Jan. 30, 1940. N. V. HAGOPIAN 2,188,684

MACHINE FOR CLEANING FURS

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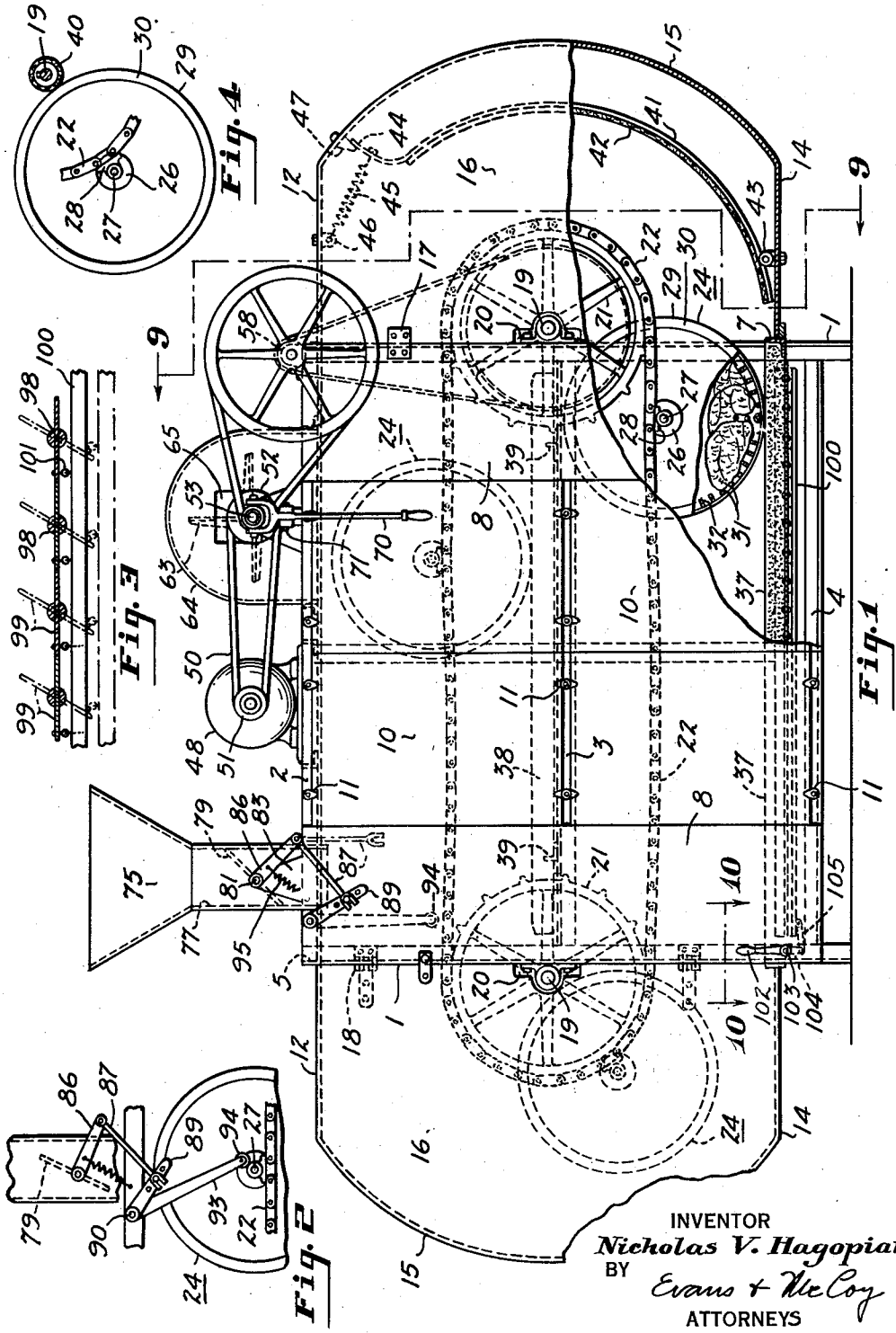


Fig. 4

Fig. 3

Fig. 1

Fig. 2

INVENTOR
Nicholas V. Hagopian
BY
Evans & McCoy
ATTORNEYS

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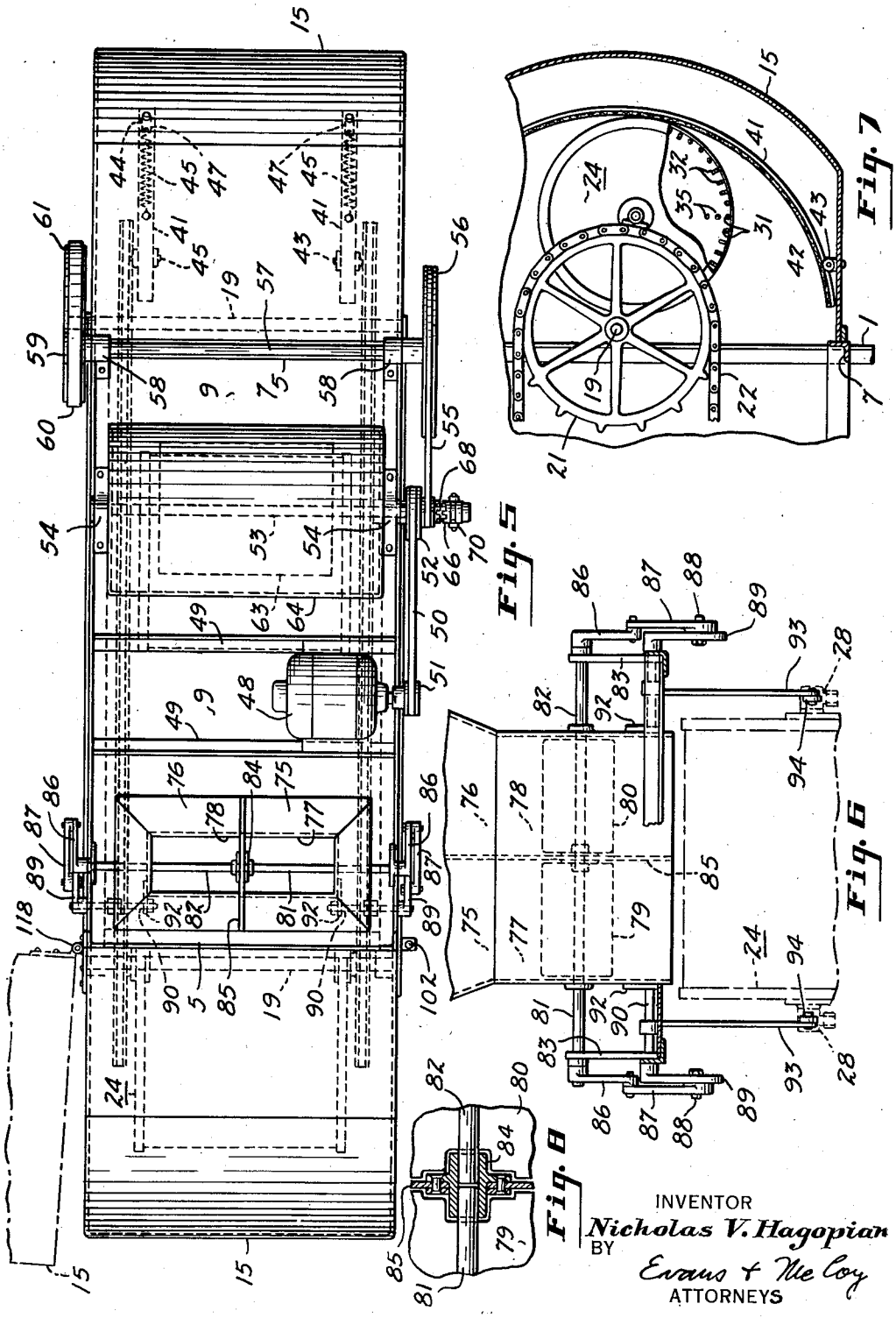


Fig. 5

Fig. 7

Fig. 6

Fig. 8

INVENTOR
Nicholas V. Hagopian
BY
Evans & McCoy
ATTORNEYS

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MACHINE FOR CLEANING FURS

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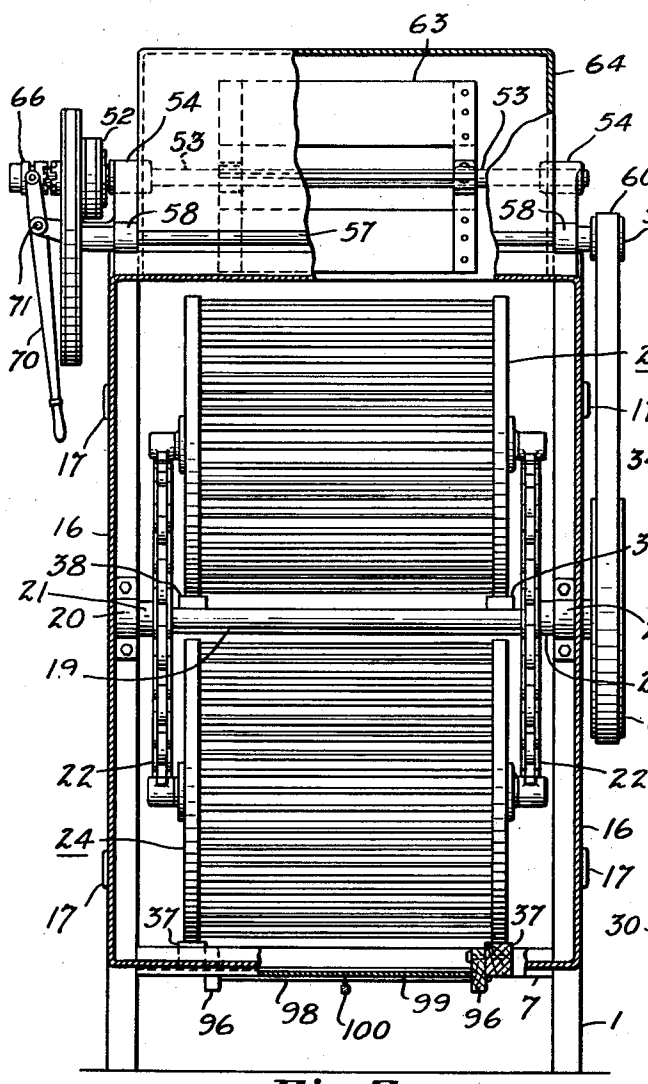


Fig. 9

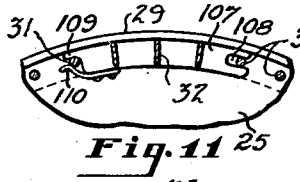


Fig. 11

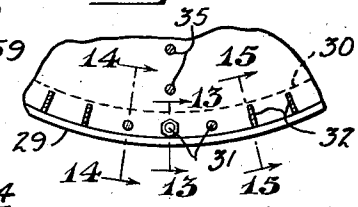


Fig. 12

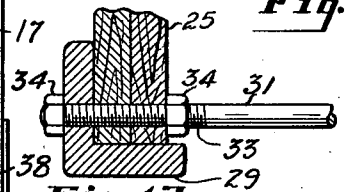


Fig. 13

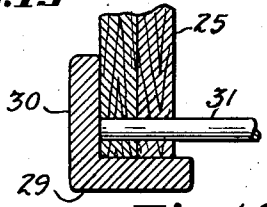


Fig. 14

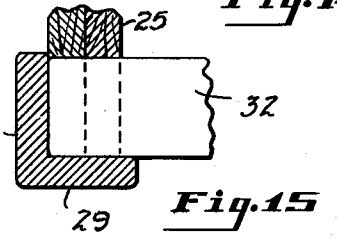


Fig. 15

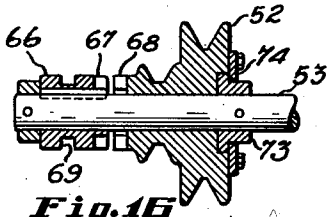


Fig. 16

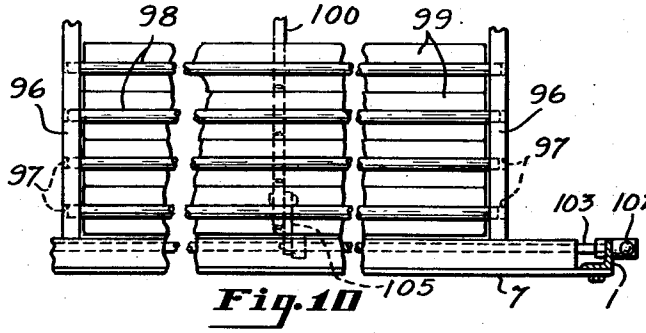


Fig. 10

INVENTOR
Nicholas V. Hagopian
BY
Evans & McCoy
ATTORNEYS

Jan. 30, 1940. N. V. HAGOPIAN 2,188,684

MACHINE FOR CLEANING FURS

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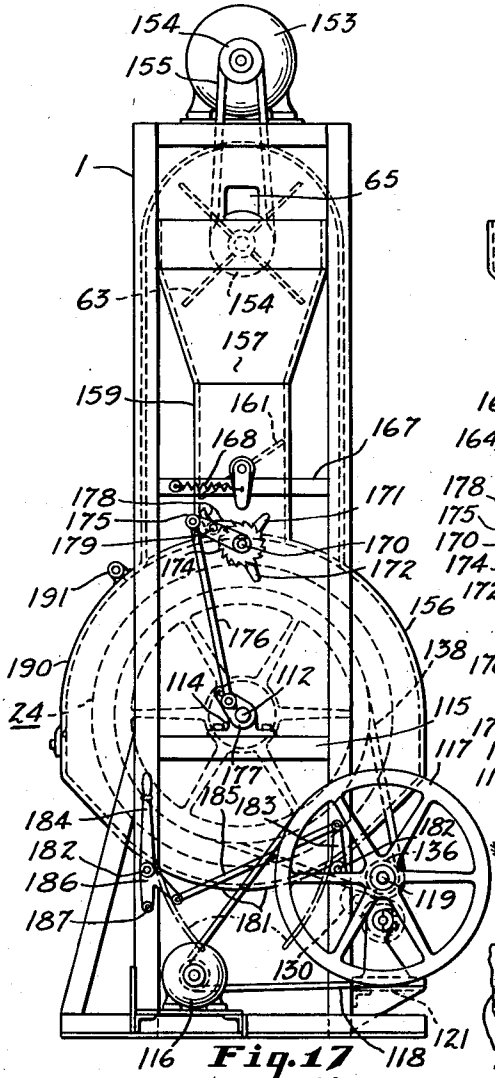


Fig. 17

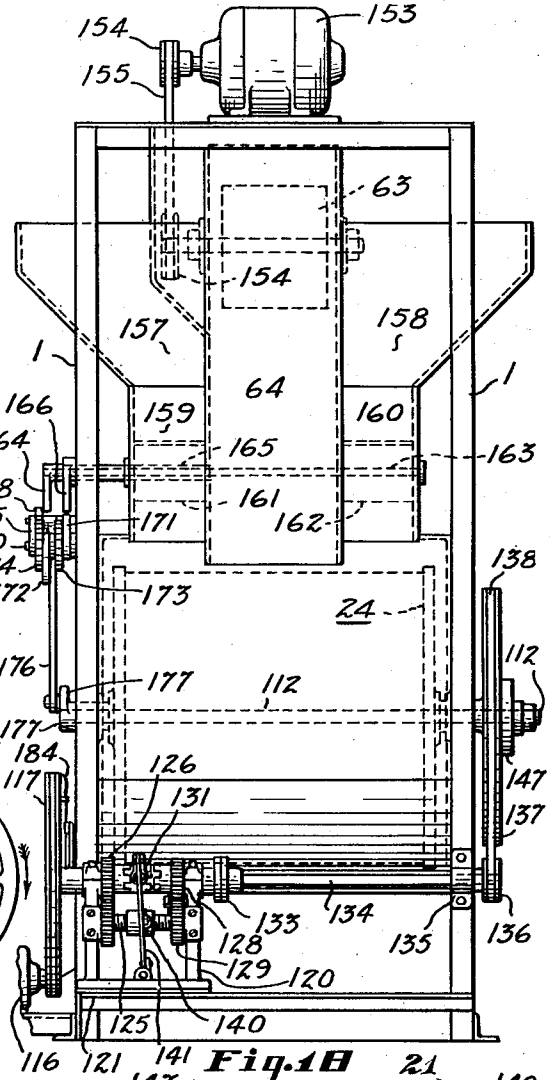


Fig. 18

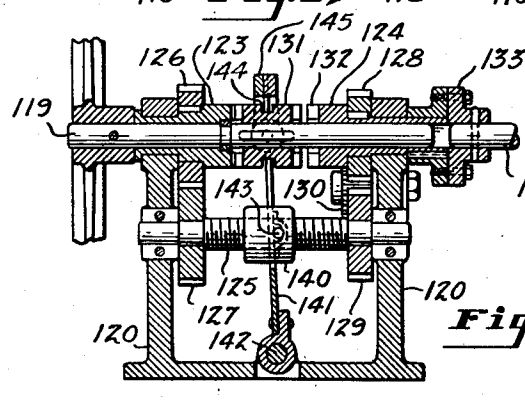


Fig. 19

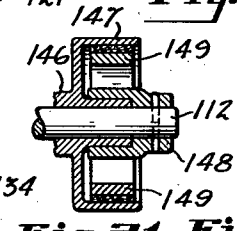


Fig. 21

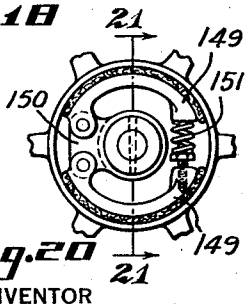


Fig. 20

INVENTOR

Nicholas V. Hagopian

BY

Evans & McCoy

ATTORNEYS

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UNITED STATES PATENT OFFICE

2,188,684

MACHINE FOR CLEANING FURS

Nicholas V. Hagopian, Cleveland, Ohio

Application June 14, 1937, Serial No. 148,020

11 Claims. (Cl. 15—4)

This invention relates to cleaning machines and more particularly to such machines in which the article or articles to be cleaned are tumbled with a cleaning agent or compound of solid character.

The usual method of cleaning fur and the like involves subjecting the articles to a drumming or tumbling action in a cylinder or cage into which a quantity of cleaning material has been introduced. This cleaning material is usually in the form of solid comminuted particles such as sawdust, sand, wood chips, or ground-up corn cobs and the like. A cleaning fluid, for example, naphthalene, gasoline, ammonia, or benzol, is usually used to wet the particles of the solid cleaning agent to promote a more efficient cleaning action. When the solid particles come into intimate contact with the fur after such drumming or tumbling has continued for a sufficient period of time, it is then necessary to remove the solid particles of the cleaning agent and dry the fur.

Various methods and apparatus for accomplishing this have been proposed but they have not operated to entire satisfaction. It is, therefore, an object of the present invention to provide an improved fur cleaning machine simple in design and construction and inexpensive to manufacture. Such a machine, constructed in accordance with the present invention, combines a multiplicity of advantageous features. It has an increased capacity and, if desired, may be maintained in continuous operation. The tumbling cylinders or cages are constructed with a view to an improved cleaning action on the fur with a minimum of scrubbing and wear thereof. At the inception of a cleaning cycle the articles are placed in a drum and remain therein without the necessity of being further handled until they are completely cleaned and dried. The supply of cleaning compound to the tumbling cages during operation of the machine is automatic, so that the careful supervision of an attendant is eliminated and provision is made for blowing the spent cleaning compound out of the articles without interfering with the tumbling thereof in the cages.

Other objects and advantages will become apparent from the following detailed descriptions of suitable embodiments of the invention made in connection with the accompanying drawings in which:

Figure 1 is a side elevational view, partly in section and with parts removed, showing a fur cleaning machine having a plurality of tumbling drums;

Fig. 2 is a fragmentary detail diagrammatically illustrating the manner in which cleaning compound is automatically supplied to the tumbling drum;

Fig. 3 is a fragmentary detail in section illustrating the construction and operation of the dump bottom for the spent cleaning material bin;

Fig. 4 is a fragmentary detail illustrating the manner in which the rotary motion of the tumbling drums is retarded as they move from the lower to the upper lap of the carrying chains;

Fig. 5 is a top plan view of the cleaning machine illustrated in Fig. 1;

Fig. 6 is a fragmentary elevational detail view showing the cleaning compound feeding mechanism;

Fig. 7 is a fragmentary vertical sectional detail with parts removed showing the manner in which a tumbling drum being carried from the upper to the lower lap of the carrying chain has its rotational velocity retarded;

Fig. 8 is a fragmentary detail in section showing the central journal for the damper shafts of the cleaning compound hoppers;

Fig. 9 is a vertical sectional view with parts removed taken substantially on the line 9—9 of Fig. 1;

Fig. 10 is a fragmentary detail plan view taken substantially on the line 10—10 of Fig. 1;

Figs. 11 to 15 are fragmentary detail views in section illustrating the construction of the tumbling cylinder or drum, Figs. 13, 14 and 15 being taken substantially on the corresponding lines indicated in Fig. 12;

Fig. 16 is a fragmentary detail in section showing the blower shaft clutch;

Fig. 17 is a side elevational view of a modified form of cleaning machine constructed in accordance with the present invention;

Fig. 18 is an end elevational view with parts broken away of the cleaning machine illustrated in Fig. 17;

Fig. 19 is a vertical sectional detail view, with parts broken away, showing the reversing mechanism used in the machine of Figs. 17 and 18 and enlarged with respect thereto;

Fig. 20 is a fragmentary detail view illustrating the friction drive for the tumbling cylinder of the modified machine of Figs. 17 and 18; and

Fig. 21 is a sectional view taken on the line 21—21 of Fig. 20.

The embodiment illustrated in Figs. 1 through

16 is supported by four rectangularly disposed uprights 1. At each side of the machine are three horizontal support members 2, 3 and 4 which extend between the uprights 1 disposed on that side of the machine. At each end of the machine extending between and supported by the uprights 1 are top and bottom cross members 5, and 7. The side supporting members 2 and 4 are positioned at substantially equivalent heights to the cross members 5 and 7 respectively.

A casing is carried by the framing members and includes side panels 8 and top panels 9. A number of the side panels, indicated by the numeral 10, are removable, being held between the side supporting members 2 and 3, and 3 and 4 respectively, by swiveled fasteners or buttons 11. Housings enclose the opposite ends of the machine and comprise top and bottm panels 12 and 14 respectively, curved end panels 15, and side panels 16. The housing positioned at the right hand end of the machine as viewed in Fig. 1 is supported by fastening plates 17 secured to the uprights 1 so that it can be swung to the broken line position illustrated in Fig. 5 for loading the tumbling drums as will be hereinafter pointed out.

Extending across each end of the machine, substantially midway between top and bottom cross members 5 and 7, are horizontal shafts 19 journaled in brackets 20 secured to uprights 1. Each of these shafts has secured thereon a pair of spaced sprocket wheels 21. The shafts 19 are disposed in spaced parallel relation with respect to one another and both pairs of the sprocket wheels 21 are equal distances apart so that a pair of endless belts or chains 22 are carried in parallel relation at opposite sides of the machine and operated in synchronization with one another. Each chain belt has an upper lap disposed above the general level of the side-supporting members 3 and a lower lap disposed generally below the side supporting members 3.

Suspended between the chain belts 22 are a plurality of tumbling drums or cages, indicated generally by the numeral 24. Each of these drums or cages has a pair of spaced parallel end members 25 preferably in the form of circular disks and provided at central portions with hub members 26. Each of the hubs has secured therein a stub shaft 27 journaled in a special link element 28 formed into one of the side chains 22.

The end members 25 of the tumbling drums or cages 24 may be suitably formed of one or more thicknesses of plywood as indicated in Figs. 13 through 15. A band or rim 29 preferably formed of metal is circumferentially disposed about each of the end members 25 and has an inwardly extending radially directed flange portion 30 overlying the peripheral margin of the end member. Extending between the end members 25 of each drum at their peripheries are a plurality of spaced parallel bars or rods which are also parallel to the axis of rotation of the drums and substantially equi-distant with respect thereto. Some of the bars are round as indicated at 31 and some are relatively thin and flat as indicated at 32. Preferably the bars 32 have their flat surfaces disposed radially with respect to the axis of rotation of the tumbling drum. In addition, it is advantageous if the inner edges of such bars are extended inwardly a slight distance with respect to the round bars 31 as shown in Fig. 12. This manner of arranging the cage bars is advantageous in facilitating a more thorough cleaning action on the furs during the tumbling thereof within the cages. The relatively narrow edges of the flat bars penetrate into the hide and have an effective though not objectionable scrubbing action on the pelt. The rods are secured in position by disposing their ends in sockets or apertures formed in the marginal portions of the end members 25; for the round bars 31 circular sockets are provided while elongated or rectangular sockets are formed for the flat bars 32. These sockets extend completely through the end members 25 so that the bars abut against the flange 30 of the rim 29. A plurality of round bars 31 have their ends threaded as indicated at 33 (see Fig. 13) and extend entirely through both the end member 25 and the flange 30. Nuts 34 screwed on these threaded rods are disposed on opposite sides of each end member and flange to hold the rim and end members of the cage together and retain the opposed end members of each cage in proper relative positions. In addition to the flat and round bars previously described, supplemental bars 35 disposed radially inwardly from the bars 31 and 32 may also be extended between the end members 25. These supplemental bars serve to arrest rolling movement of articles in the cage during rotation of the latter and upon impact of an article thereupon have a kneading action which works the cleaning compound into the interstices of the fur.

The sprocket wheels 21 are driven in a manner to be hereinafter described so that the upper lap of the endless chain travels to the right as viewed in Fig. 1 and the lower lap travels to the left. As each of the tumbling drums moves along the lower lap with the side chains 22 the rims 29 of the end members ride on spaced parallel rails or tracks 37 extending longitudinally through the machine and supported on the bottom end cross member 7. In this manner the tumbling drums in effect roll across a lower deck of the machine, being supported thereby and given a rotative movement.

During the movement of the tumbling drums traveling with the endless chains 22 across their upper lap, the rims 29 of the drums are supported by tracks or rails 38 arranged in spaced parallel relation with respect to one another and carried by auxiliary cross members 39 secured between side supporting members 3 sufficiently inward from the shafts 19 to avoid the sprocket wheels 21. Tumbling drums advancing across the upper deck of the machine are given a rotational movement opposite in direction to that of their travel across the lower deck. Such reversal in rotational movement of the tumbling drums is beneficial in a cleaning machine of this character since the furs fold and unfold a plurality of times affording a thorough working of the hides and permitting deep penetration of the cleaning compound among the individual hairs of the fur.

As the special link elements 28 are carried around the sprocket wheels 21 at the ends of the upper and lower decks, the rotational movement of the tumbling drums is retarded so that when the rims 29 re-engage one of the tracks 37 or 38 an abrupt stop or jerking of the cage is avoided. This is accomplished at the loading or left end of the machine as viewed in Fig. 1 by means of relatively small friction wheels 40 (Fig. 4) which are secured on the shaft 19 in line with the rims 29 of the tumbling drums. As each of the tumbling drums 24 reaches the end of the bottom track 37 thus completing its movement across the lower deck of the machine the rims 29 en-

gage the friction wheels 40, retarding and finally arresting the counterclockwise rotational movement of the drum as viewed in Fig. 1. This engagement between the rims 29 and friction wheels 40 continues until the tumbling drum is deposited on the track 38 in the upper deck of the machine at which time the special link element 28 moves way from the sprocket 21 and the rims 29 are released by the friction wheels 40 so that the tumbling drums can commence a rolling action over the track 38.

At the opposite end of the machine, as the tumbling drums are carried around the sprocket wheels 21 from the upper to the lower deck, the rims 29 are engaged by arc or scimitar shaped braking members 41 preferably lined with a suitable friction material 42. The lower end of the brake member 41 is pivoted at 43 to a bracket secured in the bottom panel 14 of the end housing. The upper end of the brake member 41 has an angularly disposed portion 44 connected by a tension spring 45 to a bracket 46 secured in the top panel 12 of the end housing. This spring is arranged to urge the brake member into engagement with the rims of the tumbling drums and stop elements 47 secured in the curved end panel 15 of the end housing engage the portions 44 to limit movement of the brake members 41. The considerable clockwise rotational movement (as viewed in Fig. 1) of each tumbling drum as it reaches the sprockets 21 at the end of its movement over the upper deck of the machine, is gradually arrested by the brake members 41 as shown in Fig. 7 and it is deposited on the track 37 of the lower deck with zero clockwise rotational movement or even with a slight counterclockwise rotational movement. While one of the tumbling drums is in contact with the brake members 41 the portions 44 move away from the stops 45 slightly tensioning the springs 45.

The sprocket wheels 21 and side chains 22 are driven by motor 48 carried on the top of the machine by cross members 49 extending between the side members 2. A V-belt 30 is run around pulley 51 on the motor shaft and the large sheave of a compound pulley 52 loosely carried by a shaft 53 mounted in brackets 54 secured to and upstanding from the side supporting members 2. Another V-belt 55 rides in the small sheave of the compound pulley 52 and a large pulley wheel 56 secured on one end of a shaft 57 journaled in brackets 58 secured to the top side of supporting members 2. The opposite end of the shaft 57 extends beyond the side panels 8 of the machine and has secured thereon a small flat belt pulley 59 (Fig. 9). This pulley drives a belt 60 riding on a large driven pulley 61 secured on one of the shafts 19 extending beyond the side panels 8. The sprockets 21 are thus driven from the motor 48 so that the relative high rotational velocity of the motor is reduced to about from between 20 to 45 R. P. M. for the sprockets 21.

The shaft 53 has secured thereon a blower or fan 63 disposed in a housing 64 extending above the top panels 9 of the machine. The bottom of this housing is open to the interior of the machine above the upper deck and an inlet aperture 65 is provided in the housing 64 for admitting air to the blower to be circulated through the machine. As previously mentioned, the compound drive pulley 52 is freely rotatable on shaft 53 so that the motor 48 does not at all times drive the fan 63. In order that a driving connection between the motor and fan may be established when desired, a clutch arrangement is provided and illustrated to advantage in Figs. 9 and 16. A toothed clutch element 66 is keyed to the shaft 53 and has longitudinal sliding engagement therewith. A plurality of teeth 67 are formed circumferentially at one end of this clutch element and are engageable with a plurality of similar clutch teeth 68 formed circumferentially about the abutting end of the compound pulley 52. An annular groove 69 formed circumferentially about the clutch element 66 receives the bifurcated end of a clutch lever 70 pivoted at 71 in an extension of one of the brackets 58. A flanged stop or hub 73 is secured on the shaft 53 and is received in a circular recess in the compound pulley 52. A circular gib 74 secured to the pulley 52 engages the flange of the stop 73 thus preventing longitudinal movement of the pulley 52 on the shaft 53. Accordingly, when the motor 48 is in operation driving the compound pulley 52 the fan 63 may be set in operation by actuation of the clutch lever 70. The fan is arranged to draw air in through the opening 65 and force it downwardly through the cages 24 as they pass beneath the opening from the hood or housing 64 of the fan. This blowing action serves to release comminuted particles of the cleaning compound from the furs being cleaned and the released compound drops through the openings between the bars of the tumbling drum to the bottom of the machine.

On the top of the machine at the loading end thereof and extending transversely across the width of the machine is a pair of cleaning compound hoppers 75 and 76 (Fig. 6) arranged in side by side relation with respect to one another. These hoppers have chutes 77 and 78 respectively which open into the interior of the machine directly above the path of the tumbling drums 24 as they commence their movement across the upper lap of the machine. Dampers or butterfly valves 79 and 80 are arranged in the chutes 77 and 78, respectively, to regulate the passage of the cleaning compound from the hoppers 75 and 76 into the interior of the cleaning machine. Each butterfly is carried on one of a pair of shafts 81 and 82 which extend through the hopper chutes from opposite sides of the machine and are in axial alinement with one another. At the sides of the machine the shafts 81 and 82 are journaled in brackets 83 secured to the top side supporting members 2. The inner ends of the shafts abut one another and are carried in an elongated journal 84 illustrated in detail in Fig. 8, which is carried by partition member 85 separating hopper 75 and chute 77 from hopper 76 and chute 78. A lever 86 is secured on the outer extremity of each of the shafts 81 and 82. The end of each of these levers pivotally carries a link member 87 having a bifurcated end receivable on one of a plurality of pins 88 formed at spaced intervals along an actuating lever 89. These actuating levers are secured on the ends of short shafts 90 journaled in and secured against longitudinal movement by the top side supporting members 2 and extension bracket members 92 fastened to the ends of the chutes 77 and 78. Arms 93 are secured to the short shafts 90 and depend therefrom through the top panel 9 of the machine into the interior thereof adjacent the path of the tumbling drums across the upper deck. The lower extremity of each of the arms 93 carries a cam roller 94. These cam rollers are normally disposed immediately adjacent and above the chain belts 22 at the starting end of the upper lap. Upon the movement of one of the tumbling drums 24 from the lower deck

to the upper deck of the machine so that the special link elements 28 securing the drums to the chains commence their movement across the upper lap of the chains the link elements engage the cam roller 94 just as the rims 29 of the drum are positioned on the upper track 38. Continued movement of the drum 24 across the upper deck displaces the arms 93 to the right (see Fig. 2) so that the shafts 90 are rotated in a counterclockwise direction. The butterfly or damper valve actuated by each of the arms permits the discharge of comminuted cleaning compound from the chute associated therewith. The cleaning compound thus released drops through the openings between the bars of the tumbling cage and falls among the folds of the articles being cleaned so that it is agitated therewith and worked among the fibres and hairs to thoroughly clean the fur. As the tumbling drum 24 moves further across the upper deck of the machine the cam rollers 94 are released by the special link elements 28 and the damper valves are returned to closed position by a tension spring 95 connected to the arms 93.

During normal operation of the cleaning machine it is desirable that only one of the butterfly valves or dampers be operated at a time. This is for the reason that it is proposed to fill one of the hoppers, for example hopper 76, with a cleaning compound composed of comminuted particles of solid material such as sawdust, ground-up corn cobs or the like which has been saturated with a suitable solvent such as benzene, naphthalene, ammonia, or gasoline. The other bin or hopper, for example hopper 75, will be filled with the same character of cleaning compounds but in the dry state, that is, without being saturated with a liquid solvent. Only one of these hoppers will have the cleaning compound released therefrom, and the other hopper will remain idle. This is accomplished by slipping the bifurcated end of the proper link 87 off of the pin 88 of the lever 89 so that it hangs disconnected, as indicated by the broken lines of Fig. 1. Accordingly, oscillatory movement of the arm 93 and actuating lever 89 normally associated therewith is ineffective to open the butterfly or damper 80 and cleaning compound is not released from the hopper 76 when the tumbling drum or cage passes therebeneath.

When it is desired to feed cleaning compound from the hopper 76 and discontinue the feeding from hopper 75 the link member 87 associated with the latter is disconnected and the link associated with the hopper 76 is applied over one of the pins 88 which will give the desired opening and closing movement to the butterfly 80.

During the tumbling of the articles in the drums while traveling back and forth across the upper and lower decks of the machine, particles of the cleaning compound escape from between the bars of the drum and fall into a bin at the bottom of the machine which is positioned between the lower tracks 37 and the bottom end cross members 7. This bin has side members 96 (Fig. 9), of wooden construction, which are secured to the inside of the rails 37 and extend longitudinally of the machine. Each of these side members has formed therein a plurality of evenly spaced sockets 97. Extending across the bottom of the machine and having their extremities journaled in the sockets 97 are a plurality of split bars 98 disposed in parallel relation with one another at evenly spaced intervals longitudinally of the machine. Each bar is divided longitudinally through its axis and between the two halves is positioned a relatively thin shutter 99. These shutters are each of a length to extend substantially across the entire distance between the side members 96 and are of a width substantially equal to the distance between the axes of the split bars 98. Desirably the bars 98 and shutters 99 may be of wooden construction so that each unit may be assembled by nails or screws fastening the two halves of the split bars and securing the shutter elements therebetween. A control rod 100 is positioned longitudinally through the center of the machine beneath the bars and shutters. This rod has flexible connections, such for example as the hooks and eyes indicated at 101, fastening it to corresponding marginal edge portions of each of the shutters 99 (see Figs. 3 and 10).

In normal position the shutters 99 have their flat sides disposed in a horizontal plane as shown by the solid lines of Fig. 3 so that a substantially closed bottom is provided for the bin of the machine. By movement of the control rod 100 to the right so that it is slightly lowered to the broken line position of Fig. 3, each of the shutters is pivoted on its split bar 98 to assume the broken line position shown, being thus held by the hooks and eyes 101 connected to the control rod 100. Movement of the rod to the left then pivots the shutters 99 to the horizontal position closing the bin. This back and forth movement of the control rod 100 is accomplished by a lever 102 secured to a shaft 103 extending across the machine and journaled in the uprights 1. Adjacent the rod 100 the shaft 103 has secured thereon a short lever 104 and a link 105 (Fig. 1), the latter being connected to the end of the control rod. Accordingly, during the operation of the machine as the bin becomes loaded with spent cleaning compound the latter may be released therefrom by a simple actuation of the lever 102 to dump the sawdust on the floor underneath the machine after which the shutters of the bin are closed and the machines may be continued in operation and the sawdust disposed of.

In loading the machine with articles to be cleaned, they are introduced into the tumbling drums 24 through a door of special construction, which is illustrated in Fig. 11. A number of the bars 32, instead of being secured in the previously described apertures or sockets in the end members 25 and abutting against the flanges 30 of the rims 29, have their extremities secured to segmental casing members 107. These casing members are disposed flatwise against the inner sides of the end members 25 and correspond in contour to the peripheral marginal edges thereof. A bayonet slot 108 is formed in corresponding opposite ends of each of the casing members and arranged to slide over one of the adjacent bars 31 which is secured in the end members 25. The opposite end of each of the casing members is notched to provide a finger portion 109 which engages one side of another bar 31 secured between the side members 25 of the drum, and a spring clip 110 on the casing member engages the opposite side of such bar 31 to retain the segmental casing member in position. When it is desired to remove the door from the tumbling drum the segmental casing members 107 are moved longitudinally so that one bar 31 slides to the end of the bayonet slot 108 releasing the finger 109 and spring clip 110 at the opposite end of the member which then allows the door to be pivoted out of position. The door is replaced by reversing the operation.

With the articles to be cleaned positioned in

the tumbling drums 24 the machine is operated in acordance with the following method:

Motor 48 is set in motion which rotates the sprocket wheels 21 carrying the tumbling drums back and forth across the top and bottom decks of the machine. During the travel of the drums across the upper deck they rotate in a clockwise direction and during their travel across the lower deck they rotate in a counterclockwise direction, as viewed in Fig. 1 and as previously described. Between each reversal in direction of rotation of the tumbling drum there is a gradual deceleration of rotational velocity which minimizes jerks and strains in the machine and prevents harmful scraping or abrasion of the articles being cleaned in the tumbling drum. The hopper 76 is filled with the wet cleaning compound of comminuted solid particles and the mechanism arranged so that at each passage of a tumbling drum beneath the chute 78 a quantity of the wet compound is permitted to drop by gravity therefrom between the openings of the tumbling drum bars onto the articles contained therein so that it is commingled with and worked around between the hairs of the fur, effecting an efficient and thorough cleaning thereof. As the tumbling of the articles within the drum continues some of the cleaning compound will dry and will become dislodged from the article being cleaned so that it falls from the drums and is received in the bin at the bottom. However, this loss of the cleaning compound is replenished each time the drum passes underneath the chute 78 so that at all times the articles are continuously supplied with a fresh quantity of cleaning compound. In this manner when the compound becomes dirty it is not repeatedly tossed around in the articles but is dislodged therefrom and comes to rest in the bin from which it may be removed as desired.

After a sufficient treatment of the articles with the wet cleaning compound the link 87 associated with the butter fly in he chute is disconnected from the pin on the lever 89 so that it hangs downward as shown by the broken line of Fig. 1, and movement of the tumbling drums past the corresponding cam roller 94 is ineffective to discharge more wet cleaning compound from the hopper 76. At the same time the link 87 associated with the butterfly 79 in the chute 77 is connected to its corresponding lever 89 so that dry cleaning compound, which has meanwhile been placed in the hopper 75, is deposited on the articles in the tumbling drums as each drum passes beneath the chute 77 at the starting end of the upper deck. During the operation of the machine with dry cleaning compound the latter is worked into and through the fibres of the furs so that a beneficial cleaning and glazing action is effected. Furthermore, moisture which has been received by the articles from the wet cleaning compound is absorbed by the dry cleaning compound taking the dirt and foreign particles with it so that a more thorough cleaning action is obtained than was possible with previous methods. As the tumbling with dry compound proceeds, particles thereof escape from the tumbling drums and fall into the bin at the bottom of the machine. However, a fresh supply is received at the commencement of each passage across the upper deck so that at all times an adequate quantity of the cleaning compound is commingled with the articles. Upon completion of the cleaning action with the continuous supply of fresh cleaning compound, both of the link elements 87 are disconnected so that no more cleaning compound is introduced into the machine. After a short period of operation in this fashion the particles are substantially freed of all of the solid particles of the cleaning compound and that which has collected in the bin at the bottom of the machine is dumped therefrom by actuation of the lever 104. While the rotation and tumbling of the drums 24 continues the clutch lever 70 is actuated to start the operation of blower 63 which then circulates a current of air through the interior of the machine and blows the remaining solid particles of cleaning compound from the articles being tumbled. The articles are then removed from the drums which are ready to receive another quantity and the cycle repeated.

In Figs. 17 through 21 is illustrated a modified construction of cleaning machine embodying the present invention. A number of details of construction of this modification correspond with features of the machine illustrated in Figs. 1 through 16 and have accordingly been indicated by the same numerals of reference. A single tumbling drum 24 replaces the plurality of drums used in the previous machine but may be of substantially the same construction. It is secured on a shaft 112 which replaces the stub shafts 27 and extends entirely across the machine, being journalled in brackets 114 supported on cross members 115 extending between the uprights 1 on opposite sides of the machine. The tumbling drum is driven by a motor 116 connected to a large pulley wheel 117 by a belt 118. This pulley wheel is secured on a shaft 119 (Fig. 19) journaled in upstanding brackets 120 supported by a shelf 121 at one end of the machine. Also supported by the brackets 120 is a mechanism for automatically reversing the direction of rotation of the tumbling drum 24 after a number of revolutions in each direction. Referring to Fig. 19, each of the brackets 121 has journaled therein a separate clutch sleeve (123 and 124 respectively) which axially receive shaft 119 for rotation therein. Also journaled in the brackets 120 is a threaded shaft 125 which is below and parallel with shaft 119. A gear 126 is secured on clutch sleeve 123 and meshes with a gear 127 secured on the threaded shaft 125. Similarly a gear 128 secured on the clutch sleeve 124 has driving engagement with a gear 129 secured on shaft 125, at the opposite end thereof from the gear 127, through an intermediate gear 130 journaled on a stub shaft carried by an extension of the bracket 120 which receives the clutch sleeve 124. A reciprocable clutch element 131 is received on the shaft 119 between the clutch faces on the ends of the clutch sleeves 123 and 124. This clutch element is arranged for sliding movement on the shaft 119 but is secured thereon against rotation so as to be driven by the motor 116. Circumferentially arranged teeth 132 are formed on opposite ends of the reciprocable clutch element 131 and the corresponding meeting faces on the ends of the clutch sleeves 123 and 124 to permit selective establishment of a driving connection between either the clutch element 123 and the shaft 119 or the clutch element 124 and the shaft 119.

The clutch sleeve 124 extends beyond the bracket 120 and has secured thereon a flanged coupling assembly, indicated at 133, which establishes a driving connection between the clutch element 124 and a shaft 134 (Fig. 18). This shaft 134 has its opposite end journaled in a bracket 135 secured to one of the uprights 1 and its extremity has secured thereon a small pulley

wheel 136 which receives a belt 138 and drives a large pulley wheel 137 carried by the shaft 112 of the tumbling drum. A threaded collar 140 is carried by the threaded shaft 125 and is positioned between the forks of a bifurcated spring plate 141 which has its lower end pivoted at 142 midway between the brackets 120. Pins or extensions 143 formed radially from the collar 140 are pivotally secured in bracket straps of the forks of the spring plate to secure the collar 140 against rotation on the shaft 125. The upper ends of the forks of the bifurcated spring plate have their inner edges received in a groove 144 formed circumferentially about the clutch element 131.

The distance between the toothed clutch faces of the sleeves 123 and 124 is greater than the length of the clutch element 131 so that the latter cannot be in engagement with both clutch sleeves simultaneously. When starting up the machine, if a driving connection does not exist between the clutch element 131 and one of the clutch sleeves such a connection may be established by manually drawing on handle portion 145 which extends across the upper extremities of the forks of the spring plates 141. The motor 116 is arranged to drive the large pulley wheel 117 on the shaft 119 in a clockwise direction as viewed in Fig. 17. With a driving connection between the clutch element 131 and the clutch sleeve 123 the threaded shaft 125 is rotated through the gears 126 and 127. This rotational movement is transmitted to the clutch sleeve 124 through the gears 128 and 129 and intermediate gear 130 so that the clutch sleeve 124 rotates on the shaft 119 in an opposite direction to the rotation of the shaft 119 caused by the motor 116. Through the coupling 133 this reverse rotation of the clutch sleeve 124 is transmitted to the shaft 134 which thus drives the tumbling drum 24 through the pulley wheels 136 and 137. Rotation of the shaft 125 causes longitudinal movement thereon of the threaded collar 140 which gradually moves from the left to the right as viewed in Fig. 19. This induces a clockwise pivotal movement of the spring plate 141 about the pivot 142 which tends to withdraw the clutch element 131 out of engagement with the clutch sleeve 123. However, the frictional engagement between the clutch teeth 132 resist this movement of the clutch element 131 so that the spring plate 141 is bowed. When the stress in the spring plate 141 is sufficient to withdraw the clutch element 131 from the clutch element 123 they separate with a snap action so that the clutch element 131 moves quickly across the intervening space between the clutch sleeve 123 and clutch sleeve 124, so that the latter sleeve is immediately engaged by the clutch element 131, establishing a direct drive between the shaft 119 and 134, which thus reverses the direction of rotation of tumbling drum 24. The threaded shaft 125 then rotates in the opposite direction to move the collar 140 to the left, as viewed in Fig. 19, and after several revolutions the clutch element is disengaged by the spring plate 141 from the clutch sleeve 124 and reengaged with the clutch sleeve 123. The cycle is then repeated automatically.

In order that this rapid reversal of direction of rotation of the shaft 134 will not be directly transmitted to the tumbling drum to cause a jerking of the latter and consequent deleterious or abrasive scrubbing action of the articles being cleaned, a friction drive is provided between the large pulley wheel 137 and the shaft 112 of the tumbling drum. Referring to Figs. 20 and 21, the pulley wheel 137 has a hub 146 carried by the shaft 112 and freely rotatable thereon. An annular cylindrical friction drum 147 is formed on the large pulley wheel and has an axis coinciding with the axis of the shaft 112. A brake shoe hub 148 is keyed on the shaft 112 adjacent the end thereof and has a sleeve portion which extends over the hub 146 of the large pulley 137 and within the cylindrical friction drum 147. Brake shoes 149 are pivoted to an extension 150 of the brake shoe hub 148 and urged into frictional engagement with the interior surface of the friction drum 147 by means of a compression spring 151. Accordingly, the drive between the large pulley 137 and the tumbling drum shaft 112 is through the medium of friction drum 147 and brake shoes 149. There is thus a gradual acceleration and deceleration in rotational velocity of the drum at each direction of rotation so that there are no objectionable strains exerted on the articles, and they are not violently agitated.

In this modification the fan 63 is driven by an independent motor 153 connected to the fan shaft by pulleys 154 and belt 155 and carried on cross members extending across the top of the machine. The fan housing 64 corresponds to that of the machine previously described, extending downwardly and communicating with the interior of the tumbling drum chamber formed by a casing or shell 156. The opening 65 adjacent the blower admits the air to be circulated through the tumbling drum chamber.

Disposed on opposite sides of the blower housing 64 are cleaning compound hoppers 157 and 158 which communicate with the tumbling drum chamber through chutes 159 and 160 respectively. Butterfly dampers 161 and 162 are positioned in the chutes 159 and 160 respectively to regulate the flow therethrough of the cleaning compound similarly to the action of the butterfly dampers 79 and 80 previously described. The damper 162 is secured on a shaft 163 extending through the chutes 159 and 160 and the blower hood 64. One extremity of this shaft extends beyond the uprights of the machine as shown in Fig. 18 and has secured thereon a cam lever 164. The butterfly damper 161 is secured on a tubular sleeve 165. This sleeve is concentric with and houses a portion of the shaft 163 and likewise extends beyond the uprights of the machine. At its extremity is secured a cam lever 166. Additional support is provided for the shaft 163 and tubular sleeve 165 by a cross member 167 carried between the uprights of the machine. Springs 168 extend between a stud secured in the cross member 167 and the cam levers 164 and 166 to normally retain the butterfly dampers 161 and 162 in chute closing position.

A short shaft 170 is secured in an upper portion of the shell 156 and extends beyond the uprights of the machine underneath and in parallel relation with the shaft 163 and tubular sleeve 165. This shaft carries a cam 171 rotatable in the same plane as the cam lever 166 and a cam 172 rotatable in the same plane as the cam lever 164. The cam 171 is secured to and rotates with a ratchet wheel 173 and the cam 172 is secured to and rotates with a ratchet wheel 174, both of the ratchet wheels being freely rotatable on the short shaft 170. Straddling the cams and ratchet wheels is a yoke 175 which has its ends pivoted on the shaft 170 and is connected by a link 176 to a lever 177 secured

on a projecting end of the tumbling drum shaft 112. Intermediate the ends of the yoke 175 a pair of pawls 178 are pivotally mounted on pins 179. One of the pawls is engageable with the ratchet wheel 173 and the other engageable with the ratchet wheel 174. During rotation of the tumbling drum 24 longitudinal reciprocatory motion is imparted to the link 176 by the lever 177 thus oscillating the yoke 175 about the shaft 170. This movement carries the pawls 178 back and forth circumferentially about the ratchet wheels 173 and 174 so that at each upward movement of the yoke the ratchet wheel engaged by a pawl is given a clockwise rotational movement as viewed in Fig. 17. This rotational movement is progressive and carries one of the cams past the corresponding cam lever on either the shaft 163 or tubular sleeve 165 thus momentarily opening the corresponding chute to permit the passage of the cleaning compound from the proper hopper into the cleaning chamber within the shell where it falls on the articles being tumbled in the drum 24. It is to be understood that during the cleaning operation only one of the pawls will be in engagement with one of the ratchet wheels and the other will be rotated out of operative position resting against the head of the yoke 175. In this manner the cleaning compound is selectively released from either the hopper 157 or the hopper 158 depending upon whether wet or dry cleaning compound is being used. The change from one type of cleaning compound to another may be made during continuous operation of the machine since one of the pawls 178 may be disconnected or connected with its corresponding ratchet wheel without stopping the operation of the machine. Also both pawls may be disconnected if desired and the fan or blower 63 commenced in operation.

A drop or dump bottom is provided in the shell 156 and comprises a pair of pivotally mounted doors 181 shown in open position by the broken lines of Fig. 17. These doors are pivotally mounted on shafts 182 extending across the bottom of the casing 156 marginally of the opening therethrough. Levers 183 and 184 are secured to the projecting extremities of these shafts and are tied together for synchronous movement by a link 185. The lever 184 is provided with an extension arm for manual manipulation of the dump door and an extended portion 186 of the arm receives a retractible pin 187 which is engageable with an aperture in an adjoining upright of the machine to hold the dump door 181 in closed position. A door 190 hinged at 191 is provided for the shell 156 to permit loading and unloading of the tumbling drum 24.

The operation of this modified form of cleaning machine embodying the present invention is similar to that of the multiple tumbling drum embodiment previously described. The tumbling drum 24 rotates first in one direction and then in another, being gradually decelerated and then accelerated between each reversal in direction of rotation. Wet or dry comminuted particles of cleaning agent or compound are released from the hoppers 157 and 158 in accordance with the setting of the pawls 178 so that fresh quantities of the cleaning compound are supplied through the openings in the tumbling drum to the enclosed articles being cleaned, as required, and to replace losses of the cleaning compound from the tumbling drum.

Various modifications in details of construction and design are contemplated and the embodiments illustrated and described above are given for purposes of description and explanation.

I claim:

1. A cleaning machine comprising a tumbling drum for holding articles to be cleaned, a plurality of openings through a peripheral wall of the drum, means for rotating the drum, means for blowing a current of air onto articles in the drum to dry the same, and means exterior of the drum for automatically dropping fresh cleaning compound of comminuted solid particles having a liquid entrained therein in a direction substantially parallel to the plane of rotation of the drum through the openings and onto articles in the drum.

2. A cleaning machine comprising a tumbling drum for holding articles to be cleaned, a plurality of openings through a peripheral wall of the drum, means for rotating the drum, means for blowing a current of air onto articles in the drum to dry the same, and means exterior of the drum for automatically dropping fresh cleaning compound of comminuted solid particles having a liquid entrained therein in a direction substantially parallel to the plane of rotation of the drum through the openings and onto articles in the drum, said blowing and drum rotating means actuated from a common shaft, and the blowing means arranged to be started and stopped without arresting the drum rotating means.

3. A cleaning machine comprising a tumbling drum for holding articles to be cleaned, a plurality of openings in the drum, means for rotating the drum, a hopper disposed above the drum for containing fresh cleaning compound of comminuted solid particles wetted by a suitable liquid cleaning agent and means for releasing a quantity of fresh cleaning compound from the hopper to fall by gravity into the drum through the openings, said releasing means including a member engageable with an element of the drum rotating means to periodically actuate the releasing means.

4. A cleaning machine comprising a tumbling drum for holding articles to be cleaned, a plurality of openings in the drum, means for rotating the drum, a plurality of hoppers disposed above the drum, means for releasing quantities of fresh cleaning compound from each hopper to fall by gravity into the drum through the openings, and means responsive to the movement of the drum for controlling the actuation of the releasing means.

5. A cleaning machine comprising a pair of endless chains mounted for parallel synchronous movement, each chain having an upper lap and a lower lap, a plurality of tumbling drums carried between the chains, means for rotating the drums in one direction while carried between the upper laps of the chains, means for rotating the drums in a reverse direction while carried between the lower laps of the chains, openings in the drums, and means for dropping solid comminuted particles of cleaning compound wetted by a suitable liquid cleaning agent into the drums through the openings during the movement of the drums over a portion of the path of the drums.

6. A cleaning machine comprising a tumbling drum for holding articles to be cleaned, a plurality of openings in the drum, means for rotating the drum first in one direction and then in a reverse direction, means for frictionally braking the rotational movement of the drum before

each reversal in direction of rotation, and means for dropping fresh cleaning compound of comminuted solid particles wetted by a suitable liquid cleaning agent through the openings and onto articles in the drum.

7. A cleaning machine comprising a pair of endless flexible members mounted for parallel synchronous movement, each member having an upper run and a lower run, a plurality of tumbling drums carried between the members, means for effecting rotation of the drums in one direction as they are carried by the upper runs of the members, means for effecting rotation of the drums in a reverse direction as they are carried by the lower runs of the members, and a curved member arranged to yieldingly engage each drum as it moves between the runs of the members to retard the rotation thereof.

8. A cleaning machine comprising a pair of endless flexible members mounted for parallel synchronous movement, each member having an upper run and a lower run, a plurality of tumbling drums carried between the members, upper track means arranged to engage the outer peripheries of the drums and to support the same and to effect rotation of the drums in one direction as the drums move over the upper runs of the flexible members, and lower track means arranged to engage the outer peripheries of the drums and to support the same and to effect rotation of the drums in a reverse direction as the drums move over the lower runs of the flexible members.

9. A cleaning machine comprising a pair of endless flexible members mounted for parallel synchronous movement, each member having an upper run and a lower run, a plurality of tumbling drums carried between the members and having openings in their peripheries, means for rotating the drums as they are advanced by the endless members, the drums carried by the lower runs of the members passing beneath the drums carried by the upper runs of the members, a hopper for cleaning compound above the upper runs of the flexible members, a valve in the hopper, and means for actuating said valve in response to movement of a drum to release a quantity of cleaning compound from the hopper to fall by gravity into a drum through the peripheral openings in the drum, and the drums arranged so that cleaning compound released through the openings in the drums carried between the upper runs of the endless members falls by gravity through the peripheral openings in drums carried between the lower runs of the members.

10. A cleaning machine comprising a tumbling drum for holding articles to be cleaned, a plurality of openings in the drum, means for rotating the drum, a hopper disposed above the drum for containing fresh cleaning compound of comminuted solid particles wetted by a suitable liquid cleaning agent, means for releasing a quantity of fresh cleaning compound from the hopper to fall by gravity into the drum through the openings, said releasing means including a member engageable with an element of the drum rotating means to periodically actuate the releasing means, and means closely underlying said drum for catching and retaining the cleaning compound.

11. A cleaning machine comprising a pair of endless flexible members mounted for parallel synchronous movement, each member having an upper run and a lower run, a plurality of tumbling drums carried between the members and having openings in their peripheries, means for rotating the drums as they are advanced by the endless members, the drums carried by the lower runs of the members passing beneath the drums carried by the upper runs of the members, a hopper for cleaning compound above the upper runs of the flexible members, a valve in the hopper, means for actuating said valve in response to movement of a drum to release a quantity of cleaning compound from the hopper to fall by gravity into a drum through the peripheral openings in the drum, the drums arranged so that cleaning compound released through the openings in the drums carried between the upper runs of the endless members falls by gravity through the peripheral openings in drums carried between the lower runs of the members, and means closely underlying said lower runs for catching and retaining the cleaning compound.

NICHOLAS V. HAGOPIAN.