United States Patent

Hetman et al.

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[54] **DEVICE FOR AUTOMATICALLY CLEANING A WINDOW SASH**

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[21] Appl. No.: **22,527**

[52] **U.S. Cl.** **15/302,** 15/4, 15/77, 15/309, 134/64

[51] **Int. Cl.** **A47l 1/02**

[58] **Field of Search**.....15/4, 21 D, 21 E, 21 R, 77, 15/88, 102, 302, 303, 306–309, 312 R; 134/64

[56] **References Cited**

UNITED STATES PATENTS

3,178,745	4/1965	Kleebauer	15/77
3,098,250	7/1963	Creech	15/17
1,617,833	2/1927	Armstrong	15/77 X
2,282,628	5/1942	Whann et al.	15/77 X
1,739,593	12/1929	Inglefield et al.	15/306 A
3,018,503	1/1962	Hijiya et al.	15/77
3,060,477	10/1962	Wechsler	15/77

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[57] **ABSTRACT**

A device for automatically cleaning a window sash or the like which includes a support having a housing mounted thereon, operable mechanism mounted on the support for transporting a window sash upon the support and through the housing, together with means for guiding the sash through the housing, operable mechanism carried by the support for cleaning the sash by means of a liquid as it is transported upon the support and through the housing and means for collecting the liquid used for cleaning.

14 Claims, 17 Drawing Figures

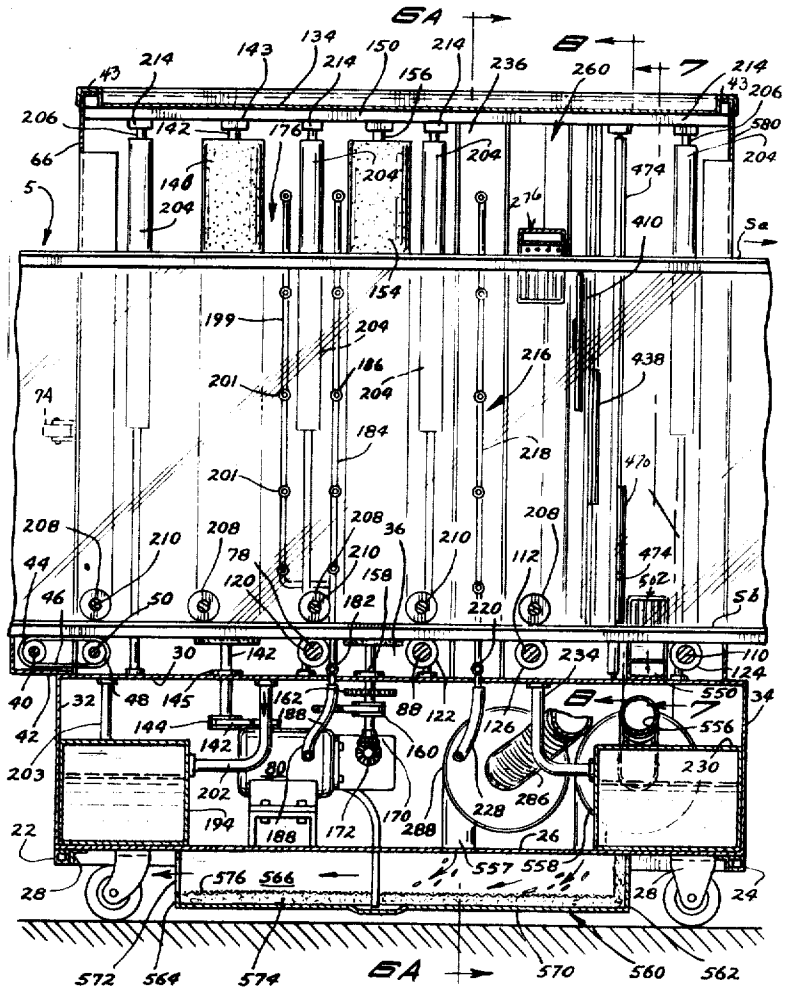
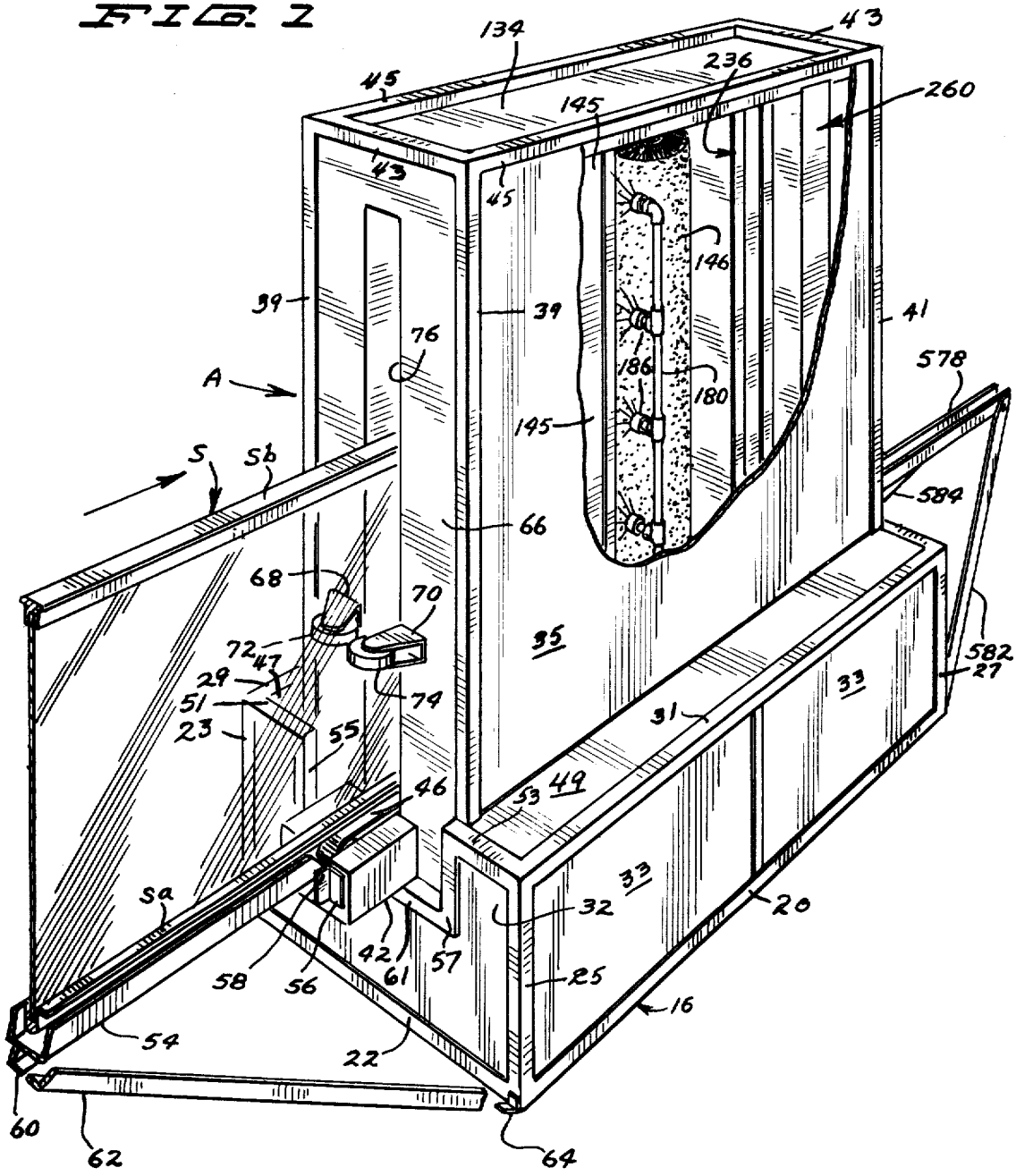


FIG. 1



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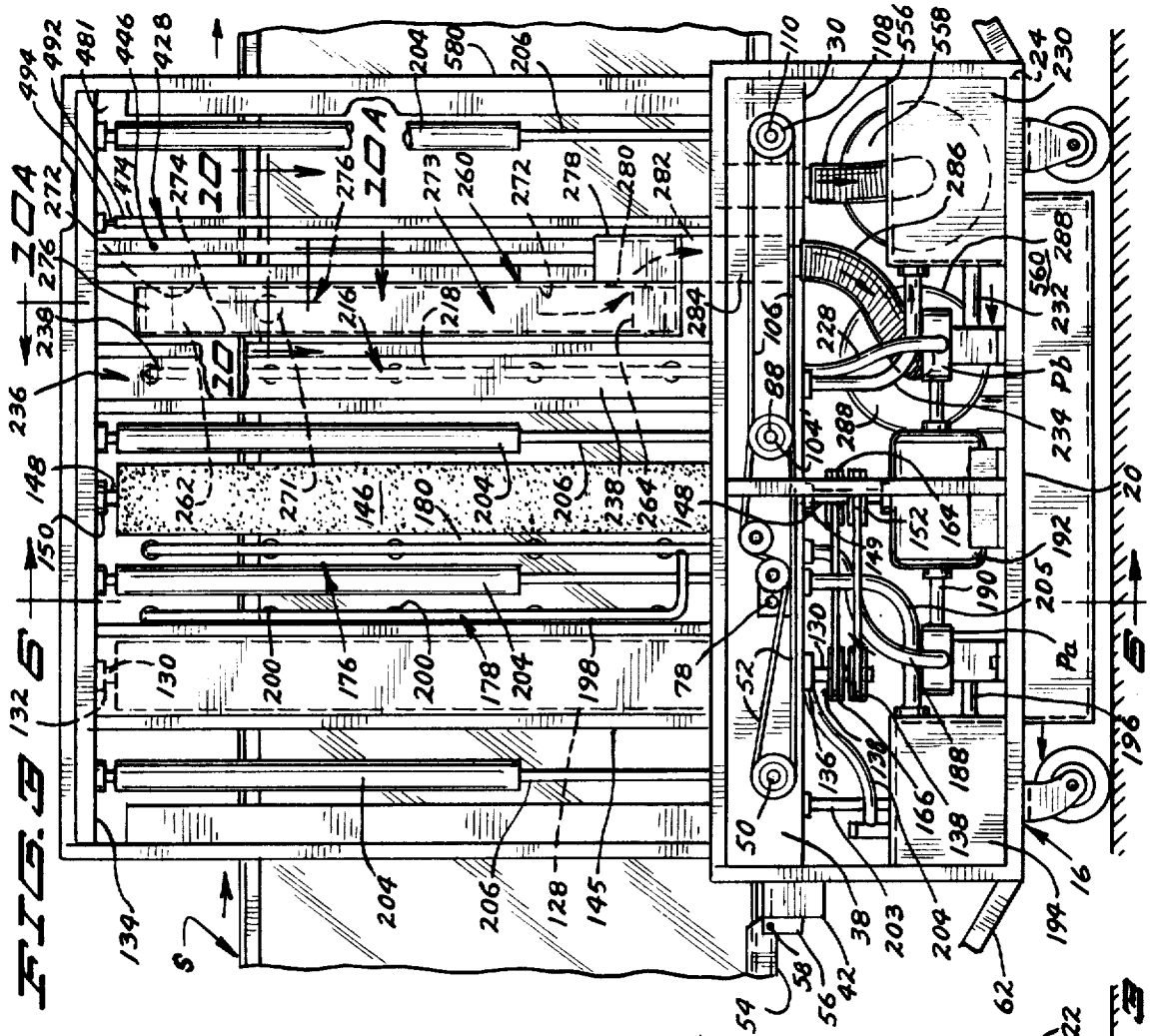

FIG. 3

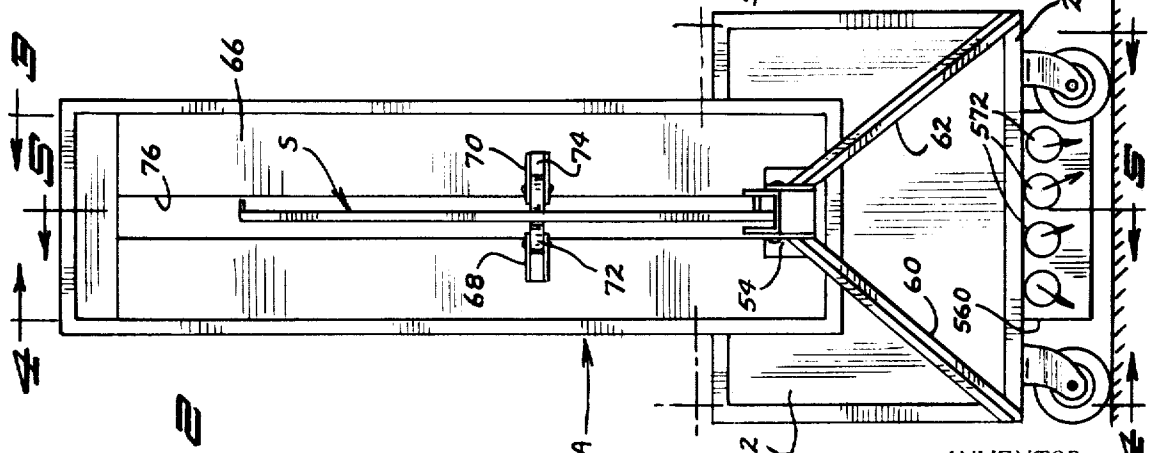

FIG. 2

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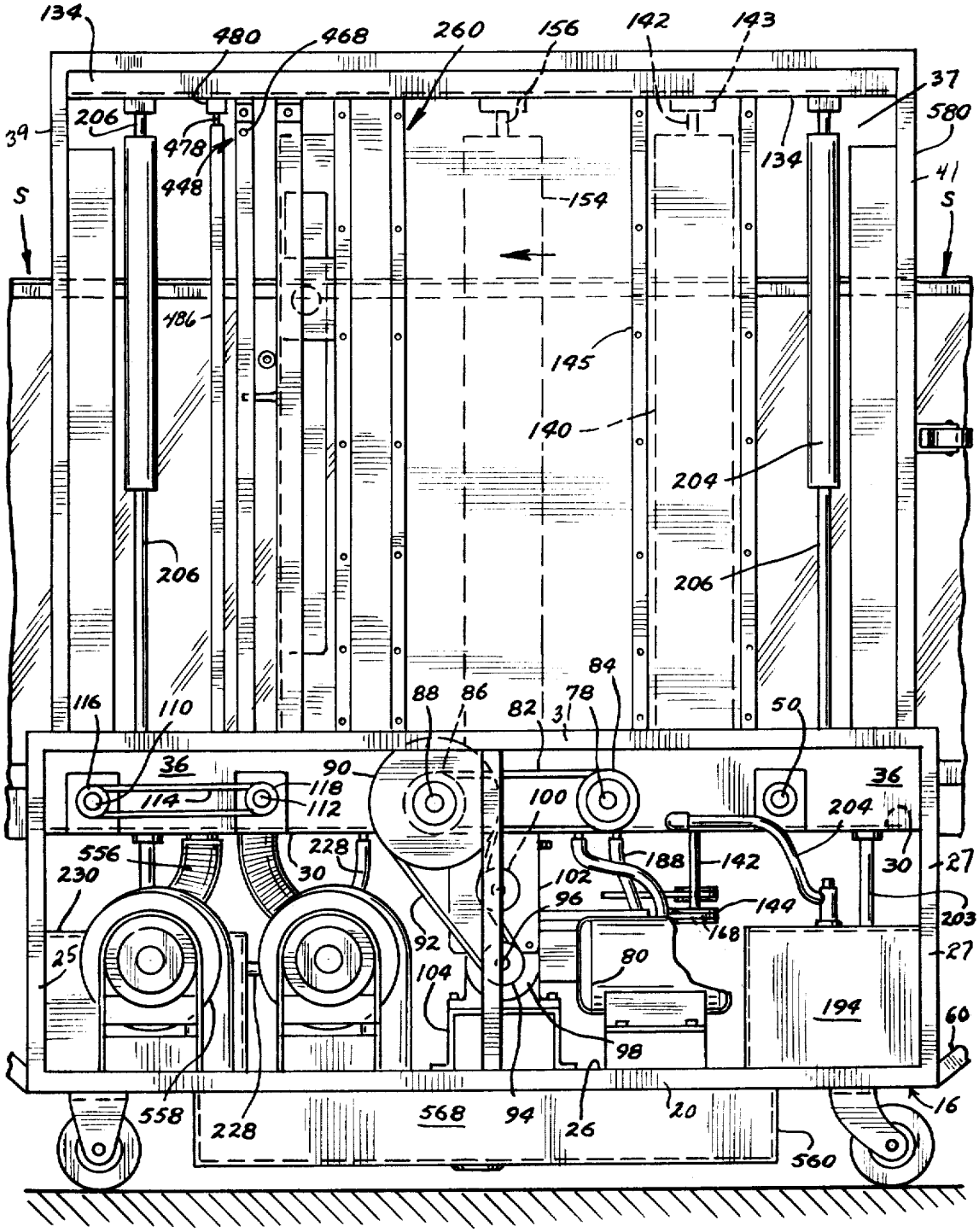

FIG. 4

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FIG. 5

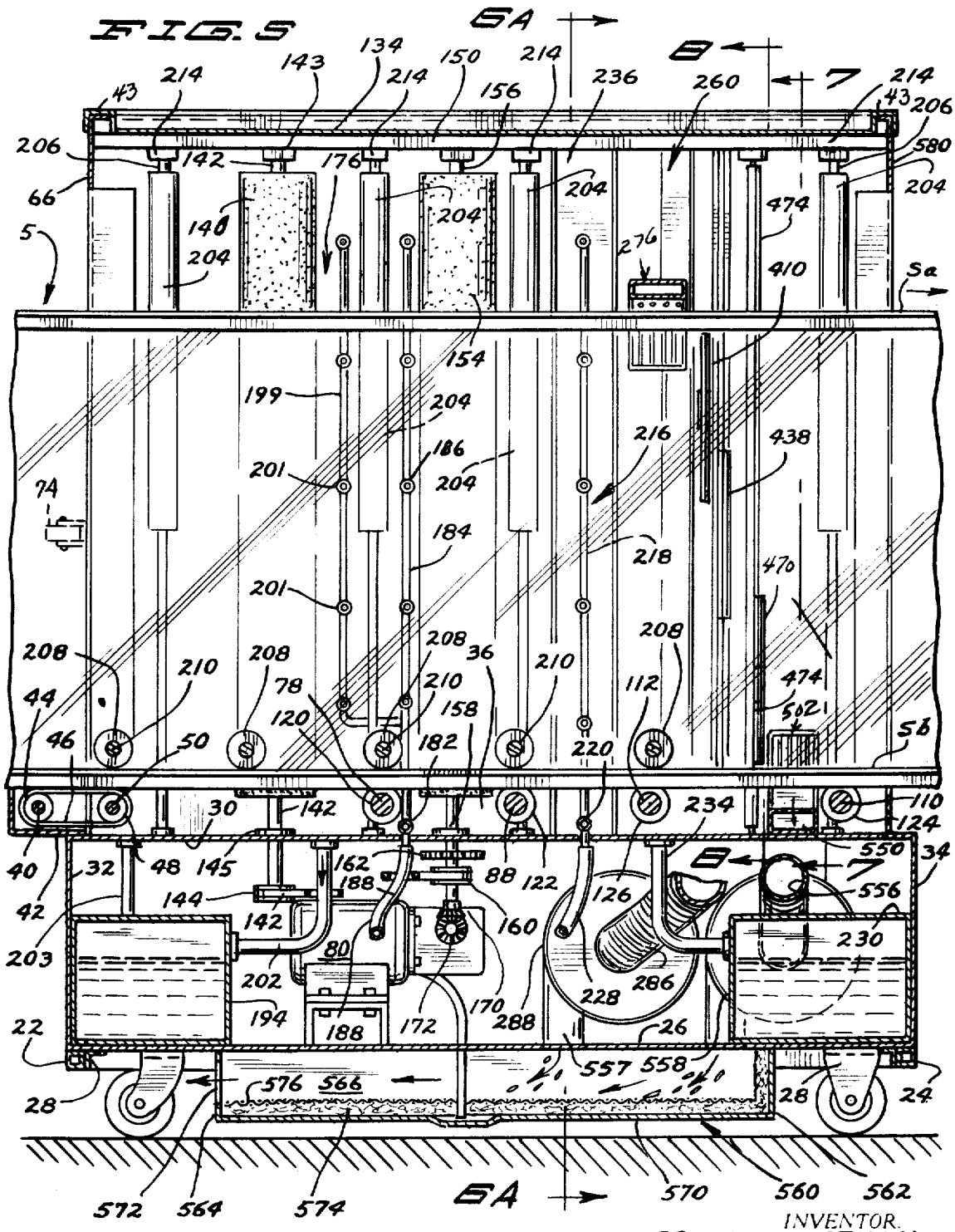

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FIG. 6

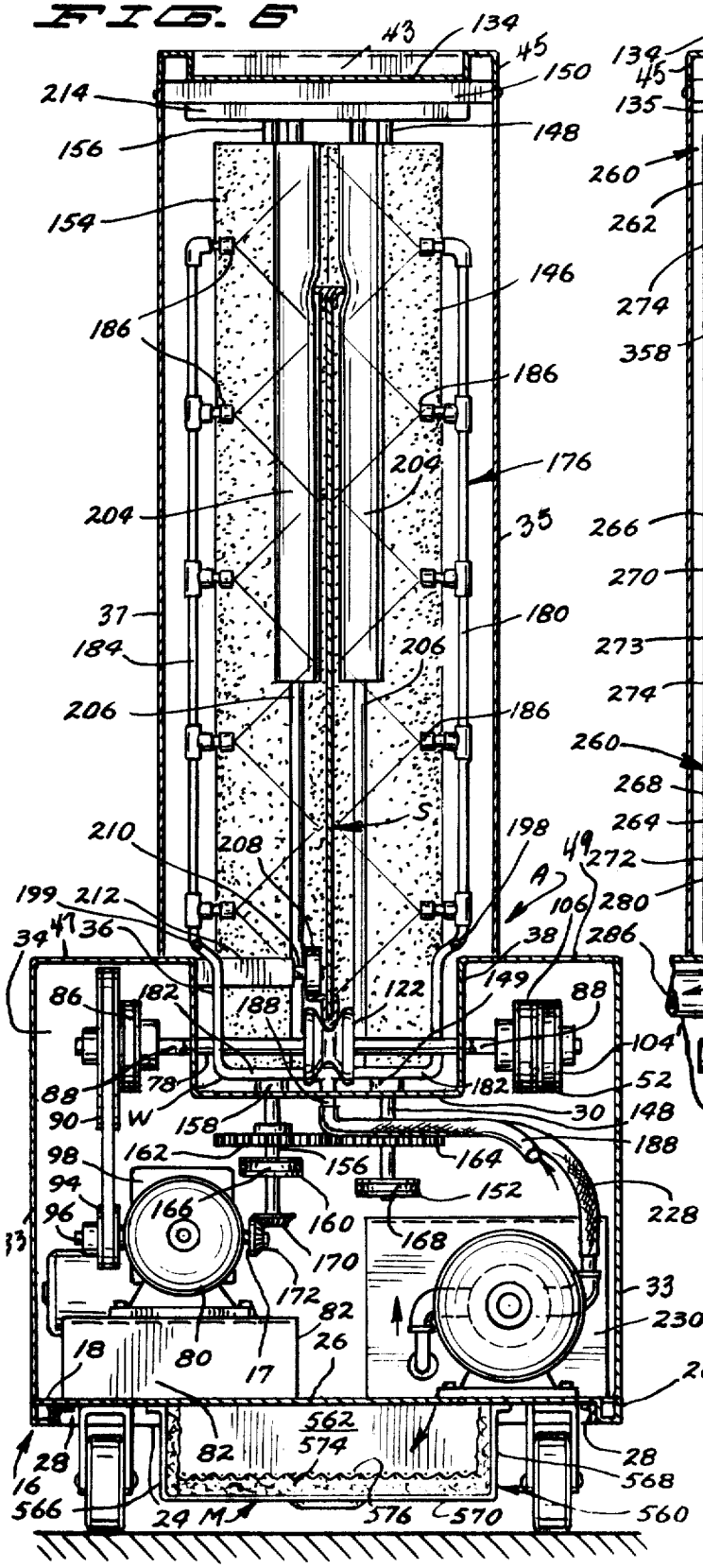

FIG. 7

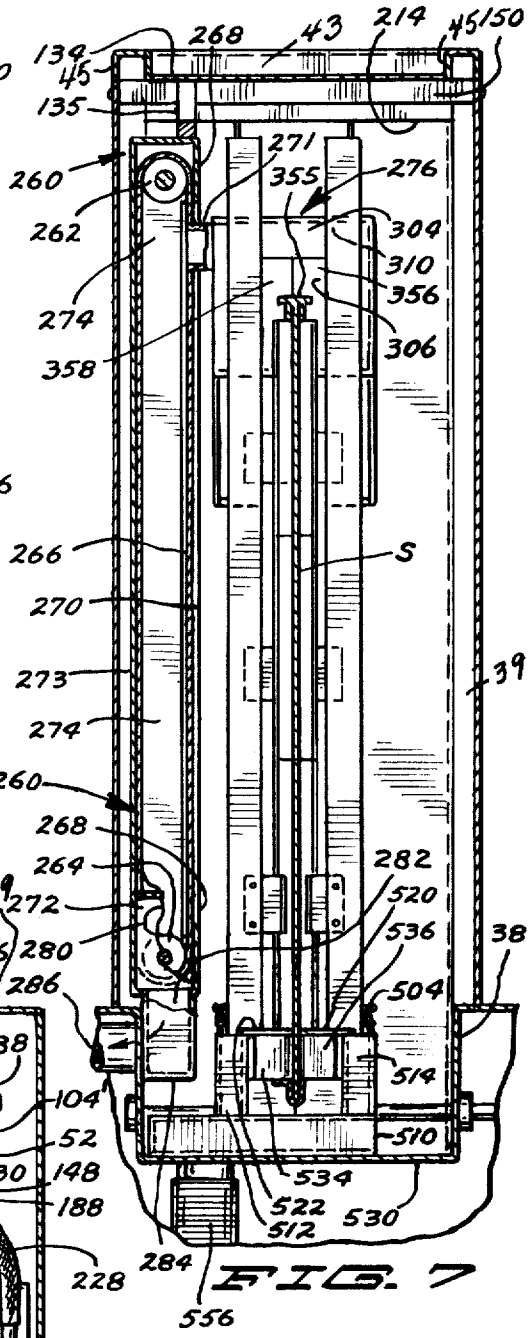

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FIG. 8

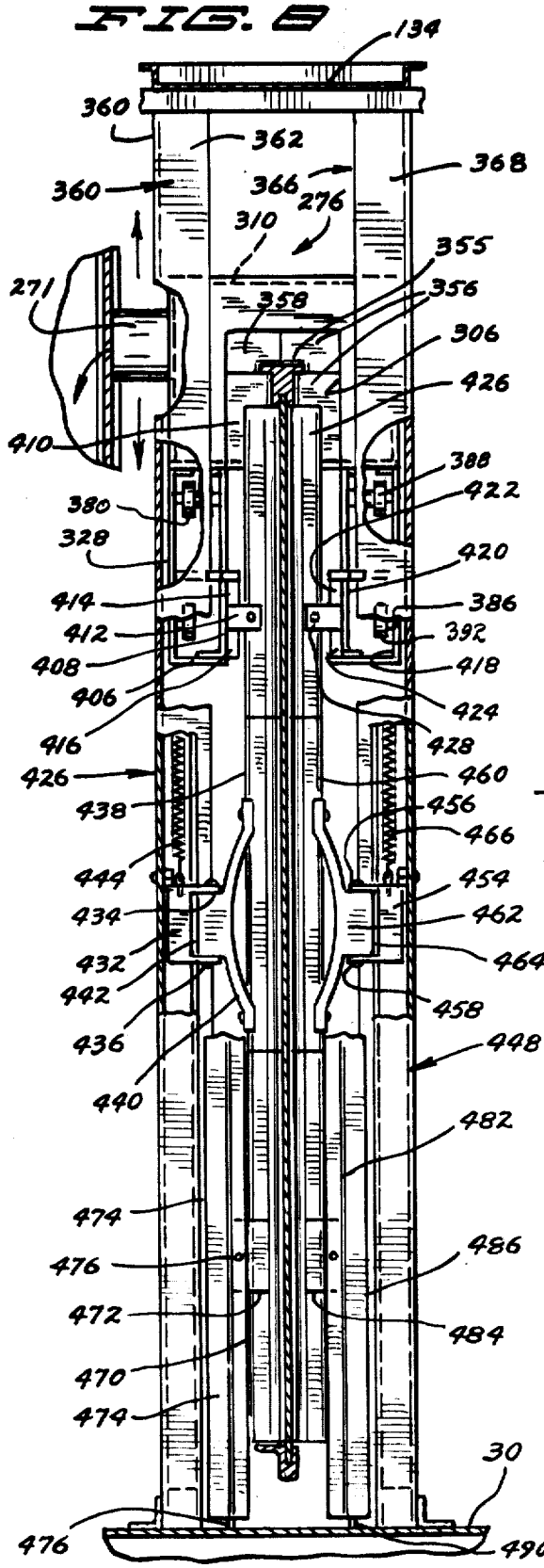
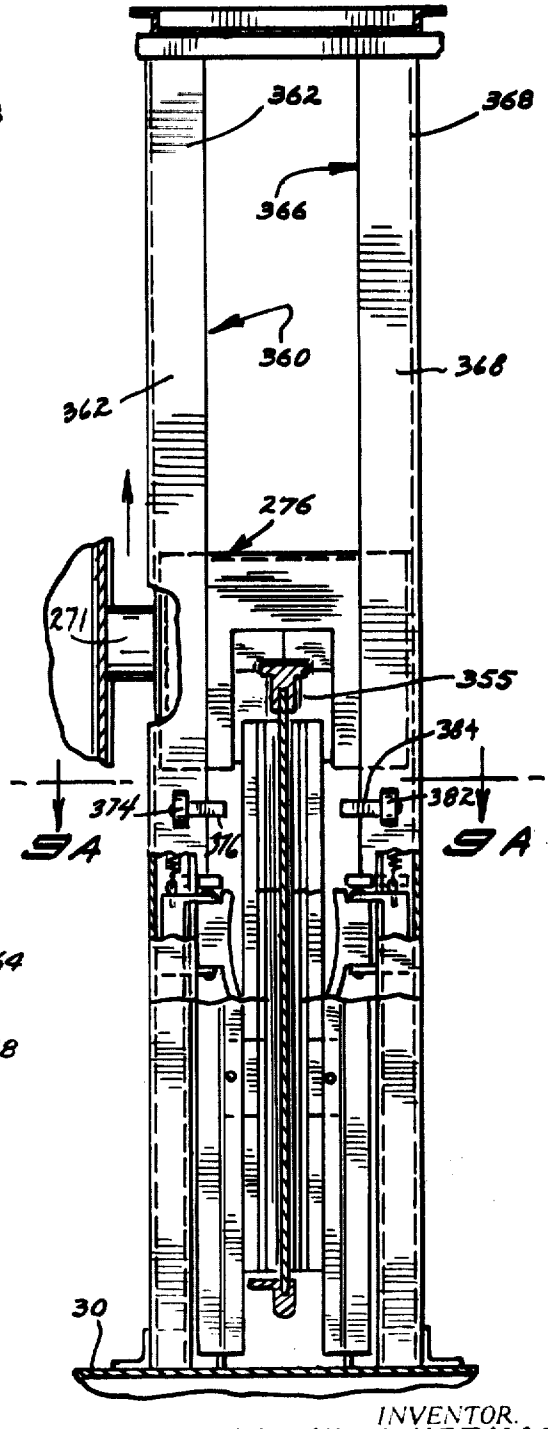


FIG. 9



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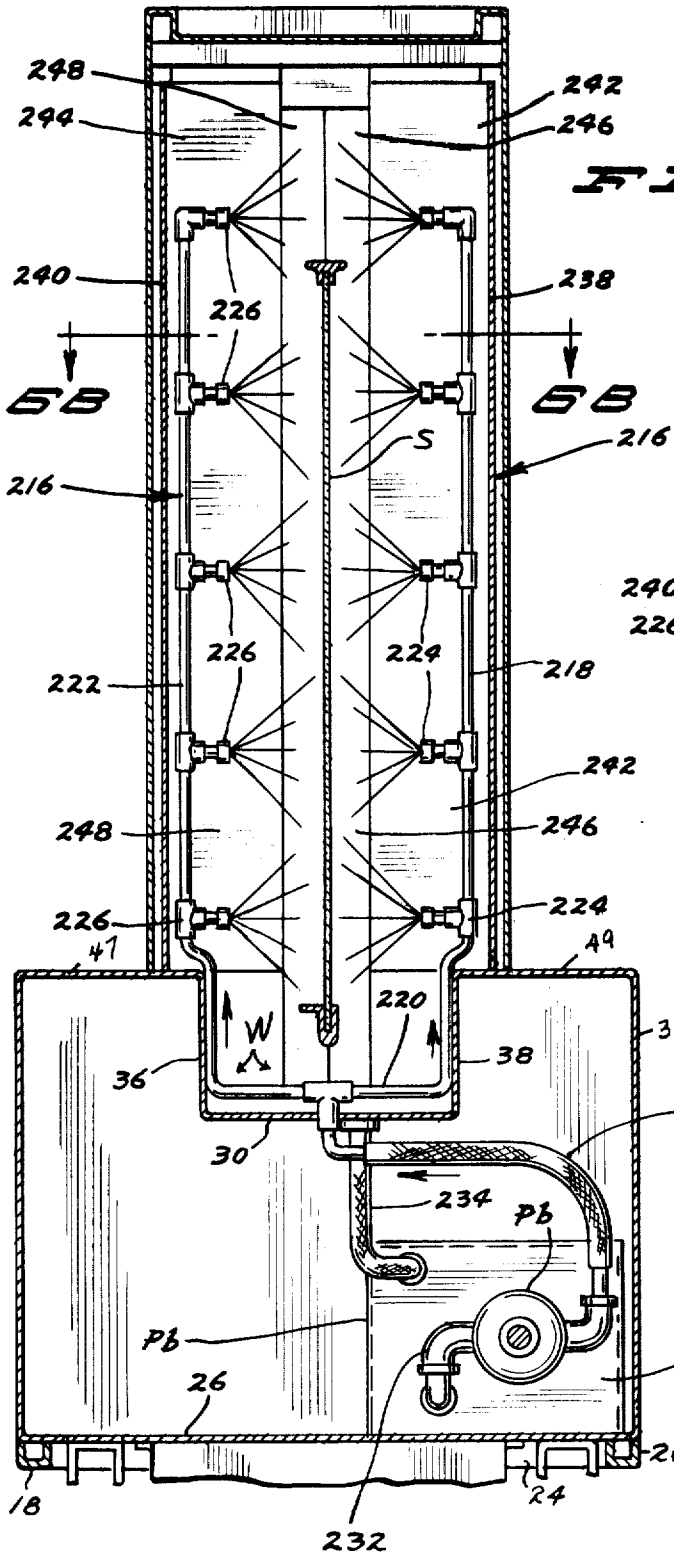

FIG. 6A

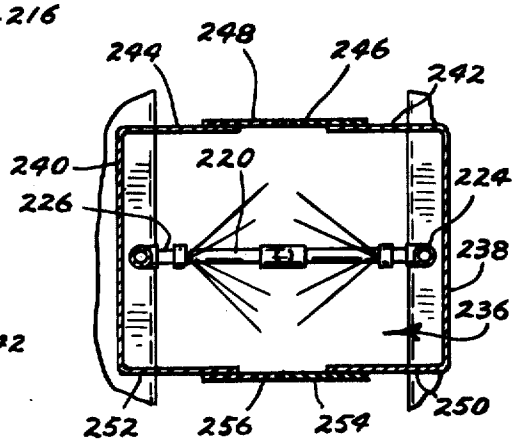

FIG. 6B

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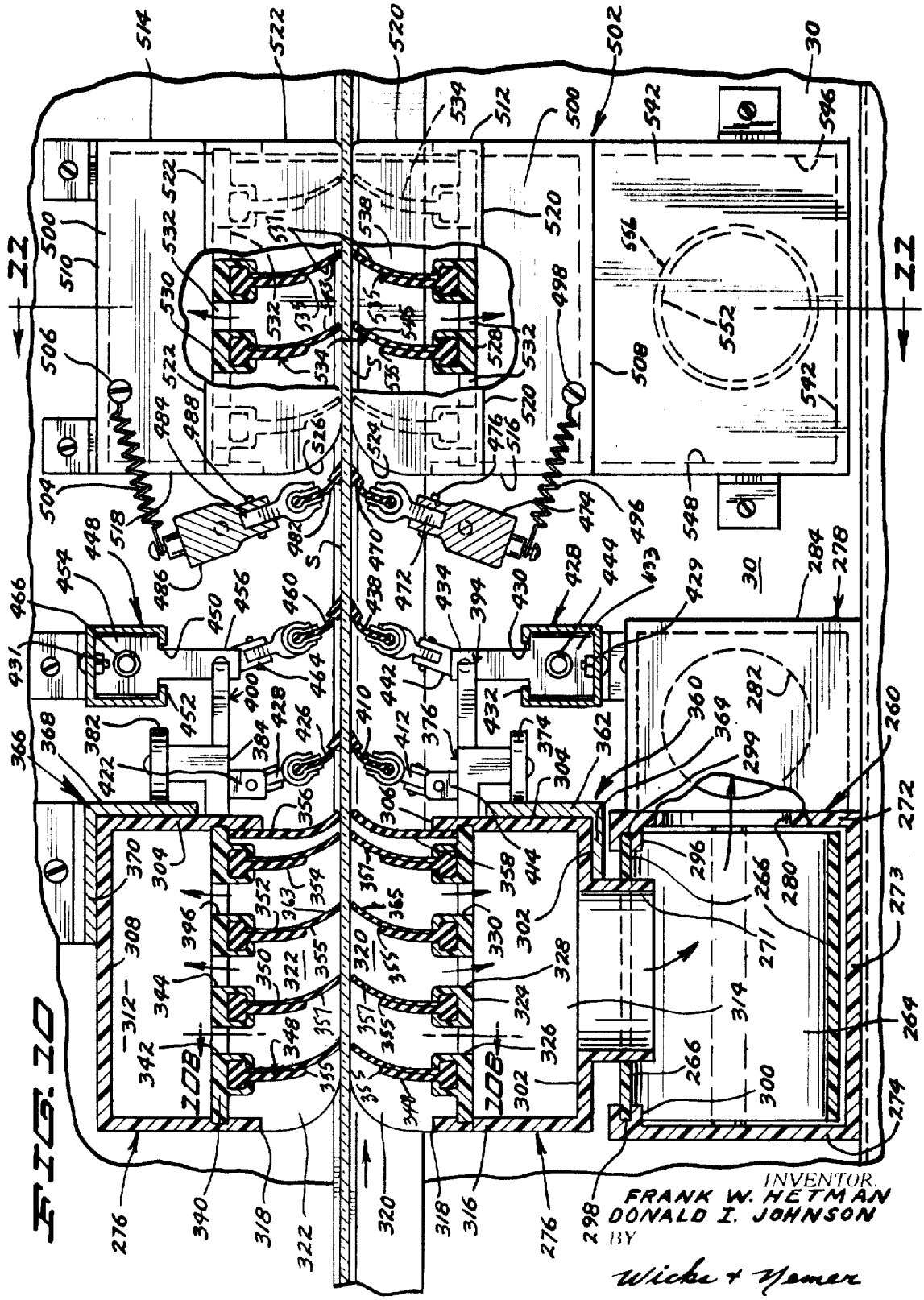

FIG. 20

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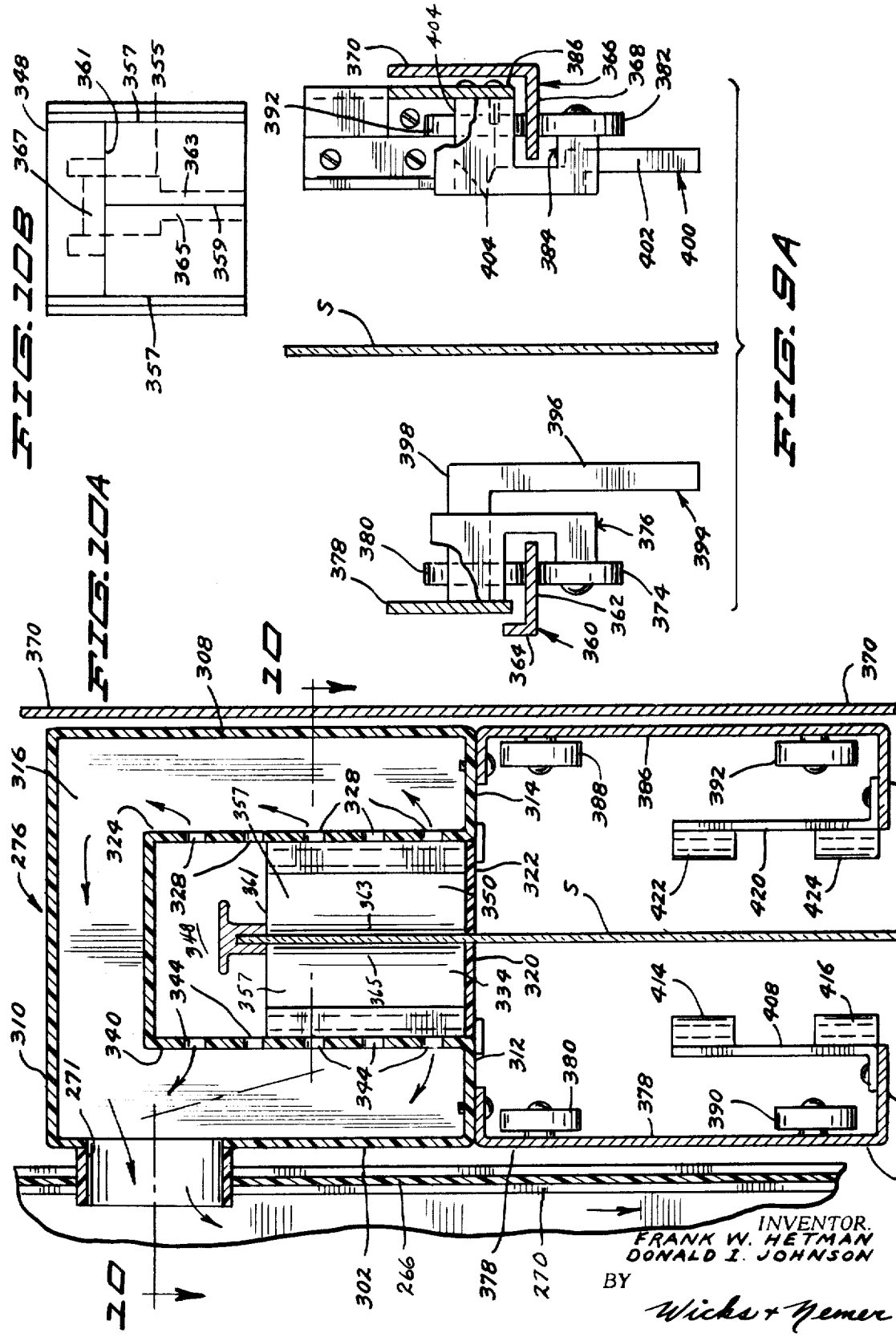
FIG. 2A
FIG. 2B
FIG. 2C
FIG. 2D
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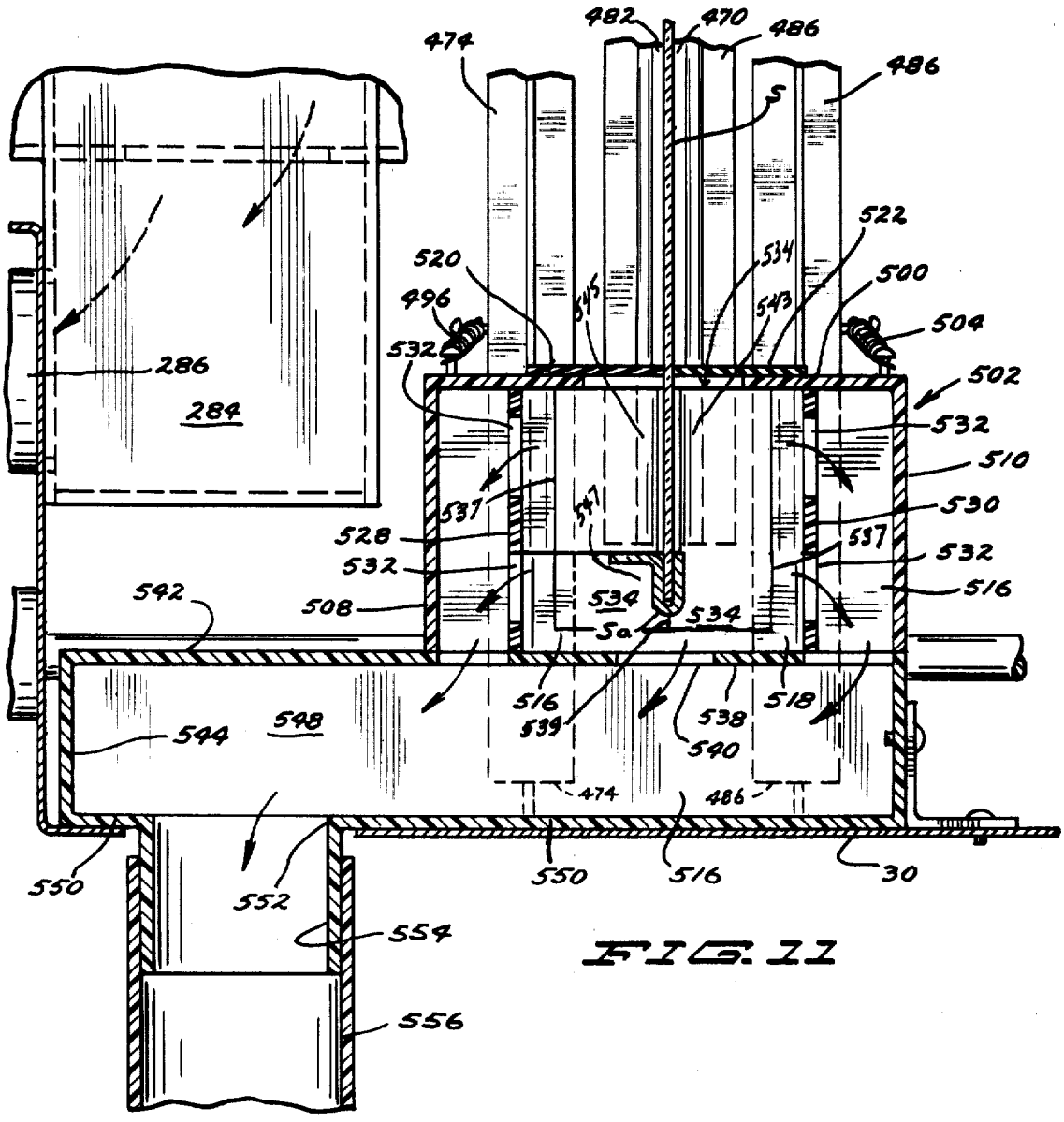

FIG. 11

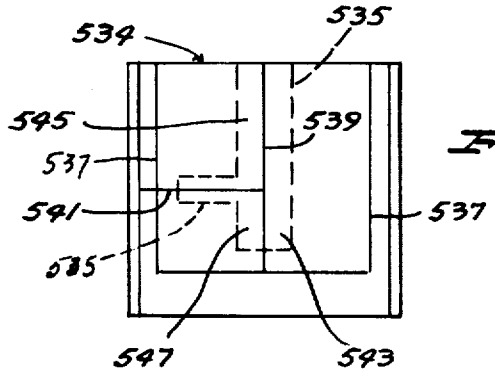

FIG. 11A

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DEVICE FOR AUTOMATICALLY CLEANING A WINDOW SASH

SUMMARY OF THE INVENTION

The invention relates to an improvement in devices for cleaning a window sash and more particularly to a device for automatically cleaning a sash as the same is caused to move through the device. The device includes mechanism for removing foreign material from the sash and the frame thereof including the application of a fluid, the rinsing of the sash, removal of the fluid and means for vacuuming fluid from the frame of the sash together with means for collecting the fluid used to clean the sash all of which is done as the sash is caused to move through the device.

In the drawings forming part of this application:

FIG. 1 is a perspective view of a window sash washing machine embodying the invention with a sash shown in the initial position of entry into the machine, a portion of a side wall being broken away.

FIG. 2 is a rear end view of the machine at which end the sash is inserted.

FIG. 3 is a longitudinal sectional view on the line 3—3 of FIG. 2.

FIG. 4 is a longitudinal sectional view on the line 4—4 of FIG. 2.

FIG. 5 is a longitudinal sectional view on the line 5—5 of FIG. 2.

FIG. 6 is a transverse sectional view on the line 6—6 of FIG. 3 looking towards the front of the machine.

FIG. 6a is a section on the line 6*a*—6*a* of FIG. 5.

FIG. 6b is a section on the line 6*b*—6*b* of FIG. 6*a*.

FIG. 7 is a transverse sectional view on the line 7—7 of FIG. 5, looking toward the rear of the machine.

FIG. 8 is a transverse sectional view on the line 8—8 of FIG. 5 looking toward the rear of the machine with portions broken away and the wiper blades positioned to accommodate the widest possible sash.

FIG. 9 is a sectional view similar to FIG. 8 but with a smaller window sash shown and the wiper blades accommodating the same in different positions relative to FIG. 8.

FIG. 9a is a section on the line 9*a*—9*a* of FIG. 9.

FIG. 10 is a sectional view on the line 10—10 of FIG. 10*a*.

FIG. 10*a* is a sectional view on the line 10*a*—10*a* of FIG. 3.

FIG. 10*b* is a view of a wiper blade on the line 10*b*—10*b* of FIG. 10 with the sash removed.

FIG. 11 is a sectional view on the line 11—11 of FIG. 10.

FIG. 11*a* is a detailed view of a wiper blade of the lower vacuum box removed therefrom.

Referring to the drawings in detail, the sash washing machine A includes the bottom frame member 16 formed of the longitudinal tubular side members 18 and 20 connected at the ends by the transverse tubular end members 22 and 24. Secured to the bottom frame members is the bottom plate 26 with the securing thereof done by means of angle members such as 28.

Further provided is the horizontal pan 30 which extends from the lower front wall 32 to the lower rear wall 34 and which is supported by and connected to the vertical longitudinal walls 36 and 38. The walls 36 and 38 together with the pan 30 form a well W.

The numeral 40 designates a shaft mounted on the extension 42 of the pan 30 particularly FIGS. 5 and 1. The shaft 40 has mounted thereon the gear 44 upon which the toothed belt 46 is mounted. The belt 46 is also mounted on the gear 48 mounted on the drive shaft 50. The shaft 50 is driven by the belt 52, the operation of which will be hereinafter described. The belt 46 initially receives the window sash S for progression of the same through the machine A.

Mounted on the ends of the transverse end member 22 is a pair of upright support members 23 and 25 which support the lower front wall 32. A further pair of upright support members 27 are mounted on the end member 24 which support the lower rear wall 34. Additional upper longitudinal side members 29 and 31 are provided which are connected to the members 23, 25, and 27. Lower side panels 33 on both sides of the device are supported by the members 23, 25, and 27 together with members 20 and 22. The numerals 35 and 37 designate upper side panels connected to the pairs of upright supports 39 and 41 connected at the top ends by cross members 43 and top side members 45. The walls 36 and 38 of the well W are connected to spaced horizontal top walls 47 and 49. The lower ends of the upright supports are connected to the inner ends of the short transverse members 51 and 53, and the members 51 and 53 are connected to the short vertical supports 55 and 57 defining the ends of the well W with the lower ends of the supports 55 and 57 connected with a central support 61. The construction is the same at both ends.

Further provided is the sash receiver channel 54 which is pivotally connected at its inner end to the bracket 56 by pin 58 mounted on the outer end of the extension 42. The outer end of the sash receiver channel 54 is supported in a horizontal position by two identical legs 60 and 62 pivotally connected at the outer ends to the channel 54 and each removably placed at its lower end upon a stop 64 extending outwardly from the ends of the end member 22. Thus, when the channel 54 is pivoted upwardly to a vertical position, the legs may be pivoted and placed alongside the channel for storage and against the upper rear wall 66. Mounted on the rear wall 66 are a pair of brackets 68 and 70 each of which carries a roller 72 and 74, respectively, the rollers adapted to guide a sash S centrally into the vertical receiving slot 76 formed in the upper rear wall 66.

The numeral 78 designates a first transverse shaft journaled in and extending between the longitudinal walls 36 and 38, particularly FIGS. 3, 5, and 6. The shaft 78 is driven by the motor 80 mounted on the support 82 mounted on the bottom plate 26, the driving connection including the belt 82 mounted on a pulley 84 on shaft 78 and pulley 86 secured to a second transverse shaft 88 journaled in the walls 36 and 38. Also, secured to shaft 88 and alongside pulley 86 is the pulley 90 which mounts belt 92, belt 92 also mounted on pulley 94 mounted on shaft 96 of gear reducer 98 operated by the motor 80. The idler pulley 100 mounted on the bracket 102 secured to the gear reducer 98 controls the tension of the belt 92. The gear reducer 98 is mounted on the support 104 mounted on the bottom plate 26.

The shaft 88 drives the shaft 78 through belt 82 and the shaft 50 through the belt 52 placed on pulleys

thereon, there being a double pulley **104'** on shaft **88**, particularly FIGS. **3** and **6**. A belt **106** is placed on double pulley **104'** and upon pulley **108** of a third transverse shaft **110** journaled in the walls **36** and **38** of the well W adjacent the front end thereof, FIGS. **3**, **4**, and **5**.

A fourth transverse shaft **112** is journaled in the wall **36** and a bearing mounted on the pan **30** with the shaft **112** between the shafts **88** and **110**. The shaft **112** is driven by a belt **114** mounted on pulley **116** on shaft **110** and on a pulley **118** on shaft **112**. Each of the shafts **78**, **88**, **110**, and **112** has mounted thereon a V-groove drive rollers **120**, **122**, **124**, and **126**, respectively, the formation of each of the pulleys best shown in FIG. **6** where pulley **122** is shown in detail. The driven rollers **120**, **122**, **124**, and **126** transport the sash S through the machine together with the toothed belt **46**, the sash being guided to the belt **46** and the transport rollers by the channel **54**.

CLEANING BRUSHES

Further provided is a first vertical cleaning brush **128** mounted on shaft **130**. The top end of shaft **130** is journaled in block **132** secured to the top plate **134**, and the lower end of the shaft is journaled in the bearing **136** on the pan **30** with the shaft extending below the pan, FIG. **3** particularly. Mounted on the lower end of the shaft **130** is the pulley **138**. The numeral **140** designates a second vertical cleaning brush mounted on shaft **142** as a companion for brush **128**, FIGS. **4** and **5**. The top end of the shaft **142** is journaled in a block **143** similar to block **132**, which is secured to the top plate **134**. The lower portion of the shaft **142** is journaled in a bearing **145** on the pan **30** as in the case of shaft **130** with shaft **142** extending below the pan. Mounted on the lower end of the shaft **142** is the pulley **144**. The brushes **128** and **140** are enclosed in the housing **145**.

The numeral **146** designates a third vertical cleaning brush mounted on shaft **148**. The top end of shaft **148** is journaled in a bearing block **150** secured to the top plate **134**. The lower end of the shaft **148** is journaled in the bearing **149** on pan **30** with the shaft extending below the pan **30**. Mounted on the lower end of the shaft **148** is the pulley **152**.

A fourth vertical cleaning brush **154** is provided as a companion brush to brush **146**, and brush **154** is mounted on shaft **156**. The upper end of shaft **156** is journaled in block **150**, and the lower end of shaft **156** is journaled in bearing **158** on pan **130**, FIG. **6**. The lower end of shaft **156** extends below the pan **30** and mounted on the lower end is the pulley **160**. Also mounted on the lower end of the shaft **156** and above pulley **160** is the spur gear **162**. The spur gear **162** engages the gear **164** mounted on the lower end of the shaft **148** of brush **146**. A belt **166** is positioned on pulley **138** of brush shaft **130** and also on pulley **160** of brush shaft **156**. Further a belt **168** is positioned on pulley **144** of shaft **142** and pulley **152** of shaft **148**.

Shaft **156** of brush **154** is driven at its lower end by means of bevel gear **170** thereon engaging bevel gear **172** on shaft **174** of gear reducer **98**.

Thus, as shaft **156** is rotated by gears **170** and **172** shaft **148** is rotated through gears **162** and **164**. Shaft **148** rotates shaft **142** through belt **168** and shaft **156** rotates shaft **130** through belt **166** whereby all four brushes: **128**, **140**, **146**, and **154**, are rotated. The pulleys mounted on the lower ends of the brush shafts **130**, **142**, **148**, and **156** are vertically staggered so that the belts **166** and **168** bypass each other.

SPRAY MECHANISM AND SASH GUIDE ROLLER

The numeral **176** designates a main spray apparatus adjacent the third and fourth cleaning brushes **146** and **154** with auxiliary spray apparatus **178** adjacent cleaning brushes **128** and **140**. The apparatus **176** includes the first vertically disposed pipe **180** positioned adjacent brush **146**. The lower end of pipe **180** terminates in the right angle transverse portion **182**. The transverse portion **182** terminates in the second vertically disposed pipe **184** which is parallel to pipe **180**. Each of the pipes **180** and **184** has mounted thereon the nozzles **186** which point inwardly of the machine and upon a sash progressing through the machine. Centrally of the transverse pipe **182** is connected one end of the cleaning fluid supply line **188** which is connected at the other end of the pump Pa driven off shaft **190** of motor **192**. The pump Pa draws a liquid supply from tank **194** through line **196** and pumps it to the pipes **180** and **184** and out nozzles **186** thereof and closely adjacent rollers **146** and **154**. A first take-off auxiliary pipe **198** is connected at its lower end to supply pipe **180** at its lower portion and is closely adjacent first cleaning brush **128**, pipe **198** mounting spray nozzles **200** which point inwardly of the machine and upon a sash progressing through the machine A. A second take-off auxiliary pipe **199** is connected at its lower end to supply pipe **184** at its lower portion and is closely adjacent first brush **128**, pipe **199** mounting nozzles **201**. Auxiliary pipe **199** is a companion to auxiliary pipe **198**.

Water or cleaning fluid deposited onto and collected by pan **30** from the various spray nozzles drains from the pan **30** down drain outlet **202** connected to tank **194**, FIG. **5**. Pan **30** is further drained by drain line **203** leading into tank **194** and a drain line **204** leading from the bottom of housing **145** at the pan to the tank **194**, FIGS. **4** and **5**.

To guide the sash S through the device A there is provided a multiplicity of elongated and vertically disposed rollers **204** mounted on shafts **206**. The length of the rollers **204** is such that the frame of a sash positioned as the upper thereof as it goes through the machine will be guided by the rollers within a wide range of widths of sashes. The lower frame of the sash S as it goes through the machine rides on the rollers **120**, **122**, **124**, and **126** particularly as shown in FIGS. **5** and **6**. Further positive guiding of the sash S through the machine by contact with the lower frame is accomplished by a multiplicity of vertically disposed spaced hold down rollers **208** mounted on horizontal shafts **210** connected to supports **212** connected to wall **36**, particularly FIG. **6**. The upper ends of the shafts **206** mounting guide rollers **204** are journaled in blocks **214** secured to top **134** with the lower ends of shafts **206** journaled on the pan **30**.

A further spray mechanism **216** for rinsing is provided which includes the first vertically disposed pipe **218** which terminates at its lower end in the transverse pipe portion **220**, particularly FIGS. **5** and **6***a*. The pipe portion **220** terminates at its other end in the second vertically disposed pipe **222**. Each of the pipes **218** and

222 is fitted with spray nozzles 224 and 226, respectively. A liquid supply line 228 extends up through the pan 30 and connects with the transverse pipe portion 220, particularly FIG. 6*a*. The supply line 228 is connected to and leads from the pump P*b*, and the pump Pb conducts fluid from the tank 230 by means of line 232. Cleaning fluid from the nozzles 224 and 226 of the rinsing mechanism 216 is drained off by means of the drain line 234 leading into tank 230. Thus the pump Pb draws cleaning fluid from supply tank 230 and delivers to nozzles 224 and 226 through line 228. The fluid is returned from pan 30 to tank 230 by means of drain line 234 leading from the pan to the tank, particularly FIG. 3. The spray mechanism 216 is enclosed within a rinse chamber 236 which includes the identical side walls 238 and 240 connected to and extending upwardly from the pan 30 and pan walls 38 and 36, respectively.

The rinse chamber 236 further includes transverse forward spaced wall portions 242 and 244 disposed at right angles to and connected to the side walls 238 and 240. The inner edge of the forward wall portion 242 has mounted thereon the forward rubber flap 246, and the inner edge of the forward wall portion 244 has mounted thereon the companion forward rubber flap 248. The inner edge of the flap 246 lies in abutment with the inner edge of the flap 248 to thereby releasably close off the forward end of the rinse chamber 236, particularly FIG. 6*a*. The rear end of the rinse chamber 236 is releasably closed off by the transverse rear spaced walls 250 and 252 disposed at right angles to and connected to the side walls 238 and 240. The rear walls 250 and 252 extend upwardly from the pan 30 and are secured at the top ends to the top plate 134. The inner edge of the rear wall portion 250 has mounted thereon the rear rubber flap 254, and the inner edge of the rear wall portion 252 has mounted thereon the companion rear rubber flap 256.

The rinse chamber 236 thus consists of the side walls 238 and 240, the forward spaced wall portions 242 and 244 together with rubber flaps 246 and 248 and the rear spaced wall portions 250 and 252 together with the rubber flaps 254 and 256, all of said members extending between the pan 30 and the top plate 134. The rear rubber flaps allow a sash, such as S, to enter the rinse chamber 236 due to the deflection of the flaps, and the rear flaps maintain linear contact with the sash so that rinse spray from the rinse nozzles 224 and 226 does not get out of the rinse chamber. Similarly the forward flaps allow a sash to exit from the rinse chamber due to the deflection of the flaps, and the forward flaps maintain linear contact with the sash so that rinse spray from the nozzles 224 and 226 does not get out of the rinse chamber. It will also be seen that rinse spray from the rinse nozzles will not escape from the rinse chamber when the nozzles are operating although no sash is caused to enter or exit from the rinse chamber 236.

ADJUSTABLE VACUUM DEVICE FOR UPPER FRAME OF SASH

The numeral 260 designates an elongated enclosed chamber mounted at its upper end to the top plate 134 by bracket 135 and adjacent rinse chamber 236, FIGS. 3, 5, and 7. Mounted in the upper end of the chamber 260 is the roller 262 and mounted in the lower end is the roller 264. Positioned on the rollers 262 and 264 and within the chamber 260 is the flexible belt 266. The inner wall 268 of the chamber 260 is formed with the elongated open slot 270 which faces inwardly of the machine, particularly FIG. 7. Secured to the belt 266 and communicating with the interior confines of the belt and between chamber front wall 272 and chamber rear wall 274 is the vacuum inlet mouth 271 of top vacuum manifold box 276. The belt 266 is substantially sealed off at its side edges due to the proximity of the side edges to the chamber walls 272 and 274. Secured to the front and rear walls 272 and 274 is the outer wall 273. Secured to the lower end of the chamber 260 is the upper air transfer box 278, particularly FIGS. 3, 7, and 10, which covers the outlet hole 280 formed in the wall 272 of chamber 260, FIGS. 3, 7, and 10. The transfer box 278 has a hole 282 formed in the bottom which communicates with the lower transfer box 284. Secured to and communicating with the lower end of the lower transfer box 284 is the flexible conduit 286 connected to the exhaust fan 288, FIGS. 7 and 3. The suction flow of air from vacuum manifold box 276 through chamber 260, upper transfer box 278, lower transfer box 284 and conduit 286 is shown by arrows in FIG. 3.

The vacuum manifold box 276 is slidably positioned so that the upper frame of the sash S passes therethrough and water remaining on the frame of the sash S positioned upwardly is vacuumed off due to the partial vacuum created in the box 276. The inlet mouth 271 of the box 276, FIGS. 10 and 10a is secured to the extends through the belt 266 which is slidably mounted in the slot 294 formed in the extension 296 of the forward wall 272 of chamber 260. The belt 266 is also slidably mounted in the slot 298 formed in the extension 300 of the rear wall 274.

Referring again to FIGS. 10 and 10*a* the top vacuum box 276 further includes the first side wall 302 in which is formed the inlet mouth 271, and connected to the first side wall is the front wall 304 formed with the opening 306. A second side wall 308 is connected to the front wall 304 together with the top wall 310 and the spaced bottom wall portions 312 and 314. The rear wall 316 of the box 276 is formed with the opening 318, FIG. 10. Secured to the bottom of the vacuum box 276 are the horizontal rubber flaps 320 and 322 which are extensions of the spaced bottom portions 312 and 314, FIGS. 10 and 10*a*. Mounted internally of the box 276 is the first internal vertically disposed wall 324 formed with the series of air transfer openings 326, 328, and 330. Further included in the box 276 is the second internal vertically disposed wall 340 formed with the air transfer openings 342, 344, and 346 and secured to and extending between 324 and the internal walls 340 are the rubber wiping blades 348, 350, 352, and 354, all of which are identical and shown in detail in FIG. 11a. Secured to the front wall 304 of box 276 at the opening 306 are the opposed and mating rubber exit flaps 356 and 358. Each of the wiper blades 348, 350, 352, and 354 is formed with a cut out 355 shown in broken lines, particularly FIG. 10*b*. The outline of the cutouts is substantially the cross-section configuration of the frame S*b* of the sash S so that the frame Sb can pass through

the wiper blades with a wiping action and a partial vacuum maintained upon the frame Sb itself and a portion of the glass of the sash S adjacent the frame, particularly FIGS. 7, 8, 9 and 10*a*. Each of the blades such as **348** has a sheet of thin rubber **357** secured thereon and covering the cutout **355**. The sheet portion **357** is formed with the vertical slit **359** and the horizontal slit **361** which forms thin flap portions **363**, **365** and **367** between the edges of the cutout **355** and the mating edges of the flaps. The edges of the thin flap portions **363**, **365** and **367** deflect and wipe the edges of the frame portion S*b* as it is passed through the blades such as **348**. The contact of the edges of thin flap portions upon the frame Sb and a small portion of the sash S also aid in maintaining a partial vacuum on the frame and sash.

The numeral **360** designates a first vertically disposed track mounted on its lower end on pan **30** and formed of an angle construction including the first leg **362** and the second leg **364**, FIGS. **8**, **9** and **9***a*. A second vertically disposed track **366** is mounted on its lower end on pan **30** which is formed of an angle construction including the first leg **368** and the second leg **370**. The vacuum box **276** is positioned for sliding operation in the tracks **360** and **366** with the wall **304** of the box against the legs **362** and **368** of the tracks **360** and **366**, respectively, and the side walls **302** and **308** against the legs **364** and **370**, respectively, FIGS. **9***a* and **10**.

Thus it will be seen that as the vacuum manifold box **276** is slidably moved in the tracks **360** and **366** to accommodate the frame of a sash a partial vacuum is maintained via mouth **271** which moves with the belt **266** so that no matter at what vertical position the vacuum box is placed there is a partial vacuum therein for removal of liquid from a sash frame of a sash passed therethrough.

The top vacuum manifold box **276** is further guided in its sliding movement upon tracks **360** and **366** by means of a first roller **374** mounted on bracket **376**, the bracket **376** connected to a first vertical strap member **378**, FIGS. **9***a* and **10** in particular. The roller **374** bears against the leg **362** of track **360** with the wall portion of box **276** adjacent the inner surface of track **360** best shown in FIG. **10**. The first strap **378** is connected to and depends from the bottom portion **314** of box **276**, particularly FIGS. **9***a* and **10***a*. Mounted directly on the inner surface of strap **378** is a second and upper roller **380** which engages the inner surface of leg **362** of track **360** to guide the box **276** along with roller **374** upon the track **360**.

Additional guiding mechanism for the vacuum box **276** is a second roller **382** mounted on bracket **384**, the bracket connected to a second vertical strap member **386**, FIGS. **9a** and **10** in particular. The roller **382** bears against the leg **368** of the track **366** with the wall portion of box **276** adjacent the inner surface of leg **368** of track **366**. The second strap **386** is connected to and depends from the bottom portion **312** of box **276**, particularly FIGS. **9***a* and **10***a*. Mounted directly on the inner surface of strap **386** is a third and upper roller **388** which engages the inner surface of leg **368** of track **366** along with roller **382** upon track **366**. Mounted on first strap **378** is a lower roller **390** and on second strap **386** a lower roller **392**, the lower roller **390** engaging leg **304** of track **360** and lower roller **392** engaging leg **368** of track **366**.

The first strap **378** mounts a first horizontal stop bar **394** formed of a first leg portion **396** and a right angle second leg portion **398**, the leg portion **398** connected at its inner end to the first strap **378**. Further provided is a second horizontal stop bar **400** formed of a first leg portion **402** and a right angle second leg portion **404** connected at its inner end to the second strap **386**. The function of the stop bars **394** and **400** carried by the slidable and adjustable vacuum box **276** will be hereinafter described.

THE UPPER WIPER BLADES

The lower end of the strap **378** has connected thereto the right angular support **406** to which is secured to upright support **408** on which is pivotally mounted the upper wiper blade **410**, FIGS. **10** and **10***a* in particular. The blade **410** has the lug **412** thereof pivotally mounted between spaced ears **414** and **416** on support **408**, particularly FIGS. **10** and **10***a*. The lower end of the strap **386** has connected thereto the right angular support **418** to which is secured the upright plate **420** which mounts the spaced ears **422** and **424**, FIGS. **10** and **10***a*. The upper wiper blade **426** has the lug **428** thereof pivotally mounted between spaced ears **422** and **424** on upright plate **420**. Thus the upper pair of wiper blades **410** and **426** pivotally carried by and adjustable with the vertically adjustable top vacuum manifold box **276**.

THE INTERMEDIATE WIPER BLADES

Further provided is the first vertical channel track **428** which has a rectangular cross section with the slot **430** formed in the inner wall **432** thereof. Slidably positioned in the track **426** is the block **433** which has extending inwardly thereof the upper ear **434** and the spaced lower ear **436**, FIGS. **8** and **10**. The numeral **438** designates a first intermediate wiper blade formed with bow portion **440** from which extends the lug **442** pivotally mounted between the ears **434** and **436** of the slidable block **432**. The block **433** and wiper blade **438** thereon is urged upwardly by a relatively weak spring **444** connected upwardly by a relatively weak spring **444** connected at its lower end to the top end of the block **432** and at its upper end to a pin **446** secured within the upper end of the track **428**, FIG. **3**.

A second vertical channel track **448** is provided which has a rectangular cross section with the slot **450** formed in the inner wall **452** thereof. Slidably positioned in the track **448** is the block **454** which has extending inwardly thereof the upper ear **456** and the spaced lower ear **458**. The numeral **460** designates a second intermediate wiper blade formed with a bow portion **462** from which extends the lug **464** pivotally mounted between the ears **456** and **458**. The block **454** and wiper blade **460** thereon is urged upwardly by a relatively weak spring **466** connected at its lower end to the top end of the block **454** and at its upper end to a pin **468** secured within the upper end of the track **448**, particularly FIGS. **8** and **4**.

THE LOWER FIXED WIPER BLADES

The numeral **470** designates a first lower wiper blade having the support block **472** pivotally connected to the pivoted elongated vertical bar **474** by pin **476**, particularly FIGS. **8** and **10**. The elongated vertical bar **474** is pivoted on its lower end by pin **476** mounted on the pan **30** and on its upper end by pin **478** mounted in block **480** connected to top plate **134**. A second lower wiper blade **482** is provided having the support block **484** pivotally connected to the pivoted elongated vertical bar **486** by pin **488**. The elongated vertical bar **486** pivoted on its lower end by pin **490** mounted on pan **30** and on its upper end by pin **492** mounted in block **480** connected to top plate **134**, FIG. **3**. The first vertical bar **474** is pivotally urged with the blade **470** towards and upon the sash S by means of the spring **496** connected to the vertical bar **474** and the anchor pin **498** secured to the top **500** of the lower vacuum box **502**, particularly FIG. **10**. The second vertical bar **486** is pivotally urged with the blade **482** towards and upon the sash S by means of the spring **504** connected to the vertical bar **486** and the anchor pin **506** secured to the top **500** of the lower vacuum box **502**, particularly FIGS. **10** and **11**.

Referring particularly to FIGS. **10** and **11**, the lower vacuum box **502** further includes the side walls **508** and **510**, the spaced partial front walls **512** and **514** and the spaced partial rear walls **516** and **518**. The top **500** includes the spaced inner horizontal thin rubber portions **520** and **522** the inner edges of which lie adjacent each other and between which the glass of the sash S passes. The rubber top portions **520** and **522** have formed at the rear entrance portions the radii **524** and **526** to facilitate the passage of the sash glass therebetween.

Internally of the lower vacuum box **502** are the spaced intermediate walls **528** and **530** each formed with a multiplicity of air transfer holes **532**, FIGS. **10** and **11**. Secured to the walls **528** and **530** are a multiplicity of vertical wiper blades **534**, FIGS. **10** and **11***a*. The blades **534** are substantially identical to the blades **348**, **350**, and **352** in construction but with a cutout **535** shown in broken lines the configuration of which is the same as the cross-section of the frame S*b*, particularly FIG. **11***a*. The blade **534** has a sheet of rubber **537** secured thereon and covering the cutout **535**. The sheet portion **537** is formed with the vertical slit **539** and the horizontal slit **541** which forms this flap portions **543**, **545**, and **547** between the edges of the cutout **535** and the mating edges of the flaps. The edges of the thin flap portions **543**, **545**, and **547** deflect and wipe the edges of the frame portion Sa as it is passed through the blades **534**. The contact of the edges of the thin flap portions upon the frame Sb and a small portion of the sash S also aid in maintaining a partial vacuum in the frame and sash.

The numeral **550** designates a base bottom wall for the box **502**, the walls **546** and **548** and short end wall **544**, FIGS. **10** and **11**. The base wall **550** is mounted on the horizontal pan **30**. The bottom wall **550** has formed therein the outlet hole **552** with the tube portion **554** connected to and extending downwardly therefrom. The tube portion **554** has connected thereto the conduit **556** connected to the suction fan face **558** mounted on the bottom plate **26**, particularly FIGS. **11**, **3**, **4**, and **5**. The conduit **557** extends through the bottom plate **26** and exhausts into the water collector muffler M having housing **560** connected to and depending from the bottom plate **26**. The water collector muffler housing includes the end walls **562** and **564** and the side walls **566** and **568** and the bottom wall **570**. The end wall **564** has a multiplicity of outlet holes **572** formed therein, FIGS. **2** and **5**, for exhaust of the air from suction fans **288** and **558**. The suction fan **288** connects with the collector housing **560** as does the suction fan **558**. The fans direct moisture into the housing **560**.

Positioned on the bottom **570** of collector muffler housing **560** and the side walls **566** and **568** thereof is the sound deadening sheet material **574** which may be of the plastic foam material. Positioned on top of the sheet material is a thin plastic sheet material **575** to prevent liquid from going into the sheet material **574** and positioned on top of the sheet material **574** upon the bottom **570** is the sheet screen piece **576**. A sump line **577** extends into muffler **560** and a conventional pump, not shown, which pumps the liquid into tank **195** from the housing **560**.

OPERATION OF THE WIPER BLADE ASSEMBLY AND TOP VACUUM MANIFOLD BOX

The wiper blade assembly includes the adjustable upper blades **410** and **426**, the adjustable intermediate blades **438** and **460** and the fixed lower blades **470** and **482**. As heretofore set forth, the upper and intermediate blades are adjustable from the fully extended upper positions to any position down to a position where both the upper and intermediate blades are opposite the fixed lower blades. In FIG. **8** the upper and intermediate blades are shown in a fully extended position above the lower fixed blades whereby the maximum width of sash can be cleaned, wiped and vacuumed as the same is moved through the device A. In such extended condition the lower ends of the upper wiper blades overlap the upper ends of the intermediate wiper blades, and the lower ends of the intermediate wiper blades overlap the upper ends of the lower wiper blades. In FIG. **9** the upper wiper blades have been lowered to a point opposite the intermediate blades whereby a narrower sash SS is accommodated.

As heretofore set forth, the upper wiper blades are carried by the mechanism connected to the top slidable vacuum box **276**, and as the box **276** is moved downwardly from the upper-most position of FIG. **8** to a point opposite the intermediate blades, the stop bars **394** and **400** carried thereby engage the outer ends of the upper ears **434** and **456**, respectively, of slidable blocks **433** and **454**, respectively. With pressure of the stop bars **394** and **400** upon the ears **434** and **456** as a result of further movement of the manifold box **276** downwardly, the intermediate wiper blades are carried downwardly with the upper wiper blades downwardly. The upper and intermediate blades may thereby be moved together downwardly to a point opposite the lower wiper blades for minimal overall wiper coverage. The intermediate wiper blades are moved downwardly against the action of the relatively weak springs **444** and **466** heretofore described and shown particularly in FIG. **10**, the springs mounted within the tracks **426** and **448**.

If it is desired to extend the intermediate and upper wiper blades upwardly to accommodate a sash, the vacuum manifold box **276** is moved upwardly thereby raising the upper wiper blades carried thereby. The intermediate wiper blades follow due to the urging by the springs **444** and **466**. At a point of upward movement of the upper and intermediate blades the blocks **433** and **454** in tracks **428** and **448** engage stops **429** and **431** in tracks **426** and **448** when the intermediate wiper blades reach a point with only a small portion of the lower ends of intermediate blades overlapping the upper ends of the lower wiper blades. With the intermediate wiper blades stopped at substantially an intermediate position, the upper wiper blades can be moved further upwardly by moving the box **276** upwardly which carries the upper wiper blades whereby maximum coverage of the wiper blades can be attained. The upper wiper blades are stopped when the same attain a position with the lower ends slightly overlapping the upper ends of the intermediate wiper blades. Thus, the wiper blades can be adjusted to cover a vertical dimension from the length of one blade to the length of the three blades minus the amount of overlap hereinbefore pointed out. The upper vacuum manifold **276** moves with, of course, the upper wiper blades, and as the upper frame portion of the sash passes through the manifold **276** water and dirt are vacuumed therefrom. The lower frame portion of the sash is similarly vacuumed as it passes through the lower manifold vacuum box **502**.

OPERATION

In using the device A to wash and dry a sash S, the vacuum manifold box **276** is vertically adjusted so that with the lower frame portion S*a* upon the belt **46** and the transport wheels **120, 122,** and **126** for progression through the machine, the upper frame portion Sb will move through the cut out openings **355** of the various flaps of the box **276**. In this position of box **276** the intermediate wiper blades **438** and **460** together with lower wiper blades **470** and **482** and upper blades **410** and **416** completely cover the glass of the sash S as it proceeds to the blades, the positioning of which has been heretofore explained.

By means of conventional well-known controls the motor **80** is started which operates the sash transport belt **46**, and the sash transport drive rollers **120** and **122, 126** and **124**. The operation of the motor **80** also rotates the cleaning brushes **128** and **140** and cleaning brushes **146** and **154** by means of the mechanism hereinbefore described.

The motor **192** is started by conventional well-known controls and the motor **192** operates the pumps Pa and Pb. The pump Pa pumps cleaning fluid from tank **194** out through line **196** to line **188** and thence to the vertical pipes **180** and **184** from which it sprays out through nozzles **186** adjacent brushes **146** and **154**. Cleaning fluid is also pumped out vertical pipe **198** and through nozzles thereon and vertical pipe **199** and the nozzles **201** thereon.

The pump P*b* pumps cleaning fluid from tank **230** out pipe **232** and via line **228** to cross over **220** and thence to vertical pipes **218** and **222** and out nozzles **224** and **226** in the rinse chamber **236**.

The cleaning fluid sprayed from the various nozzles drops down onto and is collected in the pan **30**, and from the pan **30** it is returned to the tank **194** by drain line **203** and drain line **204** leading from the bottom of the pan at brush housing **145** together with drain line **205**. Cleaning fluid from the rinse pipe mechanism **216** drains out the drain line **234** to the tank **230**. Cleaning fluid is recirculated from tank **194** to pump P*a* by line **196** and recirculated from tank **230** via line **232** by pump P*b*.

The sash S is placed on the receiver channel **54** and belt **46** which draws the sash into the machine where it engages driven roller **120** which moves the sash S so it engages driven rollers **122, 126** and **124** which causes the sash to progress through the machine. As the sash S progresses through the machine A the brushes **128** and **140** together with the spray from the nozzles adjacent the brush clean the sash. The brushes **154** and **146** together with the nozzles **186** adjacent thereto further clean the sash, and the nozzles **224** and **226** in the rinse housing **236** rinse the sash. As the sash leaves the rinse housing it is engaged by the upper wiper blades **410** and **426**, the intermediate wiper blades **438** and **460** and the lower wiper blades **470** and **482** which wipe the entire glass surface of the sash. Also the upper frame S*b* is vacuumed clean by the upper box **276**, and the lower frame S*a* is vacuumed clean by the lower vacuum box **502**. The sash is ejected from the machine onto the channel **578** where it is held until picked up. The channel **578** is connected at its inner end to the front wall **580** and with the outer end connected to the upper ends of the supports **582** and **584** which are connected at the lower ends thereof to the front end **34**.

Material in substantially any sheet form may also be passed through the machine for cleaning.

We claim:

1. A device for automatically cleaning a window sash or the like comprising:
   a. support means having
   b. housing means thereon,
   c. means mounted on said support means for transporting a window sash upon the support means and through the housing means,
   d. means carried by the support means for guiding the sash through the housing as it is transported,
   e. means carried by the support means for cleaning the sash with a liquid as it is transported upon the support means and through the housing means,
   f. means for collecting the liquid used in cleaning the sash,
   g. said transporting means including a multiplicity of rollers for engagement by the edge of the sash,
   h. means for rotating the rollers,
   i. said guiding means including a multiplicity of rollers for engagement by the sash,
   j. said cleaning means including
   k. brushes,
   l. means for moving the brushes upon and in contact with a sash transported to and past the brushes,
   m. means for supplying a cleaning liquid to and upon the sash in the area of the brushes for coaction therewith,
   n. said cleaning means also including wiper blades mounted within the housing for wiping the sash after it is contacted by said brushes.

2. The device of claim 1 in which said wiper blades are adjustable to accommodate and wipe sashes of different widths.

3. A device for automatically cleaning a window sash or the like comprising:

a. support means having

b. housing means thereon,

c. means mounted on said support means for transporting a window sash upon the support means and through the housing means,

d. means carried by the support means for guiding the sash through the housing as it is transported,

e. means carried by the support means for cleaning the sash with a liquid as it is transported upon the support means and through the housing means,

f. means for collecting the liquid used in cleaning the sash,

g. said transporting means including a multiplicity of rollers for engagement by the edge of the sash,

h. means for rotating the rollers,

i. said guiding means including a multiplicity of rollers for engagement by the sash,

j. said cleaning means including

k. brushes,

l. means for moving the brushes upon and in contact with a sash transported to and past the brushes,

m. means for supplying a cleaning liquid to and upon the sash in the area of the brushes for coaction therewith,

n. said cleaning means also including wiper blades mounted within the housing for wiping the sash after it is contacted by said brushes,

o. an upper housing through which the upper frame edge of the sash passes,

p. a lower housing through which the lower frame edge of the sash passes,

q. means for creating a partial vacuum in said upper housing, and

r. means for creating a partial vacuum in said lower housing.

4. The device of claim 3 in which

a. said upper housing is adjustable relative to said transport rollers to accommodate sashes of different widths, and

b. said blades include upper and lower, the uppermost of said wiper blades being mounted in and carried by said upper housing for wiping sashes of different widths.

5. The device of claim 4 in which said blades include intermediate wiper blades adjustable intermediate said uppermost wiper blades and said lower wiper blades for coaction with said uppermost and lower blades for wiping sashes of different widths.

6. The device of claim 5 in which the adjustable intermediate wiper-blades includes means responsive to the adjustable movement of said upper housing for causing adjustment of the intermediate wiper-blades.

7. The device of claim 5 in which said intermediate wiper blades includes means responsive to the adjustable sliding movement of said upper housing.

8. The device of claim 3 in which

a. said partial vacuum creating means for said upper housing includes an elongated housing including

b. an endless belt mounted on rollers and a portion thereof forming an internal wall thereof, and

c. a conduit connected to said upper housing and said belt and communicating internally of the belt and housing whereby a partial vacuum is maintained in said upper housing as it is adjustably positioned.

9. The device of claim 1 in which said wiper blades include

a. upper wiper blades,

b. intermediate wiper blades,

c. lower wiper blades,

d. means for positioning said upper wiper blades relative to said lower wiper blades, and

e. means for positioning said intermediate wiper blades relative to said lower wiper blades.

10. A device for automatically cleaning a window sash or the like comprising:

a. support means having

b. housing means thereon,

c. means mounted on said support means for transporting a window sash upon the support means and through the housing means,

d. means carried by the support means for guiding the sash through the housing, as it is transported

e. means carried by the support means for cleaning the sash with a liquid as it is transported upon the support means and through said housing means,

f. means for collecting the liquid used in cleaning the sash,

g. said cleaning means including an upper housing through which the upper frame edge of the sash passes,

h. a lower housing through which the lower frame edge of the sash passes,

i. means for creating a partial vacuum in said upper housing, and

j. means for creating a partial vacuum in said lower housing.

11. The device of claim 10 in which

a. said upper housing is adjustable relative to said transport rollers to accomodate sashes of different widths.

12. A device for automatically cleaning a window sash or the like comprising:

a. support means having

b. housing means thereon,

c. means mounted on said support means for transporting a window sash upon the support means and through the housing means,

d. means carried by the support means for guiding the sash through the housing, as it is transported

e. means carried by the support means for cleaning the sash with a liquid as it is transported upon the support means and through said housing means,

f. means for collecting the liquid used in cleaning the sash, and

g. said cleaning means including upper and lower spaced partial vacuum means for removing cleaning liquid from the upper and lower frame edges of the sash.

13. A device for automatically cleaning a window sash or the like comprising:

a. support means having

b. housing means thereon,

c. means mounted on said support means for transporting a window sash upon the support means and through the housing means,

d. means carried by the support means for cleaning the sash with a liquid as it is transported upon the support means and through the housing means,
e. said cleaning means including brushes and
f. wiper blades mounted within the housing for wiping the sash after it is contacted by said brushes,
g. an upper housing through which the upper frame edge of the sash passes,
h. a lower housing through which the lower frame edge of the sash passes,
i. means for creating a partial vacuum in said upper housing,
j. means for creating a partial vacuum in said lower housing,
k. said upper housing adjustable relative to said transporting means to accommodate sashes of different widths, and,
l. said blades include upper and lower, the uppermost of said blades being mounted on and carried by said upper housing for wiping sashes of different widths.

14. The device of claims 13 in which
a. said blades includes intermediate blades, and
b. means for positioning said intermediate blades relative to said lower blade.

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