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"SOOT BLOWER"

In the construction of long retracting soot blowers capable of the longer travels required by the increasing size of large public utility boilers, it has become necessary to extend the lance tube in cantilever fashion into the boiler for distances of 40 to 50 or even 55 feet. The forces resulting not only from the weight of the lance tube and carriage but also from the overhung situation which exists when the lance tube is projected creates severe problems due to the high stresses applied to all of the supporting and guiding components. In a commercially successful soot blower designed for travels of as much as 45 feet, disclosed in United States patent No. 3,439,376, the carriage to which the lance tube is connected, and by which it is actuated, is supported and guided by and between the internal walls of a box beam by means of rollers each of which travels between a pair of upper and lower tracks which are spaced apart a distance conforming to the diameter of the rollers. When the lance tube is retracted far enough so that the system is not overbalanced by the portion of the lance tube remaining in the boiler,

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the rollers bear against the bottom tracks while, when the load is overbalanced, the rollers bear against and roll along the undersides of the upper tracks. It will be recognized that the resultant vertical forces tend to separate the tracks and impose loadings which tend to spread the tracks and the walls of the box beam. Problems have resulted due to such stresses under the severe loadings imposed by conditions encountered with long travel blowers. In addition it has been necessary to employ a very heavy construction to withstand such forces.

An important object of the present invention is to provide improved supporting and guiding means wherein the forces resulting from vertical loadings tend to offset each other without imposing stresses which might distort either the track portions or the beam structure.

According to the present invention we provide a soot blower comprising: a frame structure including a generally horizontal elongated support; a lance carried by the support for movement generally parallel thereto to and from positions in which an end of the lance projects differing distances beyond the end of the support; and combined means for so moving the lance and for transmitting vertical

loadings from the lance to said support, said combined means including a carriage to which the lance is attached, the carriage being movably carried by the support to actuate the lance and having a rigid frame, a carriage driving
5 pinion journaled in the carriage on an axis extending transversely of the direction of movement of the carriage, a roller also journaled in the carriage frame on a transverse axis, vertically displaced from the first mentioned transverse axis, and a rigidly integrated
10 longitudinal rack and track structure carried by the support including a track portion having a longitudinally extending track surface and a rack portion having a generally horizontal longitudinally extending toothed surface, wherein said surfaces face away from each other
15 in opposite vertical directions and at least partly overlie each other when viewed in a vertical projection, the teeth of said rack portion mesh with the pinion, the roller is rollable on said track surface, the axes of the roller and pinion are rigidly fixed in the carriage frame on
20 parallel lines transverse to the longitudinal extent of said rack and track structure, and the line of engagement of the roller and the position of meshing engagement between the pinion and rack teeth directly overlie each other, whereby the rack and track structure is
25 confined between the pinion and roller and vertical

forces are transmitted in opposite directions via the carriage frame and the roller and pinion into the integrated rack and track structure.

Other objects and advantages will become apparent to persons skilled in the art upon consideration of the present disclosure in its entirety, with reference to the accompanying drawings, in which:-

Figure 1 is a side elevational view, centrally broken away, of a long travel soot blower incorporating the principles of the present invention;

Figure 2 is a rear elevation of the blower of Figure 1.

Figure 3 is a horizontal sectional view on a larger scale and partly broken away, taken directly beneath the top wall of the beam and showing the principal components in plan;

Figure 4 is a diagrammatic perspective view of the principal gearing components;

Figure 5 is a cross-sectional view on a larger scale taken substantially on the line V-V of Fig. 1 and looking in the direction of the arrows;

Figure 6 is a cross-sectional view taken substantially on the line VI-VI of Fig. 5 and looking in the direction of the arrows;

Figure 7 is a fragmentary sectional vertical

elevational view showing a modification; and

Figure 8 is a view corresponding to Fig. 5, showing another modified construction.

Reference character 10 designates generally
5 an inverted U-channel formed of heavy sheet metal which constitutes the main frame of the soot blower and which is adapted to be mounted appurtenant to a boiler setting (not shown) by a suitable supporting structure (not shown), as is well known in the art.
10 The box beam enclosure is completed by a U-channel bottom cover 12. A carriage generally designated 16 is supported to travel longitudinally in the beam on a pair of rigidly integrated longitudinal rack and track structures, one such structure, generally
15 designated 18, being attached to and projecting inwardly from one side wall of channel 10, shown at the right in Figure 5, and a similar integrated rack/track structure 20 being attached to the other side wall in horizontally aligned relation. Each
20 integrated rack/track structure includes a top rail portion 22, 24 having a smooth top surface, and a rack portion 26, 28 rigidly attached as by welding to the bottom of the rail and having depending teeth. The integrated rack/track structures are rigidly
25 attached to the respective walls of the U-channel throughout the effective length of travel, for example

by means of welding and lag screws 30 extending through the walls and into the rail portions.

The carriage includes a rigid cast frame 32 having integral hanger bracket portions 34, 36 which
5 extend upwardly relatively close to and somewhat above the integrated rack/track structures.

Supporting rollers 38 and 40 journalled coaxially on heavy stub shafts 42 carried by the brackets 34, 36 overlie and are rollable on the respective rails 22,

10 24. A transverse shaft 44 is journalled in the carriage frame spaced beneath and in vertical alignment with the rollers 38, 40. The ends of shaft 44 extend beneath the rack portions 26, 28 and carry walking drive pinions 46, 48 which mesh with rack
15 portions 26, 28 respectively.

The pinions 46, 48 are driven, to move the carriage and lance tube longitudinally, by power derived from a motor 50 fixedly supported by and at the rear end of the beam 10. The motor drives,
20 through a gear assembly generally designated 52 and which includes a worm 54 and worm wheel 55, a squared shaft 56 rotatably supported by and between the front and rear bulkheads 57, 59. A gear 58 journalled in the carriage 16 is axially slidably keyed to the
25 shaft 56 and meshes with a gear 60, also journalled in the carriage and which is keyed to a sleeve 62

journalled in the carriage, to which the lance tube 64 is secured in such manner as to be rotated and longitudinally driven during movement of the carriage.

As shown in Figure 6, gear 58 is formed integrally with an axially elongated hub portion 59 fastened to an extension hub section 61 having a square opening therein fitted slidably on square shaft 56. The hub assembly and gear 58 are journalled in the carriage by means of anti-friction bearings 67.

10 Gear 60 is keyed to the lance hub sleeve 62, which is mounted in the carriage frame 16 in suitable bearings 66 and, at its forward end, carries fast thereon a flange 70 to which is bolted the flange 72 attached to the rear end of the lance tube. A suitable
15 packing gland generally designated 74 provides a seal between the sleeve 62 and the stationary feed tube 76. Feed tube 76 projects through the sleeve and into the lance tube 64, the sleeve and lance tube being slidably overfitted on the feed tube, as is
20 conventional.

Gear 60 is also meshed with a gear 80 fast on a shaft 82 extending forwardly in the carriage and carrying a worm 84 meshing with a worm wheel 86 fast on the shaft 44.

25 It is believed that the operation of the system will be apparent from the description given.

When the shaft 56 is rotated by the motor 50 the gear 58, which is mounted in the carriage to travel therewith, rotates the gear 60, thereby rotating the lance tube about its axis, and at the same time drives the walking pinions 46, 48 which move the carriage along the rails to project and retract the lance tube. The gears 58, 60 and 80 are located at the rear of the carriage and are accessible by removing the rear carriage cover 90.

Figure 7 shows a modified construction designed for extremely heavy service. Parts corresponding to parts already described are designated by like reference numerals but primed.

The track portions 22' are widened, and the rack portions 26' do not occupy the full width of the underside of the track portions. (Although only one side is illustrated, it will be understood that the non-illustrated side is of conforming construction, corresponding in other respects to the showing of Figure 5.) Track portion 22' has a smooth portion 94 of its bottom surface projecting inwardly toward the centre of the beam, beyond the rack portion 26' to define a bottom rail surface. Hanger portion 34' which corresponds to hanger portion 34 of the first described embodiment carries, in addition to a top roller 38' corresponding to the roller 38, a bottom

roller 96 journalled on shaft 44' and rollable upon the bottom rail surface 94. Rollers corresponding to the rollers 38' and 96 are of course employed at the other side of the assembly. The bottom rollers corresponding to the roller 96 maintain the walking pinions at the proper pitch distance with respect to the teeth of the racks, and support the upward vertical forces when the lance is in the overbalanced condition.

10 In the further modified construction shown in Figure 8, wherein parts corresponding to parts already described are designated by like reference numerals squared, a longitudinal I-beam generally designated 100 defines the track means for supporting
15 the carriage in the box beam 10². I-beam 100 is secured, for example by welding, to the underside of the flat top flange of the box beam. The carriage 16² has a pair of hanger bracket portions 34², 36² carrying aligned stub shafts (undesignated) which
20 project inwardly toward the central web of the I-beam 100, each subshaft carrying journalled thereon a roller as 38², 40² rollable along the top surfaces of the bottom flange 102 of the I-beam, which surfaces define rail portions corresponding to the top surfaces of
25 track portions 22, 24 of Figure 5. A single rack 106 is secured, as by welding, to the bottom surface

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of the flange 102. Rack 106 is narrower than the flange 102, and the bottom surfaces of the portions of flange 102 which project laterally from the rack define bottom rail surfaces corresponding to the surface 94 of the embodiment described in connection with Figure 7. Bottom rollers 96², 98², journaled on the shaft 44², underlie the projecting portions of bottom flange 102 and are rollable therealong in the overbalanced condition of the lance. A single pinion 108 fast on shaft 44² is driven in a manner similar to the mechanism previously described to actuate the carriage and lance longitudinally.

In the assembly disclosed above and illustrated in the drawings, the loading problems are relieved by the fact that the structure is lighter in weight in proportion to its strength and stiffness as compared with prior blowers such as that disclosed in the said U.S. Patent No. 3,439,376. The structure is also lower in cost.

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CLAIMS

1. A soot blower comprising: a frame structure including a generally horizontal elongated support; a lance carried by the support for movement generally parallel thereto to and from positions in which an end of
5 the lance projects differing distances beyond the end of the support; and combined means for so moving the lance and for transmitting vertical loadings from the lance to said support, said combined means including a carriage to which the lance is attached, the carriage being
10 movably carried by the support to actuate the lance and having a rigid frame, a carriage driving pinion journaled in the carriage on an axis extending transversely of the direction of movement of the carriage, a roller also journaled in the carriage frame on a
15 transverse axis, vertically displaced from the first mentioned transverse axis, and a rigidly integrated longitudinal rack and track structure carried by the support including a track portion having a longitudinally extending track surface and a rack portion having a
20 generally horizontal longitudinally extending toothed surface, wherein said surfaces face away from each other in opposite vertical directions and at least partly overlie each other when viewed in a vertical projection, the teeth of said rack portion mesh with the pinion, the



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roller is rollable on said track surface, the axes of the roller and pinion are rigidly fixed in the carriage frame on parallel lines transverse to the longitudinal extent of said rack and track structure, and the line of engagement of the roller and the position of meshing engagement between the pinion and rack teeth directly overlies each other, whereby the rack and track structure is confined between the pinion and roller and vertical forces are transmitted in opposite directions via the carriage frame and the roller and pinion into the integrated rack and track structure.

2. A soot blower according to claim 1, wherein there are at least two such integrated rack and track structures laterally spaced from each other and secured to said support in parallel relation, there is a pair of said pinions aligned with each other on an axis transverse to the rack and track structures, one of which pinions is in meshing engagement with the toothed surface of each rack portion, and there is a pair of such rollers, one of which is rollable on the track surface of each rack and track structure.

3. A soot blower according to claim 2, wherein the frame structure comprises a hollow beam as said support and having a pair of vertical side flanges, and said integrated rack and track structures are secured to



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inwardly facing walls of said side flanges.

4. A soot blower according to claim 1 or 2, wherein the or each track surface faces upwardly and the rack teeth project downwardly.

5. A soot blower constructed and adapted to operate substantially as hereinbefore described with reference to, and as illustrated in the accompanying drawings.

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