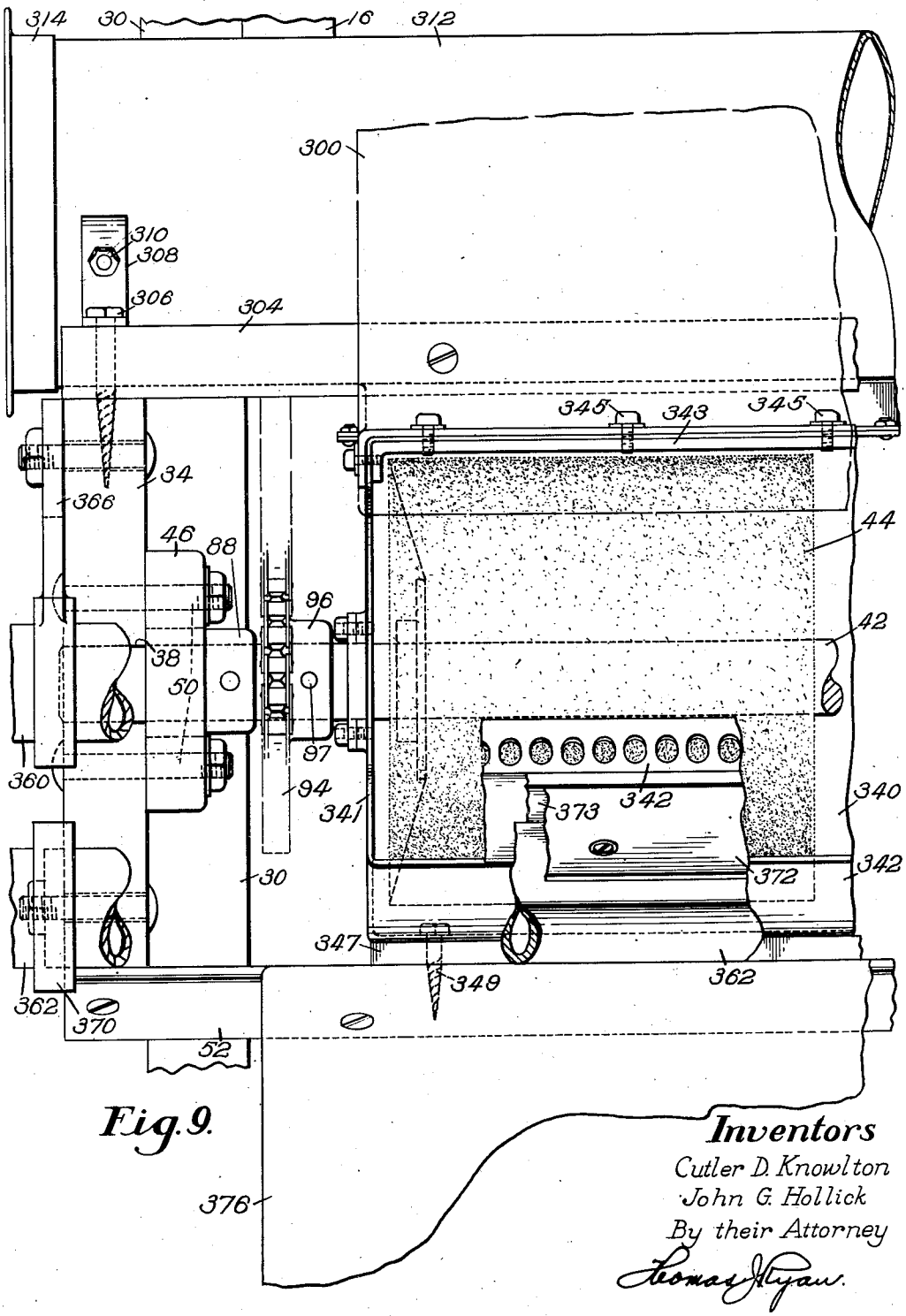


Fig. 9.

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UNITED STATES PATENT OFFICE

2,482,781

PNEUMATIC DUST REMOVAL MACHINE FOR HIDES OR SKINS

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Application April 10, 1947, Serial No. 740,666

8 Claims. (Cl. 69—1)

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This invention relates to machines for removing dust particles from the surfaces of consecutively presented hides or skins, and more particularly to apparatus for freeing fine fibrous dust from tanned hides or skins by means of a forced jet or jets of gaseous fluid such as air. The invention is herein illustrated as embodied in machines particularly adapted for use in carrying out the novel method disclosed and claimed in the copending application for Letters Patent of the United States, Serial No. 691,090, filed August 16, 1946, in the name of John G. Hollick.

Tanned hides or skins are usually subjected to a buffing operation to improve their appearance, after which the dust produced by that operation is removed from the leather surface. Such removal is for the purpose of presenting the leather in the best possible condition for subsequent finishing operations. If the dust were not removed, the resulting finish would be cloudy, streaked and unsightly.

Dust, and particularly that dust produced from buffing, is fine and fibrous and great difficulties are encountered in satisfactorily removing it from leather surfaces. The problems encountered are unique and quite unlike those involved in cleaning other types of sheet materials.

Heretofore it has been the practice and has been considered essential to employ brushing machines to remove dust from leather. In using such machines, dust would momentarily be lifted by the brush from the leather surface. After such mechanical dislodgment, suction means would remove some of the dust suspended in the air. As the brushing action led to generation of static charges in the dust particles and also in the leather there has been a strong tendency for some of the dislodged dust to return to the leather despite the suction means. As a result, the finish and appearance of the work has suffered and the difficulties have not been avoided by the development of and the improvements in complicated brushing machines which are costly to manufacture and expensive to maintain.

The present development contemplates a complete departure from the type of machines heretofore considered essential in industry for the purpose of removing dust to any reasonably satisfactory extent from leather surfaces. The copending application above referred to discloses a method whereby fibrous dust may be removed from leather surfaces to a degree greatly desired but not heretofore obtained in tanneries. The apparatus of the present application is such as to carry out the method referred to and to do so

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with a rate of production exceeding any rate heretofore obtained or thought possible and with fluid handling equipment of modest capacity. It has also been found that the apparatus of the present application is such as easily to control the passage of the individual work pieces and the flow of the dust-laden fluid thereby preventing return of the dust to the leather from which it was removed.

An object of the present invention is to provide a machine for removing dust from consecutively presented hides or skins by means of a jet or jets of fluid such as air in which machine the individual pieces may be handled in a manner that is simple, rapid, efficient and economical.

To this end and in accordance with important characteristics of the invention, a rotary member having a yielding or resilient surface is provided for engaging and bearing against each consecutive flexible work piece and progressively supporting and/or passing such work piece through the zone or zones of fluid impact contiguous to the nozzle means or duct from which the jets of fluid emanate. Preferably and as illustrated, the rotary member is in the form of a power-driven rotary brush. An important feature of the two machines which are illustrated is found in the limited effective width dimension of the orifice or orifices which dimension should not exceed $\frac{1}{32}$ of an inch. It is preferred that such orifice or orifices be in the form of a slot and that the preferred effective width of the slot be only a few thousandths of an inch, that is—not in excess of $^{5}/_{1000}$ of an inch. With such a dimension for the width the slot is barely perceptible to the eye. Regardless of the form of orifice or orifices used, the effective cross-sectional orifice area should not exceed $\frac{3}{8}$ of a square inch per linear foot—which is the same area as that of a $\frac{1}{32}$ of an inch slot. Another feature of the invention comprises an arrangement of parts whereby suction devices are employed to draw off dust-laden fluid from the impingement zone, such devices preferably being in combination with means for guiding and forming a seal with a work piece at one side of the zone referred to, the seal being effective against the passage of dust-laden air to work piece areas which have been cleaned.

In a specific and preferred form of construction in which the invention is embodied, the nozzle means are arranged first to impinge upon the under side of a given work piece, this impingement being followed by treatment of the upper side of that work piece as the latter is given one passage through the machine. A ro-

tary member is preferably used to feed the work by means of power and such member need not be enclosed within a casing.

In a modified form of the apparatus similar and other inventive features are embodied and the arrangement of parts is such that the impinging fluid is directed by the nozzle means first to clean the upper surface or side of a given portion of sheet material and subsequently to clean the lower side of that portion, the operations taking place during a single passage of the sheet material through the machine. In the last-mentioned form of construction, it is preferred that a power operated rotary member be used for feeding each work piece through the machine and that such member be enclosed within a suction casing.

When the term "hides" is used alone herein it is the intention to refer to either hides or skins. The use of the single term is merely for the purpose of avoiding excess verbiage.

The invention will now be more particularly described by reference to the accompanying drawings and thereafter pointed out in the claims.

In the drawings,

Fig. 1 is a rear view in elevation of the preferred form of the apparatus, the rear portion of the work table being merely blocked in for purposes of illustration;

Fig. 2 is an enlarged sectional view of the main operative parts of the machine shown in Fig. 1, the section being taken on the line II—II in that figure;

Fig. 3 is a perspective view of a portion of the upper suction duct shown in Fig. 2;

Fig. 4 is a plan view of the apparatus shown in Fig. 2, the upper nozzle means and suction devices being omitted;

Fig. 5 is a perspective view partially in section of portions of the lower duct and work supporting means as shown in Fig. 2;

Fig. 6 is an enlarged sectional view similar to Fig. 2 but illustrating a second form of the apparatus;

Fig. 7 is a perspective view of a portion of the upper suction duct shown in Fig. 6;

Fig. 8 is a view in elevation of one end of the machine depicted in Fig. 6, with some parts broken away;

Fig. 9 is a plan view, with parts broken away, of one end of the machine shown in Figs. 6 and 8, the upper suction devices being omitted; and

Fig. 10 is a perspective view with parts broken away of a portion of the lower exhaust casing shown in Fig. 6.

The frames of the two machine herein disclosed are similar and the principal parts thereof are designated by the same reference characters. Each frame is composed of a low horizontal platform 10 (Figs. 1 and 8), short vertical rear stanchions 12 and 14 (Fig. 1), and high front stanchions 16 and 18 (Figs. 1 and 4) as well as long transverse base members 20 (Fig. 1) and 22 (Fig. 8). Bolts 24 (Fig. 1) are used to attach the base member 20 to the vertical stanchions 12 and 14. Bolts 26 (Fig. 8) hold one end of the base member 22 to the vertical stanchion 16 and a similar fastening arrangement is used at the other end of the member 22 to hold it to the stanchion 18. A horizontal frame member 30 (Fig. 8) is rigidly bolted to the top of stanchion 12 and to a mid portion of the stanchion 16. A similar frame member 32 (Fig. 4) is bolted to the stanchions 14 and 18. A vertical block 34

(Figs. 1, 4 and 8) is bolted to a mid section of the horizontal frame member 30, and a similar block 36 (Figs. 1, 2 and 4) is bolted to the frame member 32. Blocks 34 and 36 are provided with recesses 38 and 40, respectively, to serve as support bearings for the ends of a shaft 42. The length of the shaft 42 is such as to carry a rotary member, brush or feeding means 44, the latter being of such size as to extend across the full area of the largest work piece to be treated. Upper bearing blocks 46 and 48 (Fig. 4) are attached by means of bolts 50 to the blocks 34 and 36, respectively. The blocks 46 and 48 serve to provide additional bearing surfaces for the shaft 42. Across the rear of each machine a frame member 52 is mounted and it is beveled on its top, as shown at 54 in Fig. 2. The member 52 is attached by screws 53 (Fig. 1) to the blocks 34 and 36. A horizontal frame member 55 (Figs. 1 and 8) is attached by means of screws 57 to the rear ends of the frame members 30 and 32.

In both machines an air cleaner or filter 60 (Fig. 1) is mounted to clean air drawn into the machine through pipe connections 62 which lead into the intake port of a blower 64 mounted upon the platform 10. A pipe line 66 is utilized to connect the exhaust port of the blower 64 to two cleaning ducts as will subsequently appear. The blower 64 is provided with a pulley 68 which is connected to the pulley 70 of an electric motor 72 by means of a belt 74. The electric motor 72 is mounted upon the platform 10. A second motor 76 is also supported by the platform 10 upon a mechanism 78 by means of which the motor 76 may be moved forwardly or rearwardly of the machine with respect to the platform 10 in order to control the driving operation of a pulley 80 driven by the motor 76 through a belt 82 and a split pulley having a mechanism 83 for adjusting the belt speed. The driven pulley 80 (Fig. 8) is keyed to a shaft 84 which in turn is mounted in bearings (the bracket 86 of one bearing is shown in Fig. 8) bolted to a bracket 90 attached to the platform 10. The shaft 84 also has keyed thereto a small sprocket 92 with which a chain 94 is engaged. The chain 94 also engages a large sprocket 96 keyed at 97 (Figs. 4 and 9) to the shaft 42 of the rotary brush 44. Collars 88 and 90 (Fig. 4) are maintained in position on the shaft 42 by means of set screws 97 and 99 respectively.

In the machine of Figs. 1 and 2, straps 100 and 102 are each bolted to a bracket 103 (one bracket 103 is partially shown in Fig. 2) and these brackets are directly fastened to the top ends of the stanchions 16 and 18 and support an upper large exhaust duct 104 running the full width of the machine. A sheet metal cap 106 (Fig. 1) is pressed upon one end of the duct 104 tightly to close the same. The other end 105 (Fig. 1) of the duct 104 is connected to an exhaust or vacuum system.

In Figs. 1, 2 and 4, L-shaped brackets 120 and 122 are shown for supporting an upper pressure fluid duct or nozzle means 124. Set screws 126 and 128 (Fig. 4) serve to locate the duct 124 firmly in position within the brackets 120 and 122. The left-hand end of the duct 124, as viewed in Fig. 1, has connected thereto a pressure gage 130 and the end of the connections is blocked off by means of a plug 132. The other end of the duct 124 is connected by an elbow 134 to the pipe line 66 leading from the blower 64. The duct 124 has inclined sides 140 and 142 (Fig. 2) to which are attached plates

144 and 146 by means of set screws 148. The bottom longitudinal portion (between the plates 144 and 146) of the duct 124 is provided with a number of holes 150 along its length. One hole 150 is shown in Fig. 2. The perforated portion of the duct 124 together with the plates 144 and 146 form a long uniform pressure chamber 152 having a small triangular cross section. The bottom edges of the plates 144 and 146 are beveled as shown in Fig. 2 and their interior edges are spaced to form a slot of approximately $^{3}/_{1000}$ or $^{4}/_{1000}$ of an inch in width. In the drawings the slot width is exaggerated for the purpose of illustration. As can be seen in Fig. 1, it is preferred that plate 146 be made in sections across the machine, and the same is true as to plate 148.

A flat exhaust conduit 160 (Fig. 2) is formed by an upper sheet metal member 162 joined at its upper edge to the exhaust duct 104 at 164 and having its lower edge abutting the nozzle plate 144 next to the upper pressure fluid duct 124. The duct 124, together with plates 144 and 146, as well as the conduit 160, may be said to constitute a nozzle means. This is an upper set or dust removing device for treating the upper side of a work piece. A very similar but lower set will subsequently be described The exhaust conduit 160 also includes a lower sheet metal wall 166, the upper part of which is joined to a portion 168 which is tangential with one side or the front side of the exhaust duct 104. The wall 166 extends downwardly and its lower edge is contiguous to the tops of the bristles 170 of the brush 44. Small U-shaped sheet metal members 172 (Fig. 3) are spot welded or otherwise fastened to the wall 166, and each of the bottom edges 173 of the U-shaped members 172 is formed to make a smooth line between the bottom of the wall 166 and the surface of the beveled edges on the plate 144. Vertical stiffener and separating plates 174 are mounted at regular intervals to equalize or distribute the suction action within the conduit 160 across the width of the machine as the fluid or air is forced into the duct 104 from the nozzle means 124.

The horizontal frame members 30 and 32 (Figs. 1 and 4) support the ends of a second or a lower, large exhaust duct 180 which duct has an inlet 182 extending longitudinal to the duct and across the machine and of a length substantially that of the brush 44. The duct 180 has a pressed-on cap 181 (Fig. 4) similar to the cap 106 of duct 104 and the right-hand end (Fig. 1) of the duct 180 is connected to an exhaust system.

Brackets 184 and 186 (Figs. 1 and 4) are bolted to the blocks 34 and 36, respectively, and serve to support a lower fluid pressure duct 190. Set screws 192 and 194 (Fig. 4) serve to hold the duct 190 rigidly in position within the brackets 184 and 186. The duct 190 is formed as is the duct 124 and has a row of holes 191 and carries side plates 200 and 202, which are beveled at their tops, as shown in Fig. 2, and attached in position by means of short bolts 201, 203 (Fig. 5), 209 and long bolts 211 (Fig. 2) to form a discharge slot between them of a very small width dimension. Here, again, the slot width should be in the nature of $^{3}/_{1000}$ or $^{4}/_{1000}$ of an inch. A plate 204 is held in a slightly inclined position above and to the rear of the duct 190 by screws 199 on a number of brackets. One such bracket 207 is shown in Fig. 2 and is attached to the duct 190 by one of the long bolts 211. The plate 204 is inclined downwardly and rearwardly lightly to

engage the ends of the bristles 170 of the brush 44. A flat horizontal plate 205 is perforated, as at 210, and extends forwardly (that is, to the left, as shown in Fig. 2) for attachment by means of screws 212 to a table portion 213 which, in turn, is supported at one end upon a cross piece 214 (Fig. 4) fastened at 216 and 218 to the vertical stanchions 16 and 18. The table portion 213, together with the plate 204, constitutes an exposed work support at the front of the machine and this support is so located as to be convenient for the operator in manipulating the work and presenting it to the treatment zone. An inclined flue generally indicated at 220 (Figs. 2 and 5) is attached to the upwardly inclined inlet 182 and is partially angular in cross section to fill the V-shaped cross sectional space between the upwardly inclined plate 202 of the pressure fluid duct 190 and the horizontal plate 205. The upper end of the flue 220 is open, permitting a free passage of fluid from the perforations 210 downwardly into the large, lower exhaust duct 180. The flue 220 is formed of two parts—a rear portion 222 of the same length as the upwardly inclined side plate 202 and a front portion 224 of approximately the same length. Portion 222 extends downwardly into the inlet 182 and has side flanges 226 (Fig. 2) and 228 (Fig. 5) which fit tightly within side flanges 230 (Fig. 2) and 232 (Fig. 5) of the front portion 224. It is to be noted that the front portion 224 is flanged at its lower edges permitting the use of bolts 227 for attachment of the portions 222 and 224 to the inlet 182, the top of the latter being flanged at 229 (Fig. 5).

It is to be understood that the front table portion 213 may extend forwardly and be of such size as to afford ample area for supporting and spreading out a work piece 5 (Fig. 2) to be treated. Only the rear part of the table portion 213 is shown in the drawings but it is to be noted (Figs. 2 and 5) that the plate 205 is so placed with relation to the upper surface of the table 213 that the work may be moved smoothly toward and over the lower nozzle means 190 and associated suction means and into the bite between the brush roll 44 and the exhaust conduit 160. With the parts proportioned as shown, at least one end of a hide or skin is exposed at all times and may be manipulated by an operator for straightening out wrinkles or other purposes.

The blocks 34 and 36 are each provided with four vertical slots (Fig. 2 shows such slots 231 for the block 36) and the brackets 122 and 186 have horizontal slots 233. Bolts 234 pass through the slots and serve as a means of attachment for the brackets, the slots permitting adjustments in accurately positioning the upper and lower nozzle means 124 and 190.

At the rear or work discharge end of the machine, an inclined table portion 236 (Fig. 2) is supported adjacent its forward edge upon the beveled top 54 of the frame member 52 and it extends downwardly at an angle and rests upon the long member 55 (Fig. 1). This portion 236 is not shown in Fig. 1 but dash lines are utilized to show its position. A plate 238 (Fig. 2) is attached by bolts 240 to the under side of the portion 236 and this plate is bent to follow a horizontal plane and lightly contact the bristles 170. Holes 242 (Fig. 4) are formed in the horizontal portion of the plate 238.

Fig. 5 illustrates one form of construction which may be utilized to close off each end of each pressure fluid equalization chamber for the

nozzle means. A triangular plate 244 is fitted to abut the ends of plates 200 and 202 as well as an end of the projecting perforated portion of the duct 190. The plate 244 is held in position by means of a screw 246. The slot 248 as defined by the upper edges of plates 200 and 202 and as viewed in Fig. 5 is shown enlarged for illustrative purposes as before stated.

The side plates 144 and 146 of the upper pressure fluid duct 124 and the plates 200, 202 and 204 of the lower pressure fluid duct 190 are so arranged and formed that the slots or orifices serve to direct the cleaning fluid directly against a work piece 5 so as to cause a deflection of the fluid in a direction other than that followed by the work piece as it is fed through the machine. In this connection it is to be noted that plate 146 of the upper duct and the inclined plate 204 of the lower duct have beveled edges to engage the work piece and form a seal whereby fluid is precluded from flowing over a portion of the work piece which has already been treated.

All metal work which may possibly come into contact with a work piece passing through the machine is preferably polished to provide a smooth surface thereby avoiding any marring effects such as scratches or streaks.

In operating the machine shown in Figs. 1 to 5 inclusive, a work piece such as a hide or skin 5 which has been buffed is spread out upon the table 212 and a leading edge thereof is directed over the duct 190 and into the bite between the rotary brush 44 and the exhaust conduit 160. It is assumed that the blower 64 is in operation and is forcing air through the ducts 124 and 190. It is also assumed that the suction system is in operation and that the brush roll 44 is being rotated by the motor 76 in the direction of the arrow as shown in Fig. 2. The operator then releases the work piece 5 which is immediately fed by the bristles 170 of the brush through the machine and out upon the delivery table 236. Air, serving as the pressure fluid, is simultaneously directed against the lower surface of the work piece 5 and sharply deflected from the work piece into the exhaust duct 180, thereby cleaning the lower surface of the work piece. Air which is forced from the upper duct 124 emerges from the slot between the plates 146 and 148 and impinges against the upper surface of the work piece 5, and the dust-laden air is forced up through the exhaust conduit 160 into the large duct 104.

The operation upon each work piece 5 is exceedingly rapid despite the small size of the cleaning orifices or slots and, once the work piece is introduced, it is quickly and automatically passed through the machine to the delivery table for removal. It is to be noted that in this particular construction it matters not in what manner an operator removes the work piece 5 from the delivery table 236. In the event he should prematurely lift and pull the work piece 5 such work piece would nevertheless be fully and completely cleaned on both surfaces by the fluid emerging from the ducts or nozzle means. It should also be noted that the brush roll 44 need not be enclosed within the suction system as its function is properly to present the work to the cleaning nozzles by feeding and supporting the same. Such function is independent of fluid currents around and about the brush roll.

In the modified form of construction, as shown in Figs. 6 to 10, inclusive, the main frame members are the same as those shown in the first form of construction. The rotary brush 44 is also similar and is driven in the same manner by a motor 76 supported on a platform 10. A blower may also be mounted on the platform 10 to supply the pressure fluid, such as air, to the machine.

In the second form of construction the rear portion of a table 300 is supported upon two transverse frame members 302 and 304 (Fig. 8). Each end of the frame member 302 is attached to a vertical stanchion, such as the stanchion 16 of Fig. 8. The cross member 304 is attached by means of screws, such as screw 306, to the vertical blocks 34 and 36. Each of the screws 306 (only one is shown in any one figure) also passes through the vertical portion of an angular strap member 308 which is in turn bolted at 310 to an exhaust duct 312. The exhaust duct 312 has a sealing cap 314 at its end similar to the cap 181 in Fig. 4. The exhaust duct 312 is so placed as to rest upon the horizontal frame members 30 and 32 and against the vertical frame members 16 and 18. Above the large exhaust duct 312 is a second large exhaust duct 320 having an end cap 322 (Fig. 8) like the cap 314. One end of the duct 320 is supported against the upper end of the vertical stanchions 16 by a strap member 324 (Fig. 8) and bolts 326 passing through the stanchion 16. A strap member 325 (Fig. 6) similar to the strap member 324 is bolted in a similar manner to the other vertical stanchion 18 in order to support the other end of the duct 312.

Two switch boxes 328 and 330 (Fig. 8) are mounted for convenient access on the upper portion of the vertical stanchion 16 and these serve as a means of control for the two motors 72 and 76 on the platform 10. An inclined exhaust conduit 332 similar in function to the conduit 160 of Fig. 2 is connected to the bottom of the large duct 320 and the lower edge of the conduit 332 is arranged contiguously to the ends of the bristles of the rotary brush 44. The brush 44 is mounted upon a shaft 42 to be driven by mechanism similar to that shown in Figs. 1 and 4.

The rotary brush 44 of Figs. 6, 8 and 9 is closely surrounded by a metal box-like structure 340 which is provided with a downturned lip 342 engaging the bristles slightly to the rear of the inclined exhaust conduit 332. The forward end 344 (Fig. 6) of the table portion 300 is formed and positioned to give a slight clearance between itself and the ends of the bristles of the brush. A partition 346 is mounted to extend from the under side of the table portion 300 vertically downward close to the bottom horizontal portion 348 of the box-like structure 340. An opening 350 (Figs. 6 and 10) is thus left below the bottom of the partition 346 and a plate 352 is supported upon the partition 346 by means of bolts 354 in such a way as to be vertically adjustable to close and open fully or to vary the size of the opening 350. A short duct 356 is attached to the partition 346 to communicate with the opening 350 and is formed as an integral part of and as the longitudinal means of entrance to the exhaust duct 312. The end walls of the box structure 340 are formed to enclose the brush roll 44 to such an extent that only a small area of each end of the brush is exposed. Fig. 8 illustrates the extent of the coverage. One end or side 341 of the box is shown in Figs. 8 and 9. A strap 343 (Fig. 6) attached by bolts 345 is utilized to stiffen the partition 346. A rear strap 347 is shown as a spacing means between the frame member 52 and the box 340, one screw 349 being shown as the form of fastening used.

Two pressure fluid ducts or cleaning nozzle means 360 and 362 are utilized and they are simi-

lar in construction to the nozzle means 124 of Fig. 2. The nozzle means 360 is supported at its ends upon brackets 364 and 366. The nozzle means 362 is mounted upon two brackets 368 and 370. The brackets 364, 366, 368 and 370 are attached to the blocks 34 and 36 in a manner permitting adjustment as is done in the machine of Fig. 2.

One plate 372 (Fig. 6) of the fluid pressure duct 362 is arranged to present a top surface which is in alinement with the top surface of the flange 342 of the box 340. The lower plate 373 of the duct 362 contacts the top side of the brush box 340 and gives a firm backing thereto.

The rear plate 374 of the fluid duct 360 is placed so as to form a seal with a work piece 6 inserted between it and the bristles of the brush 44. A delivery table or table portion 376 is mounted in an inclined position with an uppermost edge supported by the cross frame member 52. The bottom edge of the table 376 may be supported in any convenient manner such, for example, as upon the horizontal frame member 55 (Fig. 8).

The duct 360 is provided with a cleanout plug 378 (Fig. 8) at one end and the duct 362 may have at one end an elbow 380, small plug 382 and a pressure gage 384. The inclined exhaust duct 332 is somewhat similar to the duct 160 of Fig. 2 in that it is of similar shape and is provided with partitioning plate members 386 like members 174 but the conduit 332 has additional partitions 388 as shown in Fig. 7. These members 388 are in lieu of the U-shaped members 172, as shown in Fig. 3, and prevent the sheet material undergoing treatment from being drawn up into the exhaust duct 332.

With this second form of construction the operator spreads a work piece 6 upon the table 300 and presents one edge thereof to the brush. As in the case of the machine of Figs. 1 to 4, the work piece is fed by the brush. In the present instance, however, as the work passes through the space between the two pressure conduits 360 and 362, a given portion of the work is first treated by the upper nozzle means 360 and then by the lower nozzle means 362. The impingement fluid removes the dust from the work piece and carries it away and out through the exhaust ducts 320 and 312. The brush causes the leading edge of the work piece 6 to pass over the duct 362 and thence down upon the inclined delivery table 376. In this form of construction care should be taken that an operator, removing a given work piece from the table 376, does not act prematurely and pull the work piece from the machine without permitting the machine to give adequate treatment to the under side of the work piece.

It is to be noted that in the operation of either of the two machines the rotary brush 44 actually serves a double function. One of its functions is to feed each work piece through the machine by frictional contact of its bristles with the work piece. The second function of the rotary brush is yieldingly to support each work piece in close proximity to the nozzle means enabling the latter to perform its cleaning operation effectually. Each of these functions is considered separately below.

As for the feeding function of the rotary member, each work piece is progressively pulled through the machine by the bristles regardless of the irregularities which are unavoidably present in the contours of such work pieces as hides or skins. The irregularity of the leading edge of each work piece and the flexible nature of hides and skins present no difficulties. Variations in the thickness dimension of each work piece or of consecutively treated work pieces likewise have no adverse effect in so far as feeding the work by the brush roll is concerned. It is to be appreciated that a work piece to be treated may be fed by some other form of mechanism, the rotary member being utilized merely for performance of its second function—i. e., the resilient upward presentation of each consecutive work piece to the nozzle means.

As for the second function of the rotary member, the resilient pressure exerted by the bristles upon the work piece need not be substantial. When the air blast or jet impinges upon the surface of the work piece and the dust-laden air is discharged therefrom into the exhaust system, the Bernoulli effect is evident—potential energy is changed to kinetic energy and the pressure of the air as it forms the jet is reduced and the leather or equivalent sheet material is actually held (not repelled) adjacent to the nozzle means by the air pressure on the brush side of the work piece. This theory is substantiated by the performance of the air blast emerging from the lower nozzle means or duct 190 illustrated in Fig. 2. With that particular nozzle means no backing member or resilient mechanical device is provided or needed to hold the work piece 5 in sealing relation with the beveled edge of plate 204, and yet the air emanating from the slot deflects forwardly—toward the front of the machine—and away from the zone of impingement upon the work piece and carries the dust away from the surface area of the work piece which has already been treated. One would expect the work piece 5 to be blown upwardly and away from the edge of the inclined plate 204 but such is not the case except momentarily and at the leading edge of each work piece as it is presented. It is clear in Fig. 2, that the sealing relation of the leather 5 and the plate 204 is aided by the force of gravity and also by tension in the leather induced by the action of the brush 44.

One advantage of the apparatus of this invention is that an operator may hold back on a hide or skin to be treated and retard its rate of passage if he so desires. In fact, the operator may pull the work piece back toward him and then permit it to be treated again by the air jet. Usually one passage of a portion of a work piece past the slot or through the zone of fluid pressure impact is sufficient to remove the dust but it is obvious that the operator may, without removing the work from the machine, repeat the treatment of a given work piece any number of times, or he may prolong the treatment during a single passage by retarding the rate of feed.

A system of exhaust ducts is theoretically not essential but, as a practical matter, in commercial operation it is preferred in order to secure reliable, continuous and excellent dust removal as well as proper and continuous working conditions for the personnel.

It is preferred that the air be impinged against the work from a slot or from a multiplicity of slots but it is clear that a number of closely arranged or staggered orifices of small thickness dimensions (preferably a few thousandths of an inch) may be used and that a device or devices having these may constitute the nozzle means. It is also permissible to provide a mechanism for reciprocating the nozzle members to secure ade-

quate coverage of the surface area to be treated. Slots are preferred as they avoid any possible formation of streaks or uneven treatment of the work and they eliminate the necessity of reciprocating the nozzle members. In some cases it may prove feasible to increase the width dimension of the orifices or slots to as much as .015" or .020" and to a maximum of $\frac{1}{32}$ of an inch although such increase will necessitate an increase in the capacity of the blower and the power input. A width dimension not exceeding .005" is preferred (a slot of such width appears similar to a fine hair-line) because of the excellency of work done with a minimum of power requirements using an air pressure of from 3 to 12 pounds per square inch within the ducts **124**, **190**, **360** and **362**. The air pressure is not a critical value but, as referred to above, the slot width (if a slot is used) should not exceed $\frac{1}{32}$" and in no case should the effective cross-sectional orifice area exceed $\frac{3}{8}$ of a square inch per linear foot, if satisfactory dust removal is to be had in conjunction with reasonable power and apparatus size requirements. A width dimension as small as .001" may be used but does not fall within the preferred range because of the likelihood of such a small opening to clog and for other reasons.

It is preferable to increase the fluid pressure (rather than to increase the effective nozzle orifice area) in the event that it be desired to promote the cleaning effect. The preference is due to the fact that an increase in the fluid pressure does not result in such a pronounced rise in power requirements.

Various velocities of feed for the individual work pieces have been found satisfactory and such velocities are surprisingly high despite the small slot width or small effective cross-sectional orifice area which may be selected. This possible high velocity is particularly significant in tanneries as it results in a high rate of production. The reason for such high velocity can be understood when it be realized that the cleaning effect of the small dimension orifice or area is substantially instantaneous for any given area on a work piece. Work feed velocities of up to 325 feet per minute have been successfully used with a slot width of a few thousandths of an inch. Such velocities eliminate waiting periods for the operating personnel and demonstrate the mechanical efficiency which may be realized.

An air pressure of from 3 to 12 pounds per square inch within the nozzle means or ducts **124**, **190**, **360** and **362** has been found very satisfactory with a slot width of from .002" to .005" as stated above.

It may be seen from the above that the velocity of feed and the pressure of the fluid used are not critical conditions in so far as the operation of the machines are concerned. The impingement or impact angle of the jet (as measured with respect to the surface to be treated and before impingement) should not be much lower than 40° (although the 40° value is not critical) if the advantageous results are to be secured. The cleaning effect diminishes if the impingement angle is adjusted or changed to approach zero.

It is not essential that the dust-laden air be discharged over the untreated portion of the work piece although an arrangement of parts giving that result is preferred. The dust-laden air may be discharged in some other direction—i. e., over the treated work portion and be separated therefrom by a thin plate or sheet and/or by causing the work piece to bend sharply away from the direction of movement of the dust-laden air.

Having described our invention, what we claim as new and desire to secure by Letters Patent of the United States is:

1. A machine for removing dust from consecutively presented tanned hides comprising nozzle means for discharging fluid, said nozzle means extending the full width of a work piece and having an effective cross-sectional orifice area not exceeding $\frac{3}{8}$ of a square inch per linear foot, a power-driven work feeding device with a yielding surface adjacent to said nozzle means and arranged to engage and to urge consecutive work pieces through the machine and in a path contiguous to said orifice area, and an exposed surface upon which an operator may spread out each work piece as its leading edge is inserted between the nozzle means and the said feeding device.

2. A machine for removing dust from consecutively presented tanned hides comprising nozzle means for discharging fluid, each of said nozzle means extending the full width of a work piece and having an effective cross-sectional orifice area not exceeding $\frac{3}{8}$ of a square inch per linear foot, a power-driven work feeding device arranged to move each work piece in close association with said nozzle means, the said nozzle means being arranged to direct fluid first to remove dust from the under side of a portion of said work piece and subsequently from the upper side of said portion, and said work-feeding device being exposed for presentation thereto of the leading edge of each work piece by the operator.

3. A pneumatic machine for removing dust from a hide comprising air suction means a duct with nozzle means for discharging fluid near said suction means, said nozzle means having an effective cross-sectional orifice area not exceeding $\frac{3}{8}$ of a square inch per linear foot and a power-driven work-feeding device arranged contiguous to and parallel with the duct, a first table portion at the front of the machine for receiving a work piece from the operator and for guiding the leading edge of said work piece into the bite between the nozzle means and the said feeding device, and a second table portion at the back of the machine arranged for discharging said work piece from said bite.

4. A machine for removing dust from a hide comprising elongated upper and lower nozzle means for providing jets of fluid, said nozzle means each having an effective cross-sectional orifice area not exceeding $\frac{3}{8}$ of a square inch per linear foot, a rotary brush arranged parallel and contiguous to the upper nozzle means, a first table portion for guiding a work piece to the bite between the said brush and the upper nozzle means, and a deflector plate arranged to receive the said work piece from the brush and to guide it over and closely adjacent to the lower nozzle means.

5. A machine for removing dust from a hide comprising elongated upper and lower nozzle means for providing jets of fluid each with a thickness dimension not exceeding $\frac{1}{32}$ of an inch, suction means for withdrawing fluid discharged from said nozzle means, a member with a yielding surface arranged parallel and contiguous to the upper nozzle means, a first table portion for guiding a work piece to the bite between the said member and the upper nozzle means, and a deflector plate arranged to receive the said work

piece from the member and to guide it over and closely to the lower nozzle means.

6. A pneumatic machine for treating hides, including an exposed support at the front of the machine upon which a hide may be spread out by an operator, said machine having a treatment zone adjacent to said support and limited to receive and enclose at one time only a portion of said hide as spread out and moved from said support, said zone containing power-driven feeding means and two sets of dust-removing devices arranged to treat the full width and both sides of said hide as it is fed through the machine, each set including nozzle means for discharging air against said work piece and associated suction means for removing dust laden air, and said nozzle means having an effective cross-sectional orifice area not exceeding ⅜ of a square inch per linear foot as measured in a direction transverse to the line of feed.

7. A pneumatic machine for treating hides including power-driven work-feeding means and two sets of dust removing devices arranged to guide a hide through the machine, an exposed support upon which said hide may be spread and presented to the work-feeding means, each of said sets including nozzle means arranged to discharge air against the full width of said hide, and the said machine being so proportioned as to expose at least one end of said hide at all times for manipulation by an operator during the treating operation.

8. A pneumatic machine for treating hides including a support at the front of the machine and upon which a hide may be spread, power-driven means for feeding said hide from said support and through the machine, a lower nozzle means arranged to discharge air against the under side of a transverse portion of said hide as the same is moved on said support, and an upper nozzle means arranged subsequently to discharge air against the upper side of said hide portion as the hide is fed, the said power-driven means and upper nozzle means being arranged to contact opposite sides of said hide.

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