United States Patent

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Division of Ser. No. 486,121, Sept. 9, 1965, Pat. No. 3,439,376.
[45] Patented **Sept. 14, 1971**

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[54] LONG RETRACTING SOOT BLOWER WITH SHIFTING ROLLER SUPPORTS

6 Claims, 7 Drawing Figs.

[52] **U.S. Cl.** **15/317**
[51] **Int. Cl.** **F23j 3/02**
[50] **Field of Search** 15/316–318; 165/95

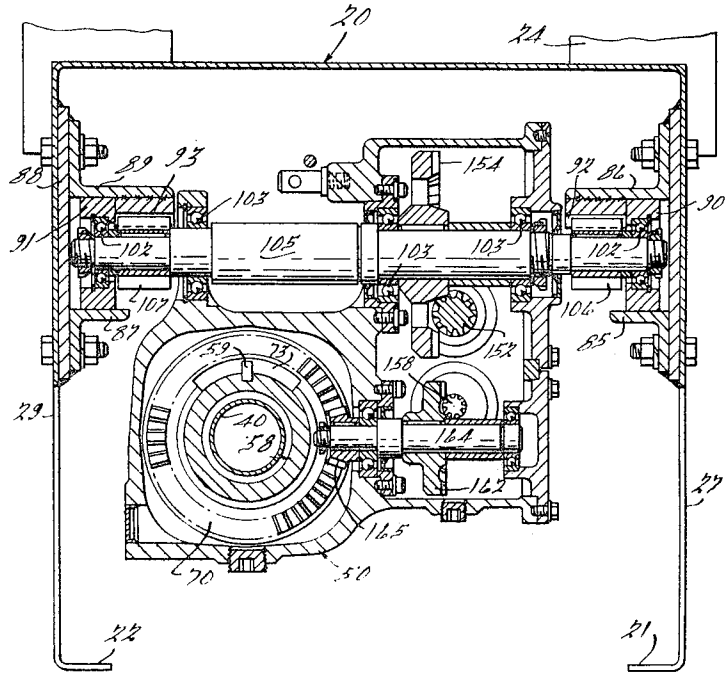
[56] **References Cited**

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2,760,222	8/1956	Andersson	15/317
2,803,848	8/1957	DeMart	15/317
2,883,694	4/1959	Hibner, Jr. et al.	15/317
3,068,507	12/1962	Evans	15/317

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ABSTRACT: Cylindrical rollers for supporting a lance tube of a soot blower are carried in a frame which is limitedly shiftable longitudinally when the lance tube moves axially. The rollers are journaled on axes tangent to a helix concentric with the lance tube and are carried by subframes which can be turned about radial axes to adjust their journal axes to helices of varying pitch.



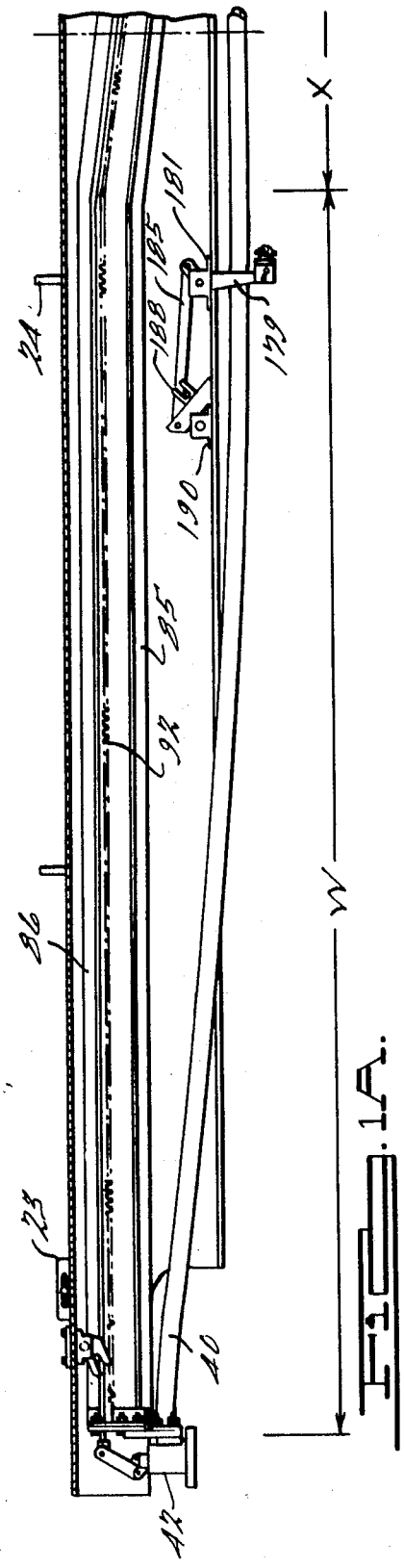


FIG. 1A.

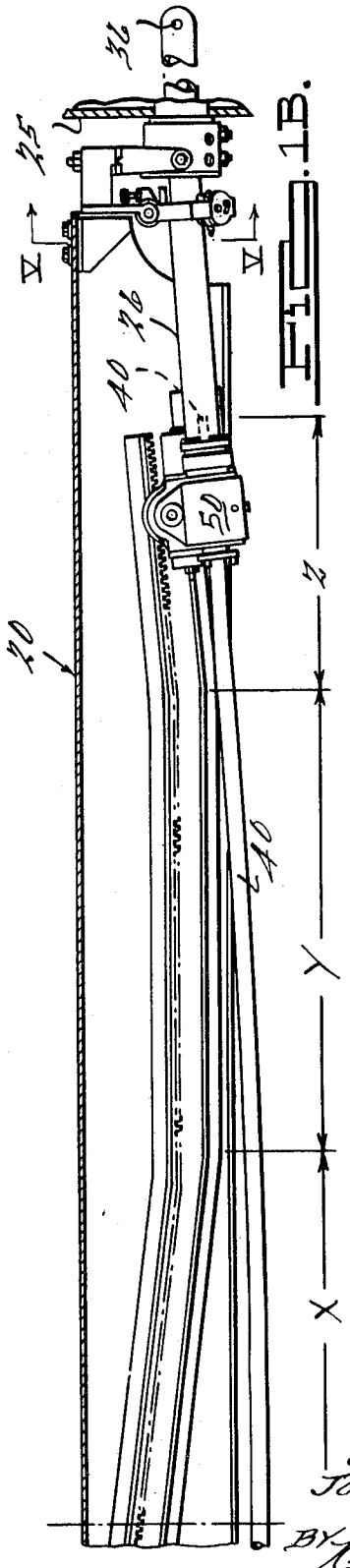


FIG. 1B.

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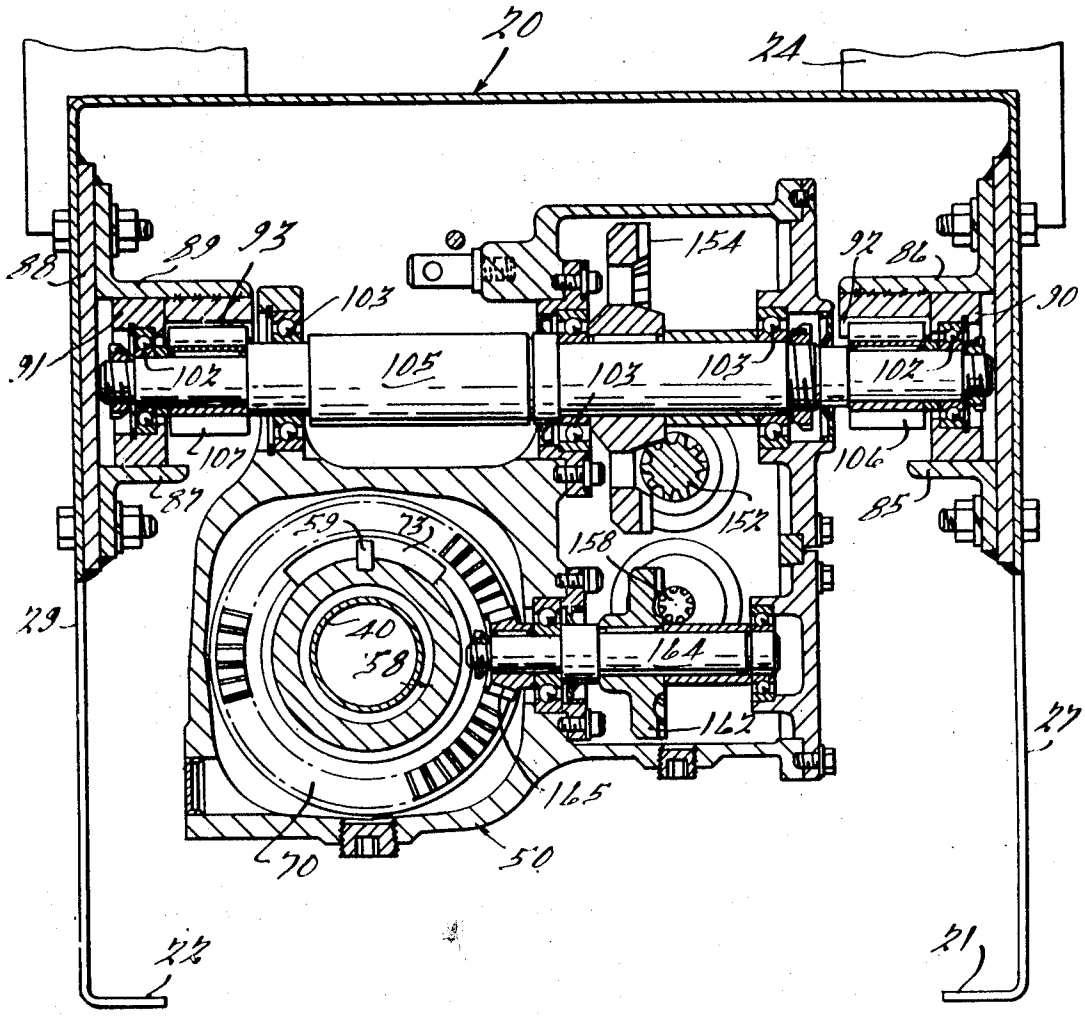
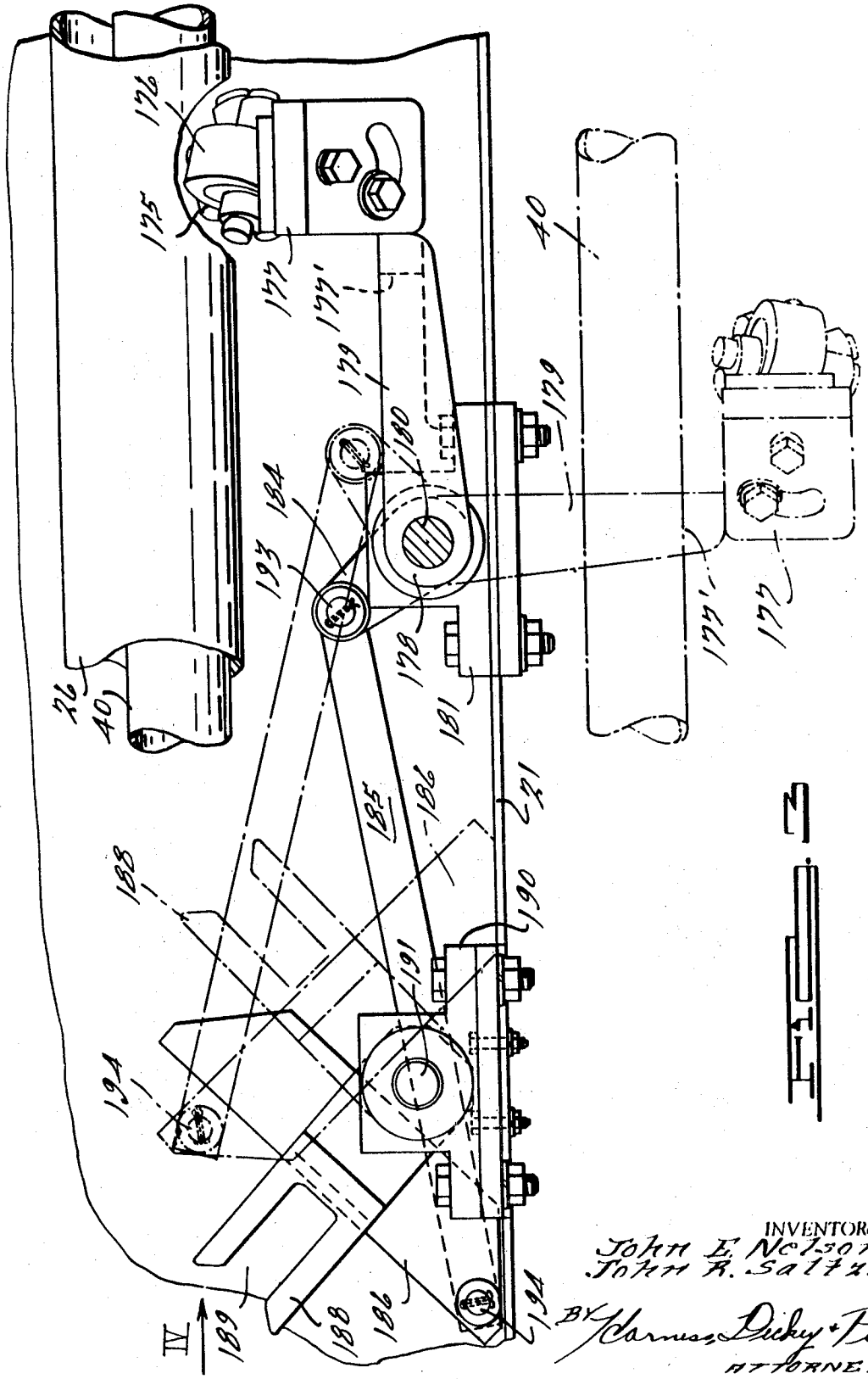


FIG. 2.

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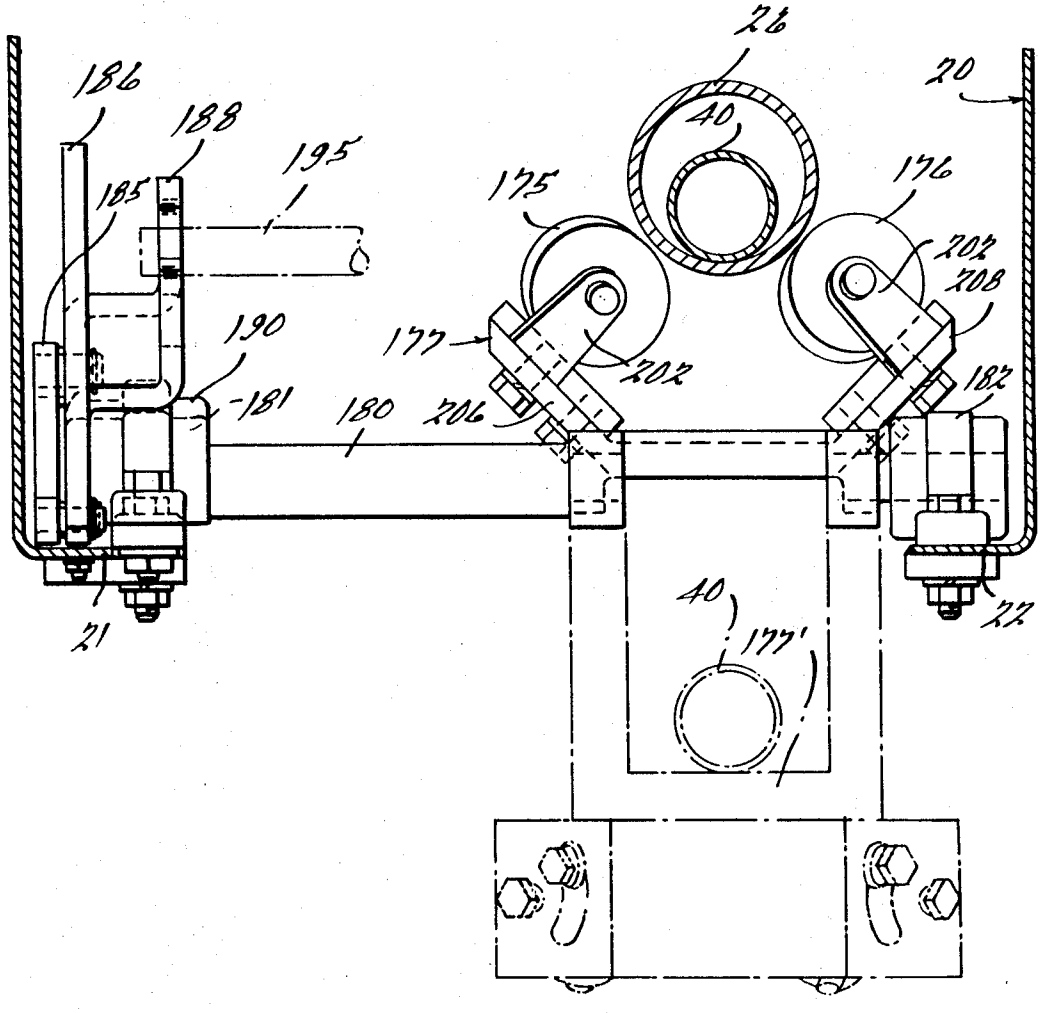


FIG. 4.

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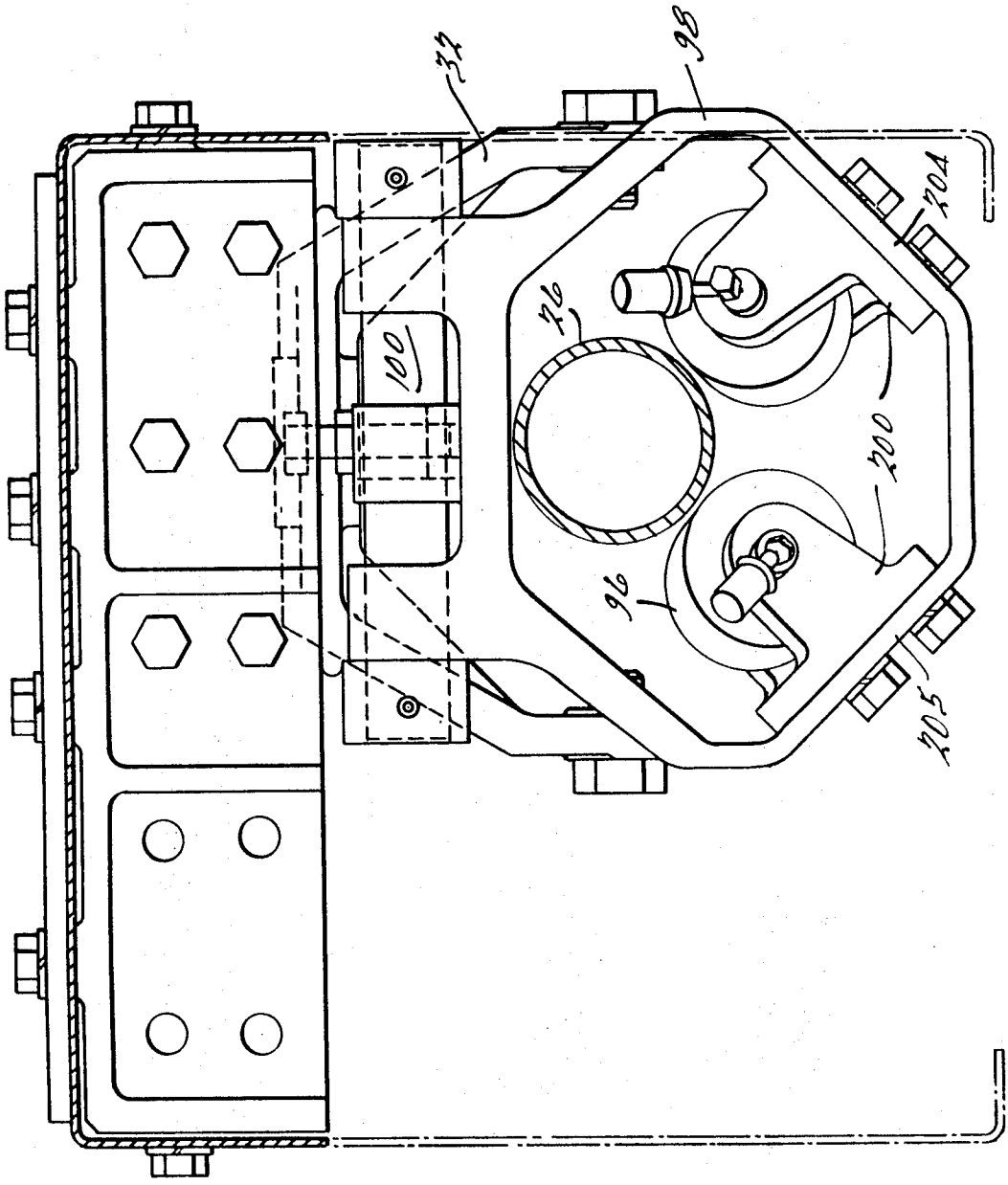


FIG. 5

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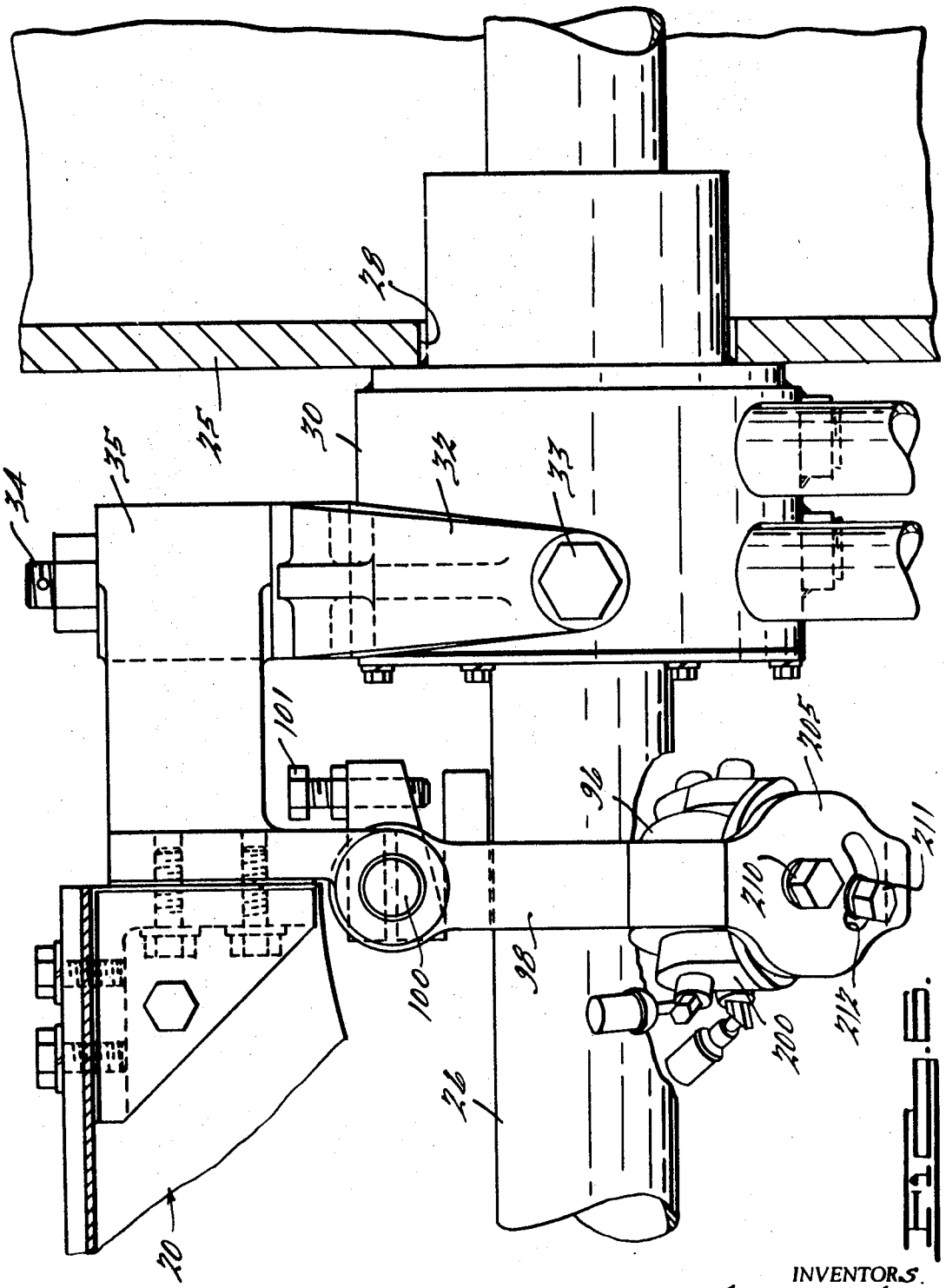


FIG. 6

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LONG RETRACTING SOOT BLOWER WITH SHIFTING ROLLER SUPPORTS

CROSS-REFERENCE TO RELATED APPLICATIONS

The present application is a divisional of our copending application Ser. No. 486,121 filed Sept. 9, 1965, now U.S. Pat. No. 3,439,376.

BACKGROUND OF THE INVENTION

This invention relates to soot blowers of the long retracting type. Principal objects of the invention may be summarized as to provide improved means for supporting and guiding the lance tube, maintaining proper alignment of the parts, and reducing wear and maintenance.

Other objects and advantages will become apparent upon consideration of the present disclosure in its entirety.

BRIEF DESCRIPTION OF THE FIGURES OF DRAWING

FIGS. **1A** and **1B** are a composite longitudinal vertical sectional elevational view of the rear and forward portions respectively of a soot blower embodying the present invention,

FIG. **2** is a vertical cross section taken near the rear with the lance tube and carriage retracted,

FIG. **3** is a side elevational view of the swingable auxiliary support assembly for the lance feed tube, shown on a larger scale than in FIG. **1A** and illustrating its two operative positions;

FIG. **4** is a vertical cross-sectional view taken substantially as indicated by the arrow IV in FIG. **3**;

FIG. **5** is a cross-sectional view taken substantially on the line V—V of FIG. **1B** and looking in the direction of the arrows;

FIG. **6** is a longitudinal sectional elevational view of the forward portion of the blower.

DETAILED DESCRIPTION OF PREFERRED FORM OF THE INVENTION

Referring now to the drawing, the soot blower construction embodying our invention is shown as corresponding to that disclosed in U.S. Pat. No. 3,439,376, reference character **20** designates generally the channel-type main beam structure of my improved blower, the cross-sectional configuration of which is best shown in FIG. **2**. As there shown, the beam **20** is formed with straight vertical side panels, a flat top, and with inturned bottom flanges **21, 22**. As shown in FIGS. **1A** and **1B**, which are intended to be read in horizontally aligned relation located to the left and right of each other respectively, the beam structure is straight, and is intended to be installed in horizontal position and to be supported in any suitable or conventional manner as by the hangers and bracket means **23, 24**, these parts serving to suspend the blower from suitable structural steel supports or the like (not shown) in the usual or any desired manner. The beam, when so supported, extends perpendicularly from the boiler wall **25** in such manner that the lance tube **26** is projectable into the boiler setting through the opening **28**, to the projected position shown in FIGS. **1A** and **1B**, and is retractable to a protected position, in which the principal parts are shown in full lines in FIGS. **3** and **6**. The opening **28** in the boiler setting is guarded by a wall box **30** through which the lance tube is slidable. The forward end of the beam assembly is connected to the wall box for limited universal movement as by means of the inverted yoke **32**, the lower bifurcated arms of which are connected to opposite sides of the wall box by trunnion-bearing screws **33**, while a central upwardly extending stem portion **34** of the yoke projects through and is turnable about a vertical axis in a nose portion **35** fastened to the forward end of the beam **20**.

The lance tube **26**, which is provided with one or more nozzle openings as **36** at its forward end, is telescopically overfitted upon and slidable with relation to the feed tube **40** which is secured at and supplied with blowing medium from the rear extremity of the beam structure, at which location it is coupled to the blow valve **42**.

Rotary drive is imparted to the lance tube through the agency of mechanism now known and which is described in said U.S. Pat. No. 3,439,376.

The carriage assembly **50** is supported in depending position by and travels along tracks carried by and projecting inwardly from the sidewalls **27** and **29** of the beam **20**. Each track consists of a bottom rail as **85, 87** and a top rail as **86, 89**. The rails extend longitudinally of the inner walls of the beam in spaced parallel relation, each rail being defined by an angle iron structure rigidly secured as by welding and bolting to longitudinal stiffening and supporting plates as **88**, which are in turn similarly secured to the inner wall of the beam structure, as shown in FIG. **2**. The left and right double rail assemblies are in parallel and transversely aligned relation with respect to one another and each pair of upper and lower rails defines in effect an inwardly opening groove or troughlike way, in which a carriage-supporting roller **90, 91** rollably fits. The inwardly extending flanges of the top rail elements **86, 89** project inwardly farther than the bottom rails **85, 87**, each of such upper flanges supporting upon its undersurface a longitudinally extending rack as **92, 93**.

As brought out in FIGS. **1A** and **1B** the track members **85, 86, 87, 89** and the rack portions **92, 93** carried by the upper track elements, are not horizontal or straight throughout the length of the beam. Commencing at the rear, and for a proportion of the length of the beam designated W, the tracks are straight, horizontal, and parallel to the top and bottom of the beam at an elevation near the top. In a successful blower constructed in accordance with the present invention and in which the travel of the lance tube is 50 feet, 6 inches, the straight horizontal section W of the track has a length of 26 feet, 4 inches. Commencing at the forward end of the horizontal section W and continuing to the forward end of the beam structure, the track portions are contoured in a manner generally similar to the contouring of the supporting rails disclosed in the copending U.S. Pat. application of Robert E. Chappell, Ser. No. 232,010, filed Oct. 22, 1962, now U.S. Pat. No. 3,216,044, although in the present construction the beam itself is straight. A downwardly sloping section designated X forms a forward continuation of the horizontal portion W, and the forward end of the downwardly sloping section X is connected with a portion Y forming a continuation thereof and extending along the beam near the bottom approximately horizontally to a position nearer the front, where the section Y communicates with a final upwardly sloping continuation section Z which terminates at a position corresponding to the forward limit of travel of the supporting rollers **90, 91**. In the embodiment described the length of section X is 6 feet, section Y 13 feet and section Z 6 feet, although the proportioning of the sections may be varied under different conditions such as may be imposed by lance tube diameter and material.

It will be recognized that when the lance tube and carriage are retracted far enough so that the weight of the carriage and of the portion of the lance tube outside the boiler exceeds the upward component of force exerted thereupon by the weight of the portion of the lance projecting into the boiler, the rollers bear downwardly on the bottom rails **85, 87**. When the lance is projected far enough to overbalance such weight, its transmitted upward component urges the carriage upwardly so that the rollers bear against the bottom surfaces of the top rails **86, 89**, the clearance between the bottom and upper rails slightly exceeding the diameters of the rollers.

The construction of the wall box **30** at the forward extremity may correspond to that disclosed in DeMart U.S. Pat. No. 2,803,848 and be provided with suitable means (not shown) for discharging sealing air toward the interior of the boiler around the lance tube. The supporting roller means for the lance tube differs from that disclosed in said DeMart patent, however, the rollers **95, 96** (FIGS. **11** and **12**) being of cylindrical form and journaled in a cage **98** rockably suspended

from above upon a transverse pivot pin **100** carried by and at the forward end of the beam structure. The rollers **95, 96** are journaled upon axes which are inclined conformably to the pitch of the helix described by a point on the lance tube during its extension and retraction. The rocking movement of the cage **98** about the transverse axis defined by the supporting pin **100** is limited by an adjustable abutment screw **101**. The rollers are positioned to tend to maintain the lance tube substantially centered in the wall box. The swingability of the cage **98** about the pin **100** permits the rollers to assume positions as close as possible to parallelism and line contact with the surface of the lance tube during its normal traveling movement between its extreme positions despite changes in the angular relationship between the roller-engaged portion of the lance tube and the horizontal due to bowing of the lance tube under gravitational forces. The lance tube is thereby prevented from running along the edge of the roller and the loading and wear are greatly reduced. The swingability of the cage also permits the rollers to move longitudinally when the lance tube moves axially without rotating, as it does for a slight distance at the end of its travel due to the lost-motion mounting of gear **70** on hub **58**. Such lost motion establishes different helical blowing paths during the projecting and retracting movements of the lance tube, as more particularly brought out in the U.S. Pat. to Andersson, No. 2,760,222. At such times the cage **98** swings toward the front or rear so that the lance tube is not dragged upon the rollers **95, 96**. Such straight travel is short, and as the lance tube continues rearwardly, it commences to rotate and such rotation of the lance tube rotates the rollers **95, 96**. Due to their cylindrical shape and the centering effect which is also augmented by gravity, the cage then swings down toward the vertical position as the rollers rotate, virtually all sliding friction being thus eliminated.

It will be noted that the entire support for the carriage **50** and the rear end of the lance tube is supplied by the aligned rollers **90** and **91**, so that the carriage and the rear of the lance tube can rock in a vertical plane about the transverse horizontal axis of the roller shaft **105**. The rollers **90, 91** are freely journaled upon antifriction bearings at the extremities of the shaft. The shaft in turn is journaled in the carriage frame as in antifriction bearings **103**. The shaft is rotatively driven through suitable transmission mechanism described in said U.S. Pat. No. 3,439,376.

In order to prevent the lance tube and the interfitted feed tube **40**, which extends forwardly inside the lance tube to a position near the front end of the beam, from sagging unduly, we preferably provide an intermediate support mechanism so constructed as to effectively prevent unwanted sagging of the tubes or dropout of the feed tube while nevertheless supporting the tubes at differing elevations which take into account the vertical displacement of the carriage and tubes which results from the contouring of the rails in the manner previously described.

When the lance tube is fully retracted, the auxiliary support mechanism is so arranged as to maintain a pair of rollers **175, 176** under the lance tube in an elevated position, as shown in full lines in FIGS. **3** and **4**, to hold the tubes against sagging and substantially straight. The rollers **175, 176** are journaled in a cradle **177** upon axes which are tilted conformably to the pitch of the helix of lance tube travel, so that the cylindrical surfaces of the rollers may turn freely during travel of the lance tube. As the carriage and lance move forwardly from the retracted position through that portion of the travel corresponding to section W during which support is required and prior to the downward movement of the carriage along sloping sections X which would exert an undesirable load upon the rollers and their supporting structure, the rollers **175, 176** remain in the raised position. Before the carriage reaches the downwardly sloping section X, the rollers and their supporting mechanism are automatically vertically downwardly displaced so that during subsequent forward travel of the lance tube, they do not interfere with a desired amount of downward displacement of the feed tube. Such downward displacement of the auxiliary support mechanism and rollers also prevents interference with movement of the carriage, which then proceeds forwardly to the position shown in FIG. **1B**, at which the lance tube is fully projected. As such position is approached, the central portion of the feed tube tends to sag under gravity until it again contacts the cradle **177** in the downwardly displaced position of the latter. In its lowered position a transverse supporting portion **177'** of the cradle **177** limits downward sagging of the feed tube, the carriage and lance tube then being forward and to the right of the auxiliary supporting mechanism as the parts are viewed in FIGS. **1A, 1B** and **3**.

The cradle **177** is carried by and at the end of an offset arm structure **179**, the side arm or throw portions of which are attached to hub portions **178** fast upon coaxial shaft portions **180, 180'** journaled in brackets **181, 182** carried by the bottom flanges **21, 22** of the beam **20**. An arm **184** fast upon one end of shaft **180** adjacent the left inner wall of the beam is connected by a link **185** to an arm **186** secured to a yoke **188** supported for rocking movement upon top of the flange **21** at a position spaced to the rear of bracket **181**, in a bracket **190**. Arm **186** is rockably supported by a shaft **191** and forms a rigid assembly with yoke **188**, members **186, 188** being rockable with their supporting shaft **191** in the bracket **190**. The link **185** is connected to the arms **184, 186** by pivot pins **193, 194**, respectively. The arm **186** limits rocking movement of the yoke **188** by engaging the top surface of flange **21**, and the parts are so proportioned and positioned that when the yoke is swung to the left or counterclockwise, as viewed in FIG. **3**, to the limit of its travel, which is the position shown in full lines in that view, the line of connection between pivot pins **193, 194** defined by the axis of link **185** lies below the axis of shaft **191**. Thus, the weight of the cradle **177** and the rollers and associated parts lying to the right of shaft **179–180** tends to urge yoke **188** and arm **184** toward and hold them in the full line position and the resulting tension on link **185** holds the rollers raised.

An arm **187** on the carriage **50** is so positioned that as the carriage moves forwardly, it enters the open-ended slot **189** in the yoke **188** and rocks the yoke clockwise to lift the link **185** above the axis of shaft **191**, thereby permitting the rollers and cradle **177** to swing downwardly to the position shown in dotted lines. Thereafter, the downward movement of the feed tube is limited only by the offset cradle-supporting portion **177'**, which prevents undue sagging of the feed tube but permits it to move downwardly to a position such that, as the carriage is tilted upwardly due to the combined effect of the forward sloping section Z and the front rollers, the feed tube tends to assume an angular position more nearly axially parallel to the lance tube, carriage and hub **58**, which are now tilted at the angle at which the carriage **50** is shown in FIG. **1B**, thereby preventing any tendency of the feed tube and the carriage and packing to cock with respect to one another, so as to create undue wear and friction, and keeping the feed tube from sliding entirely out of the lance tube, which might occur if undue sagging were permitted. It will be seen that since the front rollers **95, 96** are at an elevated position with relation to the carriage, as the carriage moves forwardly over the depressed section Y, as well as during its travel on the sloping section Z, the angular displacement and depression of the rear portion of the lance tube corresponds to the sagging tendency of the feed tube. Thus, the feed tube tends to remain substantially axially parallel to the hub **58** and packing assembly **52**, although limited axial misalignment is accommodated by the form and shiftability of ring **65**, as noted above.

Each of the rollers **95, 96** and **175, 176** is preferably journaled in a bracket which is adjustably mounted in the hanger **98** in the case of front rollers **95, 96**, and in the cradle **177** in the case of auxiliary support rollers **175, 176**. The brackets for the front rollers are designated **200** and those for the auxiliary support rollers are designated **202**. As brought in FIGS. **4** and **5**, each bracket is secured to a flat supporting area **204, 205, 206, 208** which, when the rollers are in their operative sup-

porting positions, lies below the supported tube **26** and/or **40**, and is parallel thereto but perpendicular to a line radial to the axis of the supported tube. When the rollers are in their regular and centered operative positions, the bracket-supporting surfaces **204**, **205** of hanger **98** and the corresponding surfaces **206**, **208** of cradle **177** lie at 45° to a transverse horizontal line and 90° to each other. Each bracket is attached to its supporting surface by two machine screws, one of which, as **210** (FIG. **6**) is positioned midway of the axial length of the roller radially with respect to the roller and the axis of the tube in the roller-supported position of the latter. The other screw, **211**, is offset from screw **210** and extends through an arcuate slot **212** in the supporting surface, which slot is concentric with the axis of screw **210**. When the screws are loose, the rollers can be turned about the axes of their radial screws **210** to lie parallel to helices of variant pitch. Tightening the screws fastens the rollers in their adjusted positions.

While one commercially practical embodiment of the invention has been described and illustrated herein somewhat in detail, it will be understood that various changes may be made as may come within the purview of the accompanying claims.

What is claimed is:

1. In a long retracting soot blower construction, in combination with a lance tube, means for simultaneously axially moving and rotating the same whereby it may be extended into and retracted from a boiler setting or the like in helical paths, and means for shifting the lance tube longitudinally without rotating the same in order to change the helical path of travel of the lance tube, the novelty which comprises a front antifriction support for the lance tube limitedly shiftable longitudinally with and in response to such axial movement of the lance tube which occurs without rotation thereof.

2. Means as defined in claim **1** including a pair of cylindrical rollers incorporated in said antifriction support and carrying the lance tube, said rollers being mounted upon axes substantially perpendicular to a radius and to the pitch line of a helix corresponding to a path of helical movement of the lance tube.

3. In a long retracting soot blower construction, in combination with a lance tube rotatable and axially movable in a helical path, the novelty which comprises a cylindrical antifriction roller underengaging and supporting said lance tube and rotatable upon an axis perpendicular to the helical path traced by a point on the lance tube, supporting means for said roller, and means for securing the supporting means in any of a plurality of angular positions concentric with an axis of rotation which is perpendicular to the axis of the roller and radial to the lance tube.

4. In a long retracting soot blower construction, in combination with a lance tube rotatable and axially movable in a helical path, the novelty which comprises a plurality of cylindrical antifriction rollers underengaging and supporting said lance tube and rotatable upon axes perpendicular to the helical path traced by a point on the lance tube, supporting means for said rollers comprising a carrier having portions spacedly underlying the lance tube and lying in planes parallel to lines tangent to the lance tube, a journaling support for each of said rollers, and means for securing each of said supports to one of said portions of the carrier in any of a plurality of angularly rotated positions about an axis radial to the lance tube and perpendicular to the roller axis.

5. In a long retracting soot blower construction, in combination with a lance tube rotatable and axially movable in a helical path, the novelty which comprises a plurality of cylindrical antifriction rollers underengaging and supporting said lance tube and rotatable upon axes perpendicular to the helical path traced by a point on the lance tube, a carrier for said rollers having portions spacedly underlying the lance tube, and means supporting said carrier for limited movement lengthwise of the lance tube.

6. A construction as defined in claim **5** wherein said means for supporting the carrier includes means pivotally mounting the same for swinging movement about an axis spaced above and transverse to the lance tube.