

PICK-UP HEAD SYSTEM

FIELD OF THE INVENTION

[0001] The present invention relates to pick-up head systems for factory, sidewalk and street sweepers, and more particularly to such pick-up head systems that fully clean the surface to be cleaned.

BACKGROUND OF THE INVENTION

[0002] Prior art recirculating air type pick-up heads typically incorporate a full-width suction and full-width air blast to clean the surface and transfer debris-laden air to the right hand side suction tube. Additionally, the pick-up head incorporates a rotating main broom in an internal broom chamber built into the rear of the pick-up head. The main broom sweeps debris forwardly into the internal air stream that captures the swept debris.

[0003] Since the rotating main broom is sweeping rearwardly of the internal air stream within the housing, some of the dust and other fine particulate matter created by the rotating main broom is not carried away by the internal air stream, but instead remains on the surface to be cleaned. This problem is exacerbated by the fact that the surface cleaning vehicle is moving forwardly. Furthermore, prior art rotating main brooms are typically about 14" in diameter, and the contact area of a rotating main broom with the surface to be cleaned is directly under the axis of rotation of the rotating main broom. Accordingly, the debris must be propelled a considerable distance to reach the internal air stream, which occasionally does not happen for some materials. As a result, in the prior art, a significant amount of dust and other fine particulate matter can remain on the surface to be cleaned.

[0004] Further, the direction of propulsion of the debris is not towards the debris outlet of the pick-up head. Instead, the direction of propulsion of the debris is generally transversely oriented to the path the debris must take to reach the debris outlet of the pick-up head.

[0005] Another significant problem stems from the fact that in such prior art pick-up heads, the front-to-back cross-sectional area is quite significant in order to accommodate the rotating main broom. Accordingly, either the speed of the internal air stream is slowed due to larger cross-sectional area of head therefore a very high powered main fan is required.

[0005] It is an object of the present invention to provide a dustless debris pick-up head system.

[0006] It is another object of the present invention to provide a pick-up head system wherein dust and other fine particulate matter are propelled by the broom in a direction towards the debris outlet of the pick-up head.

[0007] It is another object of the present invention to provide a pick-up head system wherein a significant amount of dust and other fine particulate matter do not remain on the surface to be cleaned.

[0008] It is another object of the present invention to provide a pick-up head system wherein the front-to-back cross-sectional area is minimized.

[0009] It is another object of the present invention to provide a pick-up head system that is significantly narrower from front-to-back than prior art pick-up heads.

[00010] It is another object of the present invention to provide a pick-up head system wherein the speed of the internal air stream is not affected by a large cross-sectional area broom chamber housing.

[00011] It is another object of the present invention to provide a pick-up head system wherein a very high powered main fan is not required.

[00012] It is another object of the present invention to provide a pick-up head system that cleans virtually all debris from a surface being cleaned.

[00013] It is another object of the present invention to provide a pick-up head system wherein the direction of propulsion of the debris is generally transversely oriented to the path the debris must take to reach the debris outlet of the pick-up head.

[00014] It is another object of the present invention to provide a pick-up head system that is more efficient thereby allowing either a faster effective sweeping speed or reduction of energy, thus fuel, to perform the same job.

SUMMARY OF THE INVENTION

[00015] In accordance with one aspect of the present invention there is disclosed a novel pick-up head system for use with a surface cleaning vehicle. The pick-up head system comprises a housing extending between a first end and a second end, and having a front and a back, and a suctioning bottom opening; a debris outlet in the housing for permitting dust and debris to egress from the housing into a hopper; a debris passage disposed within the

housing in dust and debris delivery relation with respect to the debris outlet; and at least one non-rotating main broom operatively mounted in the housing adjacent the debris passage for cleaning contact with a surface to be cleaned, thereby loosening debris for subsequent suctioning into the debris outlet.

[00016] Other advantages, features and characteristics of the present invention, as well as methods of operation and functions of the related elements of the structure, and the combination of parts and economies of manufacture, will become more apparent upon consideration of the following detailed description and the appended claims with reference to the accompanying drawings, the latter of which is briefly described herein below.

BRIEF DESCRIPTION OF THE DRAWINGS

[00017] The novel features which are believed to be characteristic of the pick-up head system according to the present invention, as to its structure, organization, use and method of operation, together with further objectives and advantages thereof, will be better understood from the following drawings in which a presently preferred embodiment of the invention will now be illustrated by way of example. It is expressly understood, however, that the drawings are for the purpose of illustration and description only, and are not intended as a definition of the limits of the invention. In the accompanying drawings:

[00018] **Figure 1A** is a partially cut-away perspective view from the front right of the first preferred embodiment pick-up head system according to the present invention;

[00019] **Figure 1B** is a partially cut-away top plan view of the first preferred embodiment pick-up head system of Figure 1A;

[00020] **Figure 1C** is a partially cut-away front elevational view of the first preferred embodiment pick-up head system of Figure 1A;

[00021] **Figure 2A** is a partially cut-away top plan view from the right of the second preferred embodiment pick-up head system according to the present invention;

[00022] **Figure 3A** is a partially cut-away top plan view from the right of the third preferred embodiment pick-up head system according to the present invention;

[00023] **Figure 4A** is a partially cut-away top plan view from the right of the fourth preferred embodiment pick-up head system according to the present invention;

[00024] **Figure 5A** is a partially cut-away top plan view from the right of the fifth preferred embodiment pick-up head system according to the present invention;

[00025] **Figure 6A** is a partially cut-away top plan view from the right of the sixth preferred embodiment pick-up head system according to the present invention;

[00026] **Figure 7A** is a partially cut-away top plan view from the right of the seventh preferred embodiment pick-up head system according to the present invention;

[00027] **Figure 7B** is a partially cut-away front elevational view of the seventh preferred embodiment pick-up head system of Figure 7A;

[00028] **Figure 7C** is an enlarged front elevational view of a portion of the seventh preferred embodiment pick-up head system of Figure 7A;

[00029] **Figure 8A** is a partially cut-away top plan view from the right of the eighth preferred embodiment pick-up head system according to the present invention;

[00030] **Figure 9A** is a partially cut-away top plan view from the right of the ninth preferred embodiment pick-up head system according to the present invention;

[00031] **Figure 10A** is a partially cut-away top plan view from the right of the tenth preferred embodiment pick-up head system according to the present invention;

[00032] **Figure 11A** is a partially cut-away top plan view from the right of the eleventh preferred embodiment pick-up head system according to the present invention;

[00033] **Figure 12A** is a partially cut-away top plan view from the right of the twelfth preferred embodiment pick-up head system according to the present invention;

[00034] **Figure 13A** is a partially cut-away top plan view from the right of the thirteenth preferred embodiment pick-up head system according to the present invention;

[00035] **Figure 14A** is a partially cut-away top plan view from the right of the fourteenth preferred embodiment pick-up head system according to the present invention; and,

[00036] **Figure 15A** is a partially cut-away perspective view from the front right of the fifteenth preferred embodiment pick-up head system according to the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[00037] Reference will now be made to Figures 1A through 1C, which show the first preferred embodiment of the dustless pick-up head system for a mobile surface cleaning vehicle (not specifically shown) according to the present invention, as indicated by general reference numeral 100. In order to perform its sweeping function, the mobile surface cleaning vehicle travels forwardly generally along the longitudinal axis "L".

[00038] The dustless pick-up head system 100 for a mobile surface cleaning vehicle comprises a housing 110 extending between a first end 111 (a right end) and a second end 112 (a left end). The housing 110 also has a front 114 and a back 116, and a suctioning bottom opening 118. There is also a debris outlet 119 in the housing 110 for permitting dust and debris to egress from the housing 110 into a hopper (not specifically shown) via a delivery duct 106.

[00039] The pick-up head system 100 further comprises an airflow obstructing means 120 depending from the front bottom edge 115 of the housing 110 for generally obstructing the passage of air between the front bottom edge 115 of the main housing 110 and the surface to be cleaned 104. The airflow obstructing means 120 comprises a stiff flap, in order to substantially preclude the entry of debris into the housing 110 through the suctioning bottom opening 118 via passage under the front bottom edge 115 of the housing 110.

[00040] A debris passage 130 is disposed within the housing 110 in dust and debris delivery relation with respect to the debris outlet 119. The debris passage 130 is oriented generally along the length of the housing 110.

[00041] The pick-up head system 100 further comprises an optional debris suctioning inlet 60 in the housing 110 disposed adjacent the first end 111 of the housing 110, and preferably at the first end 111 of the housing 110. The debris suctioning inlet 60 is for suctioning dust and debris into the debris passage 130. The debris passage 130 extends from the debris suctioning inlet 60 to the debris outlet 119.

[00042] The housing 110 also has a front wall 115, and further comprises a debris receiving main inlet 142 in the front wall 115 of the housing 110 in debris receiving relation with respect to a surface to be cleaned 104, for

receiving debris to the housing 110, and a door apparatus 150 operatively mounted at the debris receiving main inlet 142. The door apparatus preferably comprises a substantially sealed door apparatus 150, itself comprising a rotatable door assembly 146 defining a substantially horizontally oriented central pivot axis "P" and an outer periphery 147. A seal is operatively disposed in sealing relation between the rotatable door assembly 146 and the housing 110.

[00043] There is also at least one non-rotating main broom 140 operatively mounted in the housing 110 adjacent the debris passage 130 for cleaning contact with a surface to be cleaned 104, thereby loosening debris for subsequent carrying along the debris passage 130 by a flow of air and also for immediately subsequent suctioning into the debris outlet 119. The term non-rotating main broom refers to a broom that does not rotate about a generally central fixed axis.

[00044] In the first preferred embodiment, the at least one non-rotating main broom 140 comprises a stationary main broom 140 disposed forwardly of the debris passage 130. The stationary main broom 140 extends substantially along the length of the debris passage 130, and air and debris may flow all around the top or front of the stationary main broom 140, as it does along the debris passage 130.

[00045] Preferably, as can readily be seen in Figure 1B, the stationary main broom 140 is less than about eight (8) centimeters in width, and even more preferably about four (4) centimeters in width. Resultingly, in the first preferred embodiment is illustrated, the fore-to-aft width of the housing 110 is no more than about five (5) or six (6) centimeters greater than the width of the debris passage 130 itself, with most of the slight extra width being taken up by the stationary main broom 140. Accordingly, the cross-sectional area of the overall path within the housing 110 that air and debris can flow along, is only slightly greater than the cross-sectional area of the debris passage 130, thereby maximizing the effectiveness of the air flow through the debris passage 130. It can therefore be seen that the present invention provides a pick-up head system 100 wherein high speed airflow is maintained at as close to an optimal level as reasonably possible, by having a narrow main sweeping broom 140 in the pick-up head system 100, instead of a much wider diameter cylindrically shaped rotating sweeping broom, as is known in the prior art.

[00046] Reference will now be made to Figure 2A, which show a second preferred embodiment of the pick-up head system according to the present invention, as indicated by reference numeral 200. The second preferred embodiment pick-up head system 200 is similar to the first preferred embodiment pick-up head system 100, except that the at least one non-rotating main broom 240, which is still a stationary main broom, is disposed rearwardly of the debris passage 230. As in the first preferred embodiment, high speed airflow is maintained at as close to an optimal level as reasonably possible, by having a narrow main sweeping broom 240 in the pick-up head

system 200, instead of a much wider diameter cylindrically shaped rotating sweeping broom, as is known in the prior art.

[00047] Reference will now be made to Figure 3A, which shows a third preferred embodiment of the pick-up head system according to the present invention, as indicated by reference numeral 300. The third preferred embodiment pick-up head system 300 is similar to the first preferred embodiment pick-up head system 100, except that at least one non-rotating main broom 340 comprises a movable main broom 340, and more specifically comprises an oscillating main broom 340 and a selectively operable motor means 350 for operating the oscillating main broom 340. The selectively operable motor means 350 preferably comprises a pneumatic motor 350 operatively coupled to the oscillating main broom 340 by means of a suitable cam arrangement 342. The oscillating main broom 340 oscillates longitudinally along its length, as indicated by double-ended arrow "A". As in the other preferred embodiments, high speed airflow is maintained at as close to an optimal level as reasonably possible, by having a narrow main sweeping broom 340 in the pick-up head system 300, instead of a much wider diameter cylindrically shaped rotating sweeping broom, as is known in the prior art.

[00048] Reference will now be made to Figure 4A, which shows a fourth preferred embodiment of the pick-up head system according to the present invention, as indicated by reference numeral 400. The fourth preferred embodiment pick-up head system 400 is similar to the third preferred embodiment pick-up head system 300, except that the oscillating main broom 440 oscillates substantially transversely with respect to its length, as indicated by double arrows "B". As in the other preferred embodiments, high speed airflow is maintained at as close to an optimal level as reasonably possible, by having a narrow main sweeping broom 440 in the pick-up head system 400, instead of a much wider diameter cylindrically shaped rotating sweeping broom, as is known in the prior art.

[00049] Reference will now be made to Figure 5A, which shows a fifth preferred embodiment of the pick-up head system according to the present invention, as indicated by reference numeral 500. The fifth preferred embodiment pick-up head system 500 is similar to the third preferred embodiment pick-up head system 300, except that the movable main broom 540 comprises a vibrating main broom 540 and a selectively operable motor means 550 for operating the vibrating main broom 540. The selectively operable motor means 550 preferably comprises a pneumatic motor 550 operatively coupled to the vibrating main broom 540 by means of a suitable cam arrangement 542. The vibrating main broom 540 vibrates in various directions, as indicated by multiple arrows "C".

[00050] As in the other preferred embodiments, high speed airflow is maintained at as close to an optimal level as reasonably possible, by having a narrow main sweeping broom 540 in the pick-up head system 500, instead of a much wider diameter cylindrically shaped rotating sweeping broom, as is known in the prior art.

[00051] Reference will now be made to Figure 6A, which shows a sixth preferred embodiment of the pick-up head system according to the present invention, as indicated by reference numeral 600. The sixth preferred embodiment pick-up head system 600 is similar to the third preferred embodiment pick-up head system 300, fourth preferred embodiment pick-up head system 400, and fifth preferred embodiment pick-up head system 500, except that the vibrating main broom 640 is disposed rearwardly of the debris passage 630.

[00052] As in the other preferred embodiments, high speed airflow is maintained at as close to an optimal level as reasonably possible, by having a narrow main sweeping broom 640 in the pick-up head system 600, instead of a much wider diameter cylindrically shaped rotating sweeping broom, as is known in the prior art.

[00053] Reference will now be made to Figures 7A through 7C, which show a seventh preferred embodiment of the pick-up head system according to the present invention, as indicated by reference numeral 700. The seventh preferred embodiment pick-up head system 700 is similar to the first preferred embodiment pick-up head system 100, except that the movable main broom 740 comprises a segmented main broom 740 comprising a plurality of broom segments 741, and a selectively operable motor means 750 for operating the segmented main broom 740.

[00054] The plurality of broom segments 741 are each mounted to a chain drive mechanism 742 comprising a drive chain 743 operatively engaged on a plurality of sprockets 744, specifically on a drive sprocket 744d and an idler sprocket 744i. The selectively operable motor means 750 preferably comprises a hydraulically driven motor 750, but could alternatively comprise an electrically driven motor. The hydraulically driven motor 750 rotationally drives the drive sprocket 744d in rotational direction as indicated by arrow "D", which causes motion of the drive chain 743 along its path around the drive sprocket 744d and the idler sprocket 744i, as indicated by arrows "E", which further causes the idler sprocket 744i to rotate in a rotational direction as indicated by arrow "F". The bristles 741b of the plurality of broom segments 741 are forcefully moved across the surface to be cleaned 704 in a direction as indicated by arrows "G", thereby moving debris on the surface to be cleaned 704 directly linearly towards the debris outlet 719, and transversely to the direction of travel of the surface cleaning vehicle. Accordingly, the segmented main broom 740 sweeps the surface to be cleaned 704 in a superior manner as compared to known prior art rotating main brooms in that the debris is moved directly to the debris outlet 719 instead of just being thrown forwardly into the stream of air traveling through the debris passage 730 of the housing 710. Furthermore, all this is accomplished by a main broom 740 having a width of about four (4) centimeters instead of about thirty (30) centimeters, as is standard in the prior art.

[00055] As in the other preferred embodiments, high speed airflow is maintained at as close to an optimal level as reasonably possible, by having a narrow main sweeping broom 740 in the pick-up head system 700, instead of a much wider diameter cylindrically shaped rotating sweeping broom, as is known in the prior art.

[00056] Reference will now be made to Figure 8A, which shows a eighth preferred embodiment of the pick-up head system according to the present invention, as indicated by reference numeral 800. The eighth preferred embodiment pick-up head system 800 is similar to the seventh preferred embodiment pick-up head system 700, except that the segmented main broom 840 is disposed rearwardly of the debris passage 830.

[00057] As in the other preferred embodiments, high speed airflow is maintained at as close to an optimal level as reasonably possible, by having a narrow main sweeping broom 840 in the pick-up head system 800, instead of a much wider diameter cylindrically shaped rotating sweeping broom, as is known in the prior art.

[00058] Reference will now be made to Figures 9A, which shows a ninth preferred embodiment of the dustless pick-up head system according to the present invention, as indicated by reference numeral 900. The ninth preferred embodiment pick-up head system 900 is similar to the first preferred embodiment pick-up head system 100, except that the pick-up head system 900 further comprises a partition 960 disposed between the debris passage 930 and the at least one non-rotating main broom 940, which is a stationary main broom 940. The partition 960 physically sections off the debris passage 930 from the space that houses the stationary main broom 940. As in the other preferred embodiments, high speed airflow is maintained at as close to an optimal level as reasonably possible, by having a narrow main sweeping broom 940 in the pick-up head system 900, instead of a much wider diameter cylindrically shaped rotating sweeping broom, as is known in the prior art.

[00059] Reference will now be made to Figure 10A, which shows a tenth preferred embodiment of the pick-up head system according to the present invention, as indicated by reference numeral 1000. The tenth preferred embodiment pick-up head system 1000 is similar to the ninth preferred embodiment pick-up head system 900, except that the stationary main broom 1040 is disposed rearwardly of the debris passage 1030, behind the partition 1060. As in the other preferred embodiments, high speed airflow is maintained at as close to an optimal level as reasonably possible, by having a narrow main sweeping broom 1040 in the pick-up head system 1000, instead of a much wider diameter cylindrically shaped rotating sweeping broom, as is known in the prior art.

[00060] Reference will now be made to Figure 11A, which shows a eleventh preferred embodiment of the pick-up head system according to the present invention, as indicated by reference numeral 1100. The eleventh preferred embodiment pick-up head system 1100 is similar to the first preferred embodiment pick-up head system 100, except that the housing is substantially straight and is slanted rearwardly from the first debris suctioning inlet

1160 to a left end wall portion 1117 disposed at the second end 1112 of the housing 1110. There is only one debris suctioning inlet 1160 disposed at the first end 1111 of the housing 1110. Furthermore, the debris outlet 1119 is disposed towards the second end 1112 of the housing 1110. The debris receiving main inlet 1142 and the sealed door apparatus 1150 are also disposed adjacent the second end 1112 of the housing 1110. The debris outlet 1119 is disposed in the back wall portion 1116 of the housing 1110 adjacent the second end 1112 of the housing 1110.

[00061] There is a single non-rotating main broom 1140 operatively mounted in the housing 1110 adjacent the debris passage 1130 for cleaning contact with a surface to be cleaned 1104, thereby loosening debris for subsequent carrying along the debris passage 1130 by a flow of air and also for immediately subsequent suctioning into the debris outlet 1119. The term non-rotating main broom refers to a broom that does not rotate about a generally central fixed axis. In the eleventh preferred embodiment, the non-rotating main broom 1140 comprises a stationary main broom 1140 disposed forwardly of the debris passage 1130. The stationary main broom 1140 extends substantially along the length of the debris passage 1130, and air and debris may flow all around the top or front of the stationary main broom 1140, in addition to flowing along the main part of the debris passage 1130.

[00062] Reference will now be made to Figure 12A, which shows a twelfth preferred embodiment of the pick-up head system according to the present invention, as indicated by reference numeral 1200. The twelfth preferred embodiment pick-up head system 1200 is similar to the eleventh preferred embodiment pick-up head system 1100, except that the non-rotating main broom 1240 is disposed rearwardly of the debris passage 1230.

[00063] Reference will now be made to Figure 13A, which shows a thirteenth preferred embodiment of the pick-up head system according to the present invention, as indicated by reference numeral 1300. The thirteenth preferred embodiment pick-up head system 1300 is similar to the first preferred embodiment pick-up head system 100, except that there are four non-rotating main brooms 1340 (only two shown), two brooms 1340 behind the debris passage 1330 and two brooms 1340 in front of the debris passage 1330. Furthermore, two of the brooms 1340 are on the left side of the debris outlet 1319 and two of the brooms 1340 are on the right side of the debris outlet 1319.

[00064] Reference will now be made to Figure 14A, which shows the fourteenth preferred embodiment of the dustless pick-up head system 1400 for use with a surface cleaning vehicle 1402, as indicated by the general reference numeral 1400. The fourteenth preferred embodiment dustless pick-up head system 1400 comprises a housing 1410 extending between a front 1410f, a back 1410b, a first end 1411 and a second end 1412, and having a first suctioning bottom opening 1414a and a second suctioning bottom opening 1414b.

[00065] A debris passage 1430 is disposed within the housing 1410 in dust and debris delivery relation with respect to a dust and debris outlet 1420. The dust and debris outlet 1420 is for receiving dust and debris from the debris passage 1430 and permitting dust and debris to egress from the housing 1410 into a hopper (not specifically shown). An air supply passage 1480 is disposed adjacent the rear of the housing 1410 and extending between the dust and debris outlet 1420 and the first end 1411 of the housing 1410. The debris passage 1430 has a particulate-laden air ingress 1407 for receiving particulate-laden air flow from the air supply passage 1480. The air supply passage 1480 has an air inlet 1481 in fluid communication with a source of high speed air such as the main fan 1417, a bottom opening 1484 for permitting high speed air from the air inlet 1481 to be forcefully directed to a surface to be cleaned 1404, and an air outlet 1489 in fluid communication with the particulate-laden air ingress 1407 of the housing 1410 for permitting the transfer of particulate-laden air from the air supply passage 1480 to the housing 1410. A first pair of non-rotating main brooms 1440 (only one shown) are operatively mounted in the housing 1410 adjacent the debris passage 1430 for cleaning contact with a surface to be cleaned 1404, thereby loosening debris for subsequent suctioning into the dust and debris outlet 1419. A second pair of non-rotating main brooms 1440 (only one shown) are operatively mounted in housing 1410, within the air supply passages 1480, specifically at the back of the air supply passages 1480.

[00066] Reference will now be made to Figure 15A, which shows the fifteenth preferred embodiment of the dustless pick-up head system, as indicated by the general reference numeral 1500. The fifteenth preferred embodiment dustless pick-up head system 1500 is similar to the first preferred embodiment pick-up head system 100, except that there is a vertical support wall 1552 disposed directly rearwardly of the main broom 1551 in supporting relation with respect to the main broom 1551 as it sweeps the surface to be cleaned 1504. As the surface cleaning vehicle 1502 moves forwardly along the surface to be cleaned 1504, the main broom 1551 can be bent rearwardly at the bottom, thus losing its effectiveness. The vertical support wall 1552 retains the main broom 1551 in a generally straight and upright orientation as it sweeps. Alternatively, a horizontally oriented bar disposed immediately behind the bottom of the main broom 1551 could be used.

[00067] As can be understood from the above description and from the accompanying drawings, the present invention provides a dustless debris pick-up head system, and a pick-up head system wherein dust and other fine particulate matter do not need to be propelled a significant distance to an air stream, wherein a significant amount of dust and other fine particulate matter do not remain on the surface to be cleaned, wherein the front-to-back cross-sectional area is minimized, that is significantly narrower from front-to-back than prior art pick-up heads, wherein the speed of the internal air stream is fast enough to clean effectively, wherein a very high powered main fan is not required, that cleans virtually all debris from a surface being cleaned, and wherein the direction of propulsion of the debris is generally transversely oriented to the path the debris must take to reach the debris outlet of the pick-up head, all of which features are unknown in the prior art.

[00068] Other variations of the above principles will be apparent to those who are knowledgeable in the field of the invention, and such variations are considered to be within the scope of the present invention. Further, other modifications and alterations may be used in the design and manufacture of the dustless pick-up head system of the present invention without departing from the spirit and scope of the accompanying claims.

I CLAIM:

1. A pick-up head system for use with a surface cleaning vehicle, said pick-up head system comprising:

5 a housing extending between a first end and a second end, and having a front and a back, and a suctioning bottom opening;

a debris outlet in said housing for permitting dust and debris to egress from said housing into a hopper;

10 a debris passage disposed within said housing in dust and debris delivery relation with respect to said debris outlet; and,

15 at least one non-rotating main broom operatively mounted in said housing adjacent said debris passage for cleaning contact with a surface to be cleaned, thereby loosening debris for subsequent suctioning into said debris outlet.

2. The pick-up head system of claim 1, wherein said at least one non-rotating main broom has an overall front-to-back thickness and a bottom contact surface with a front-to-back thickness, and wherein said overall front-to-back thickness of said at least one non-rotating main broom is substantially the same as said front-to-back thickness of said bottom contact surface.

3. The pick-up head system of claim 1, wherein said housing has a front wall, and further comprising a debris receiving main inlet in said front wall of said housing in debris receiving relation with respect to a surface to be cleaned, for receiving debris to said housing, and a door apparatus operatively mounted at said debris receiving main inlet.

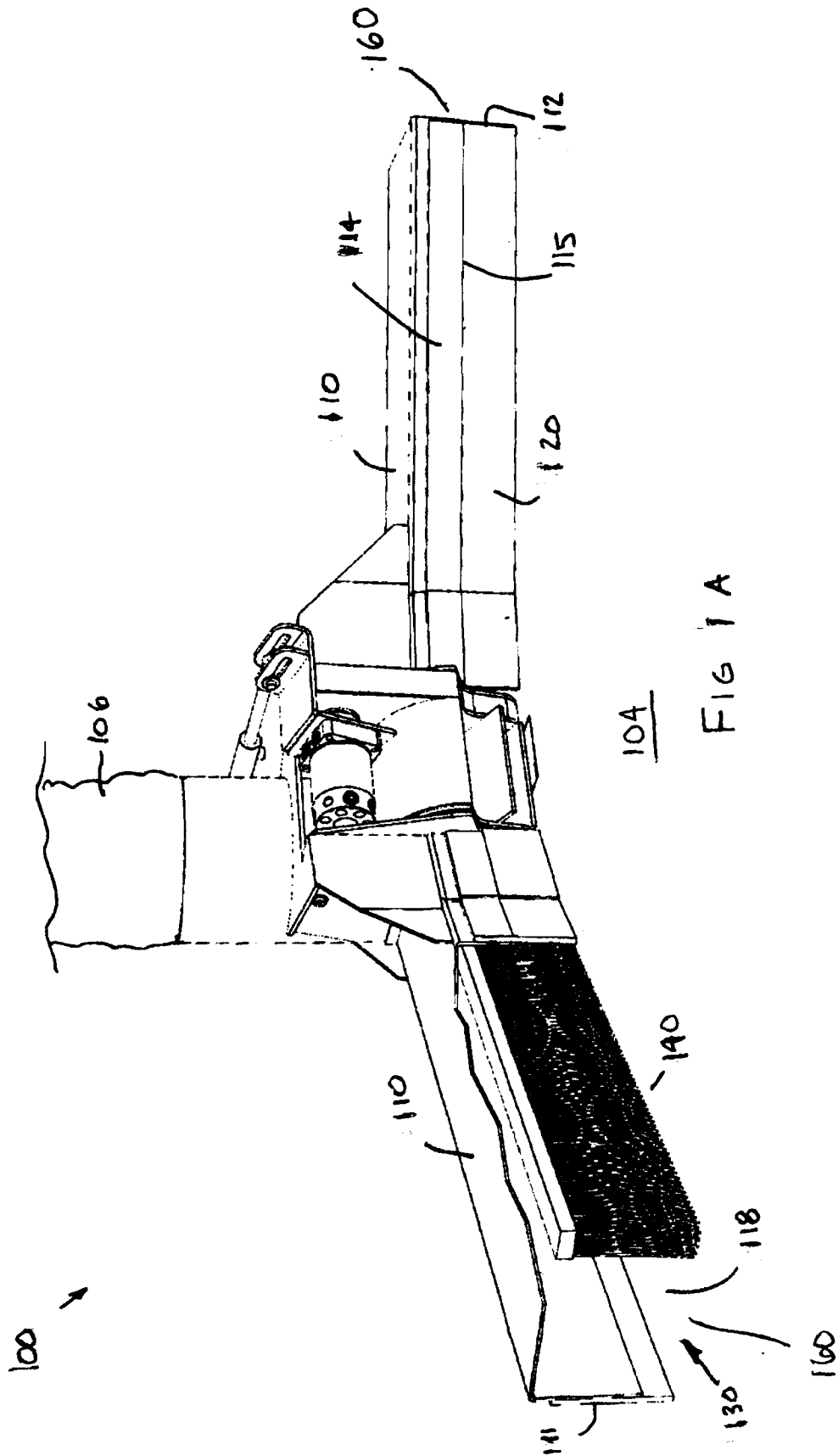
4. The pick-up head system of claim 3, wherein said door apparatus comprises a substantially sealed door apparatus.

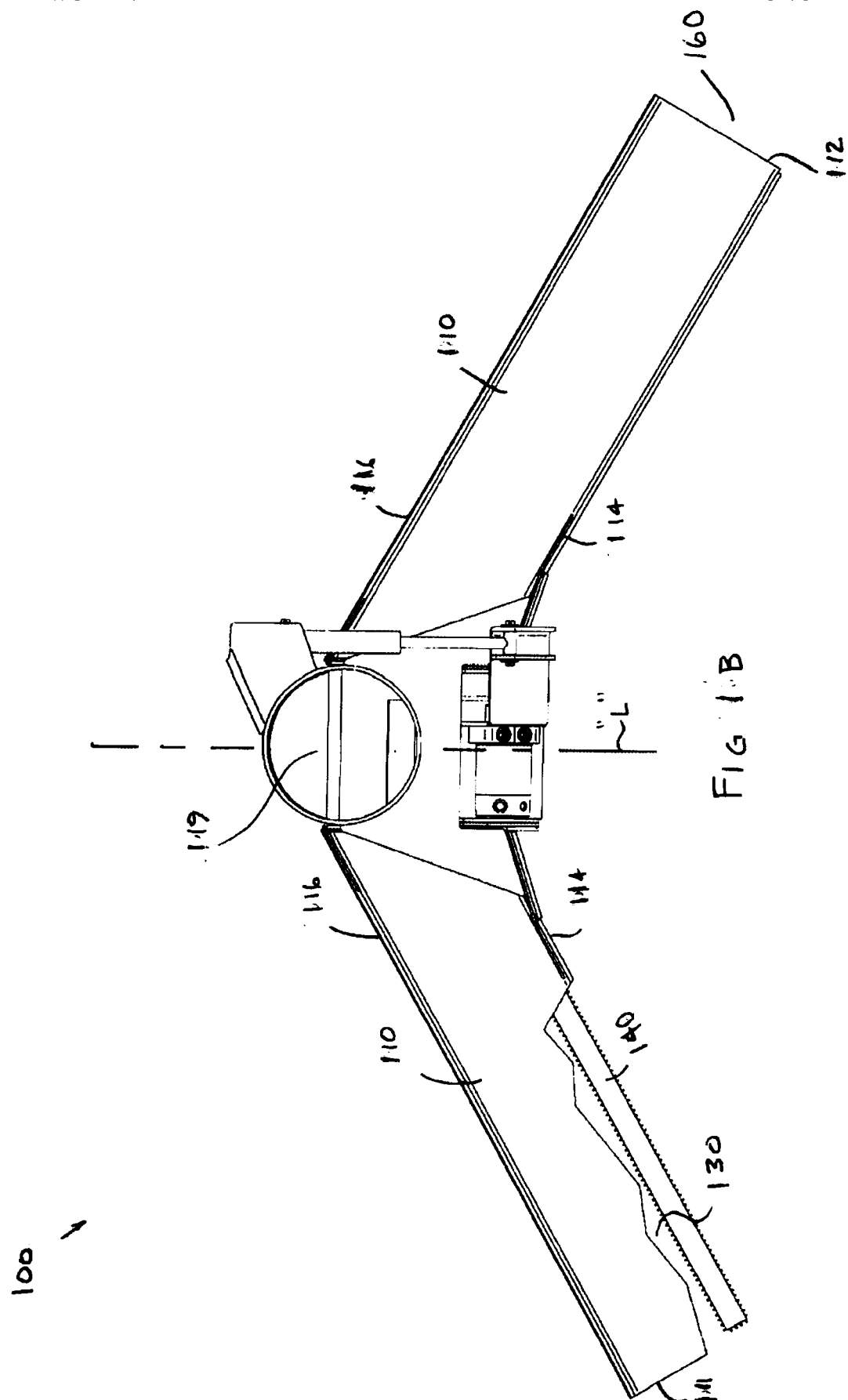
5. The pick-up head system of claim 4, wherein said substantially sealed door apparatus comprises a rotatable door assembly defining a substantially horizontally oriented central pivot axis and an outer periphery, and a seal operatively disposed in sealing relation between said rotatable door assembly and said housing.

6. The pick-up head system of claim 1, further comprising a partition disposed between said debris passage and said at least one non-rotating main broom.
7. The pick-up head system of claim 1, wherein said at least one non-rotating main broom is disposed forwardly of said debris passage.
8. The pick-up head system of claim 1, wherein said at least one non-rotating main broom is disposed rearwardly of said debris passage.
9. The pick-up head system of claim 1, wherein said at least one non-rotating main broom comprises a stationary main broom.
10. The pick-up head system of claim 1, wherein said at least one non-rotating main broom comprises a movable main broom.
11. The pick-up head system of claim 8, wherein said movable main broom comprises a vibrating main broom and a selectively operable motor means for operating said vibrating main broom.
12. The pick-up head system of claim 8, wherein said movable main broom comprises an oscillating main broom and a selectively operable motor means for operating said oscillating main broom.
13. The pick-up head system of claim 10, wherein said oscillating main broom oscillates longitudinally along the length of said oscillating main broom.
14. The pick-up head system of claim 10, wherein said oscillating main broom oscillates substantially transversely with respect to the length of said oscillating main broom.
15. The pick-up head system of claim 14, wherein said movable main broom comprises a segmented main broom comprising a plurality of broom segments, and a selectively operable motor means for operating said segmented main broom.
16. The pick-up head system of claim 13, wherein said plurality of broom segments are each mounted to a chain drive mechanism comprising a drive chain operatively engaged on a plurality of sprockets, and wherein said selectively operable motor means drives at least one of said sprockets.

17. The pick-up head system of claim 1, wherein said at least one non-rotating main broom extends substantially along the length of said debris passage.
18. The pick-up head system of claim 1, wherein said debris outlet is disposed in between said first end and said second end of said housing, and wherein said at least one non-rotating main broom comprises a first non-rotating main broom disposed between said first end of said housing and said debris outlet, and further comprising a second non-rotating main broom disposed between said second end of said housing and said dust and said debris outlet.
19. The pick-up head system of claim 16, wherein said first non-rotating main broom and said second non-rotating main broom together extend substantially along the length of said debris passage.
20. The pick-up head system of claim 17, further comprising a left partition and a right partition disposed between said debris passage and said first non-rotating main broom and said second non-rotating main broom, respectively.
21. The pick-up head system of claim 18, wherein said debris passage is disposed between said first non-rotating main broom and said second non-rotating main broom.
22. The pick-up head system of claim 19, further comprising substantially rigid skirt disposed at said bottom peripheral edge of said housing for interfacing said housing in substantially sealed relation with the surface to be cleaned as the surface cleaning vehicle moves along said surface to be cleaned.
23. The pick-up head system of claim 20, further comprising an air supply passage within said housing having an air inlet adjacent said debris outlet and an air outlet adjacent said first end of said housing, wherein said air inlet is connectable to a source of high speed air flow, wherein said air supply passage provides a flow of high speed air to said debris passage at the first end of said housing for cleaning the surface to be cleaned substantially evenly from the first end of said housing to said debris outlet.
24. The pick-up head system of claim 1, further comprising an airflow obstructing means depending from the front of said housing for generally obstructing the passage of air between the bottom edge of said main housing and the surface to be cleaned.
25. The pick-up head system of claim 24, wherein said airflow obstructing means is stiff.

26. The pick-up head system of claim 1, wherein said at least one non-rotating main broom is less than about eight centimeters in width.
27. The pick-up head system of claim 1, wherein said at least one non-rotating main broom is about four centimeters in width.
28. The pick-up head system of claim 1, wherein said at least one non-rotating main broom has a ratio of length to fore-aft width of greater than 20:1.
29. The pick-up head system of claim 1, further comprising a debris suctioning inlet in said housing disposed adjacent said first end of said housing for suctioning dust and debris into said debris passage, and wherein said debris passage extends from said debris suctioning inlet to said debris outlet.
30. The pick-up head system of claim 29, wherein said debris suctioning inlet is disposed at said first end of said housing.





100.

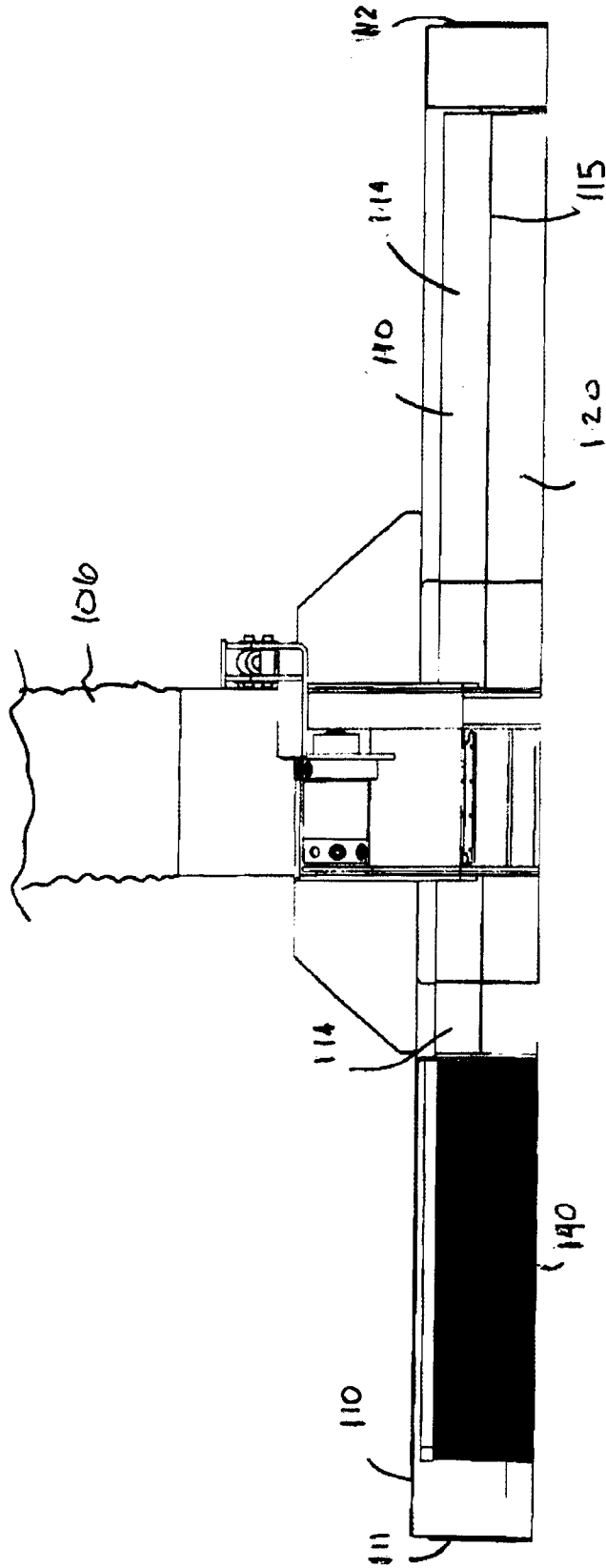
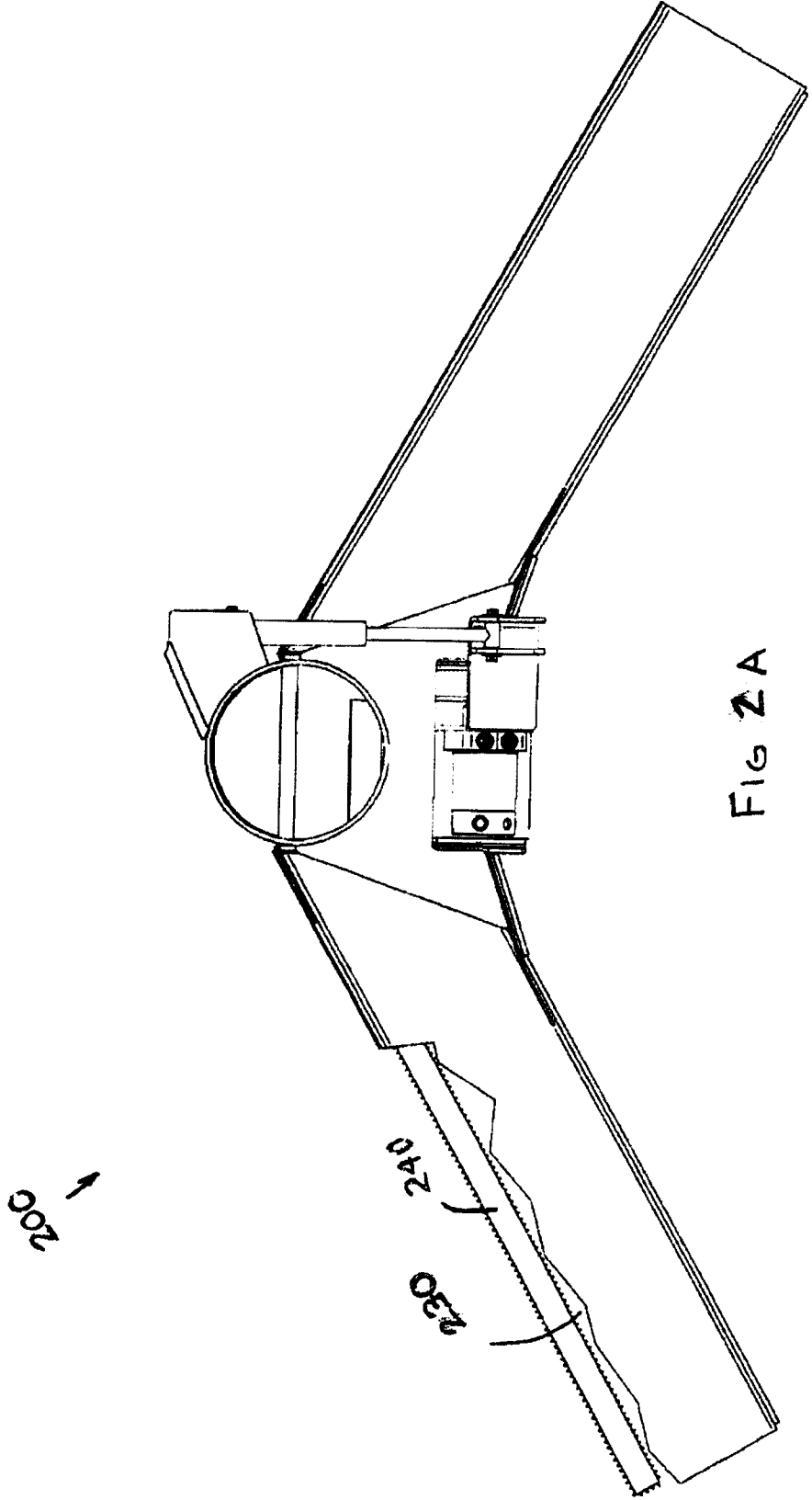
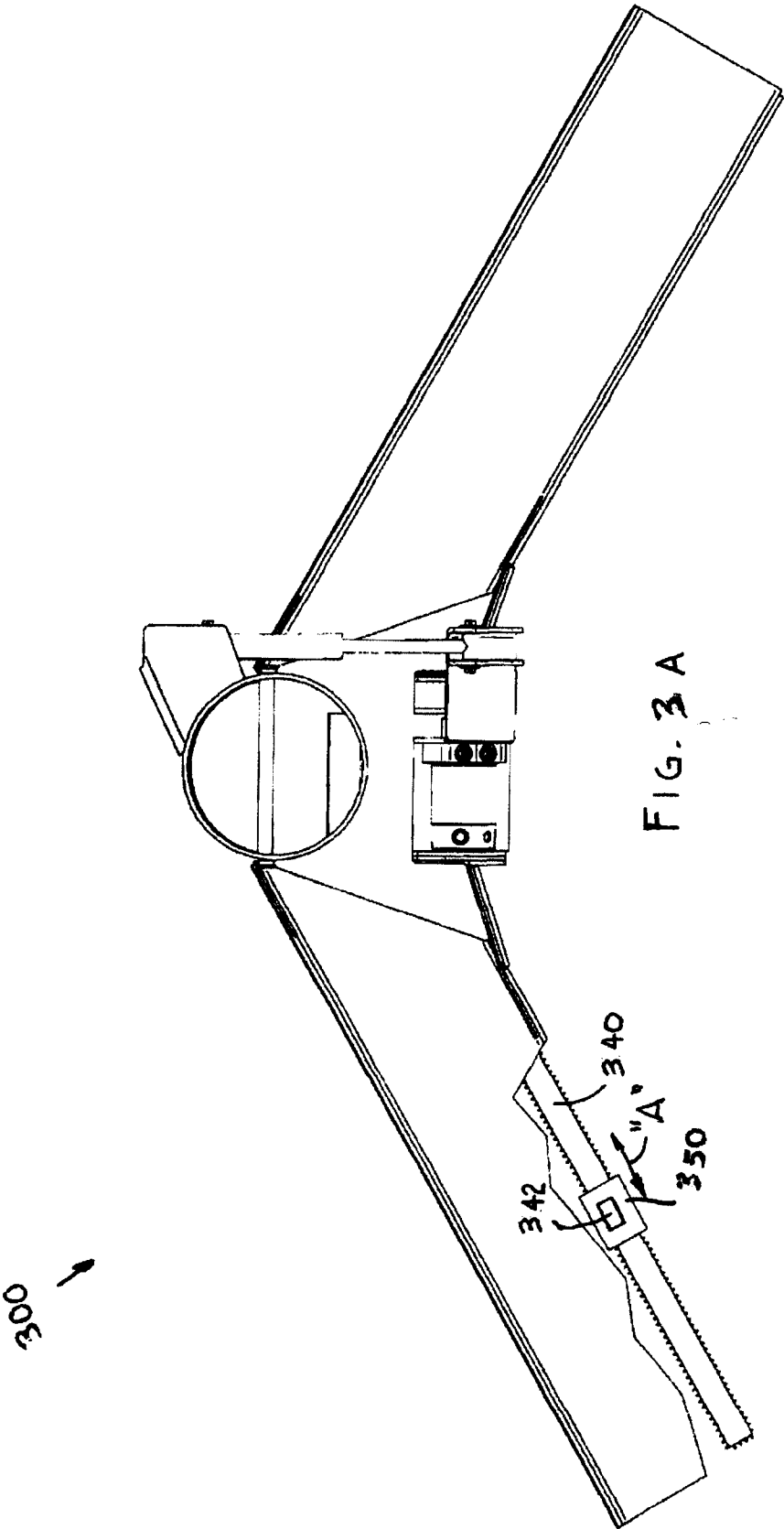
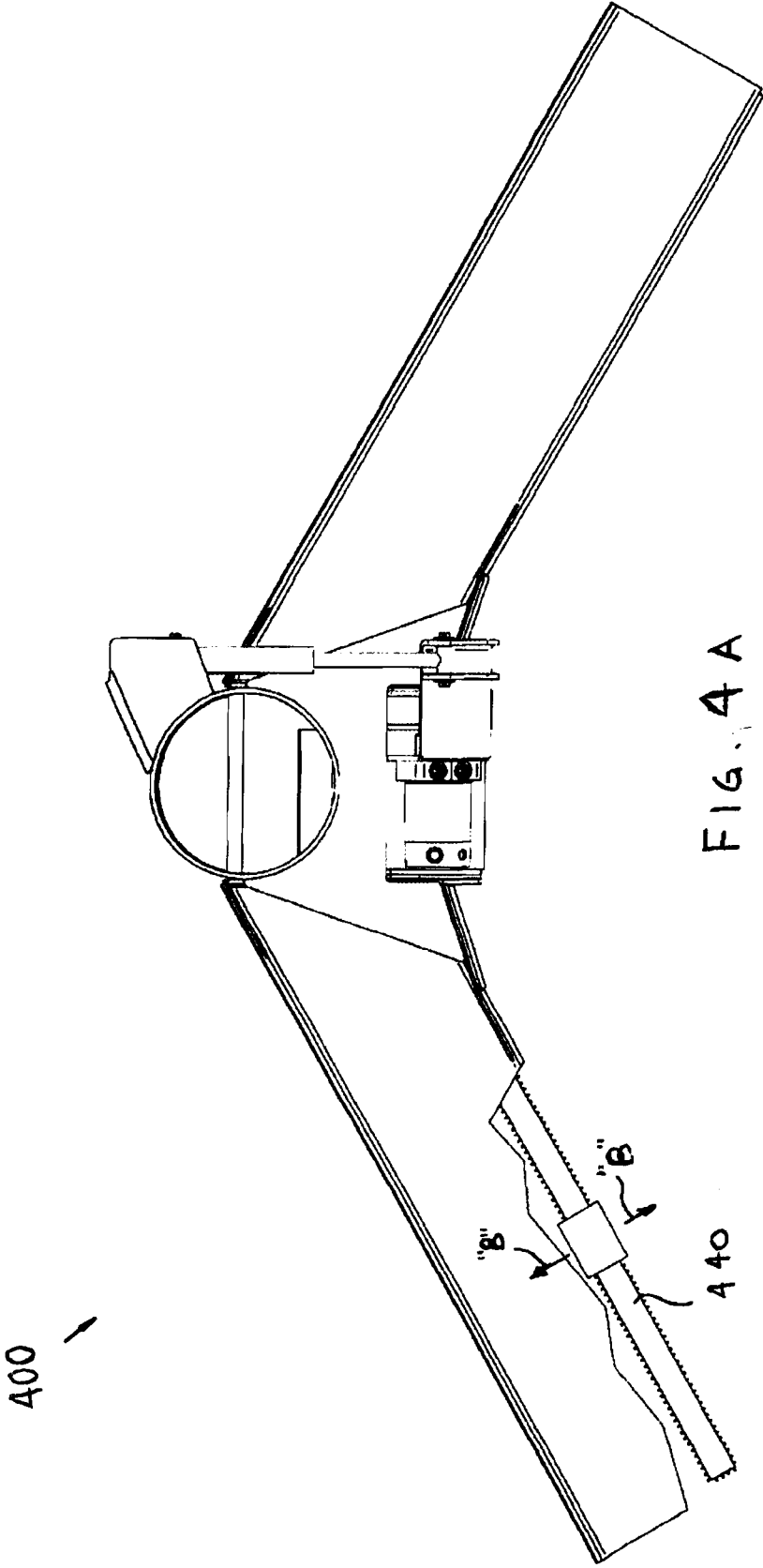


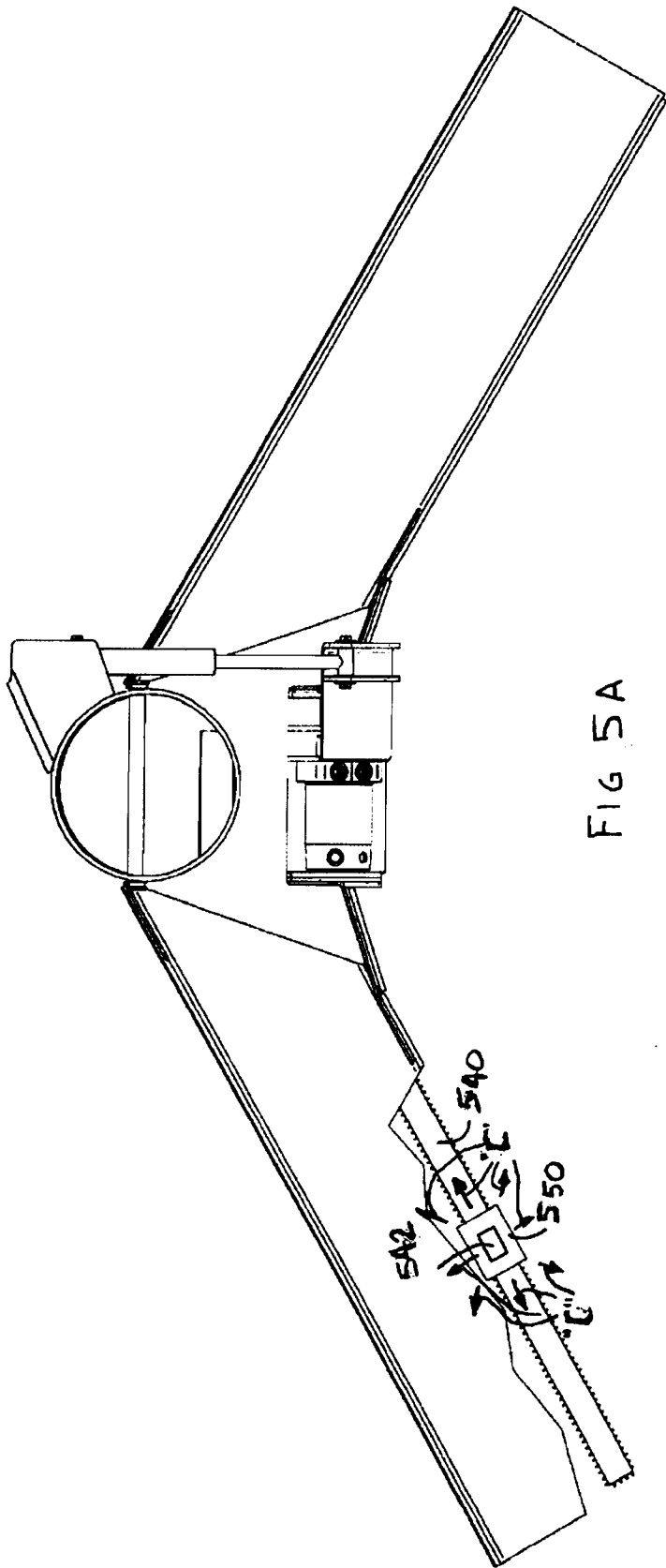
FIG. 1c

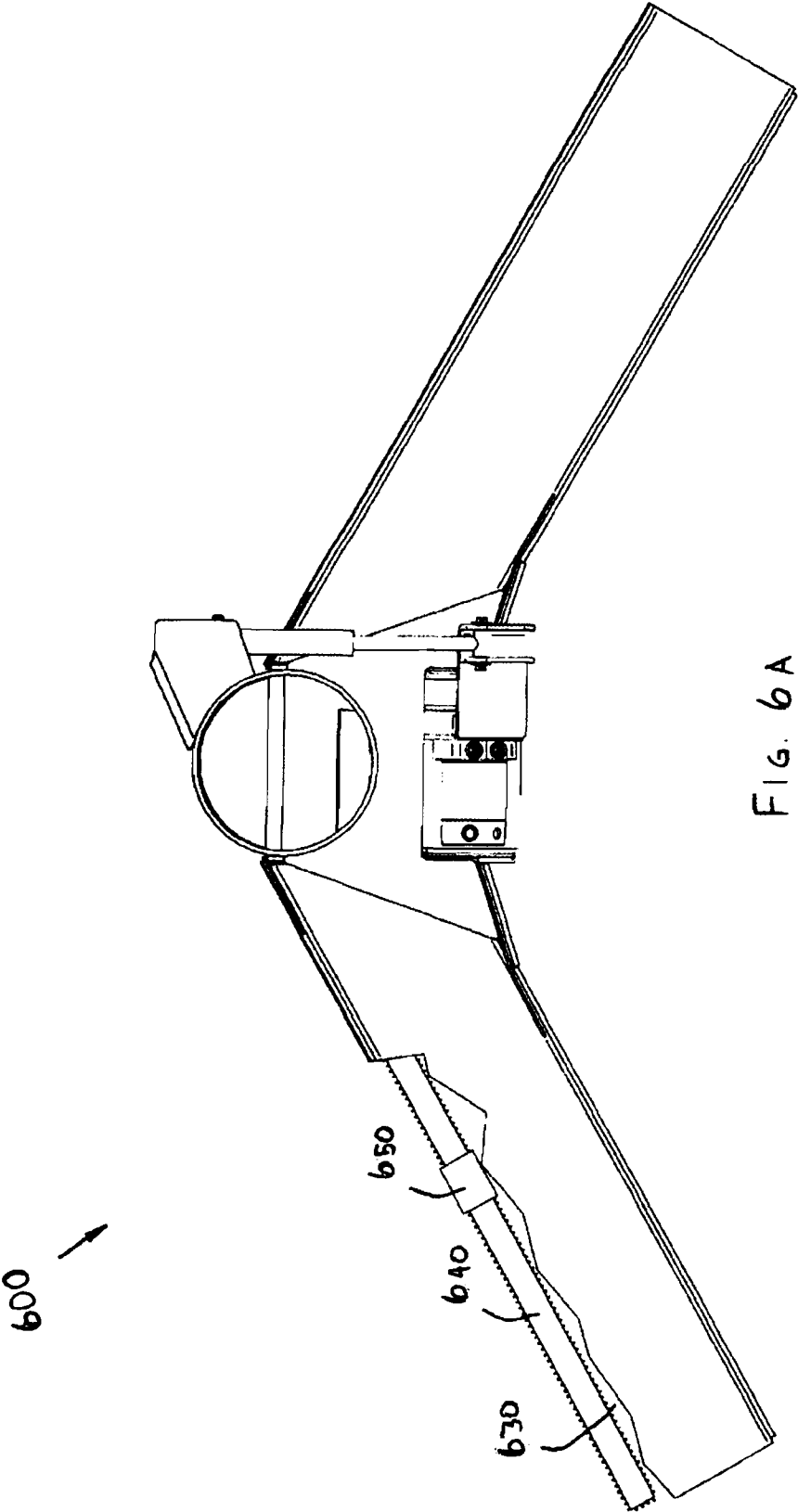






500 ↗





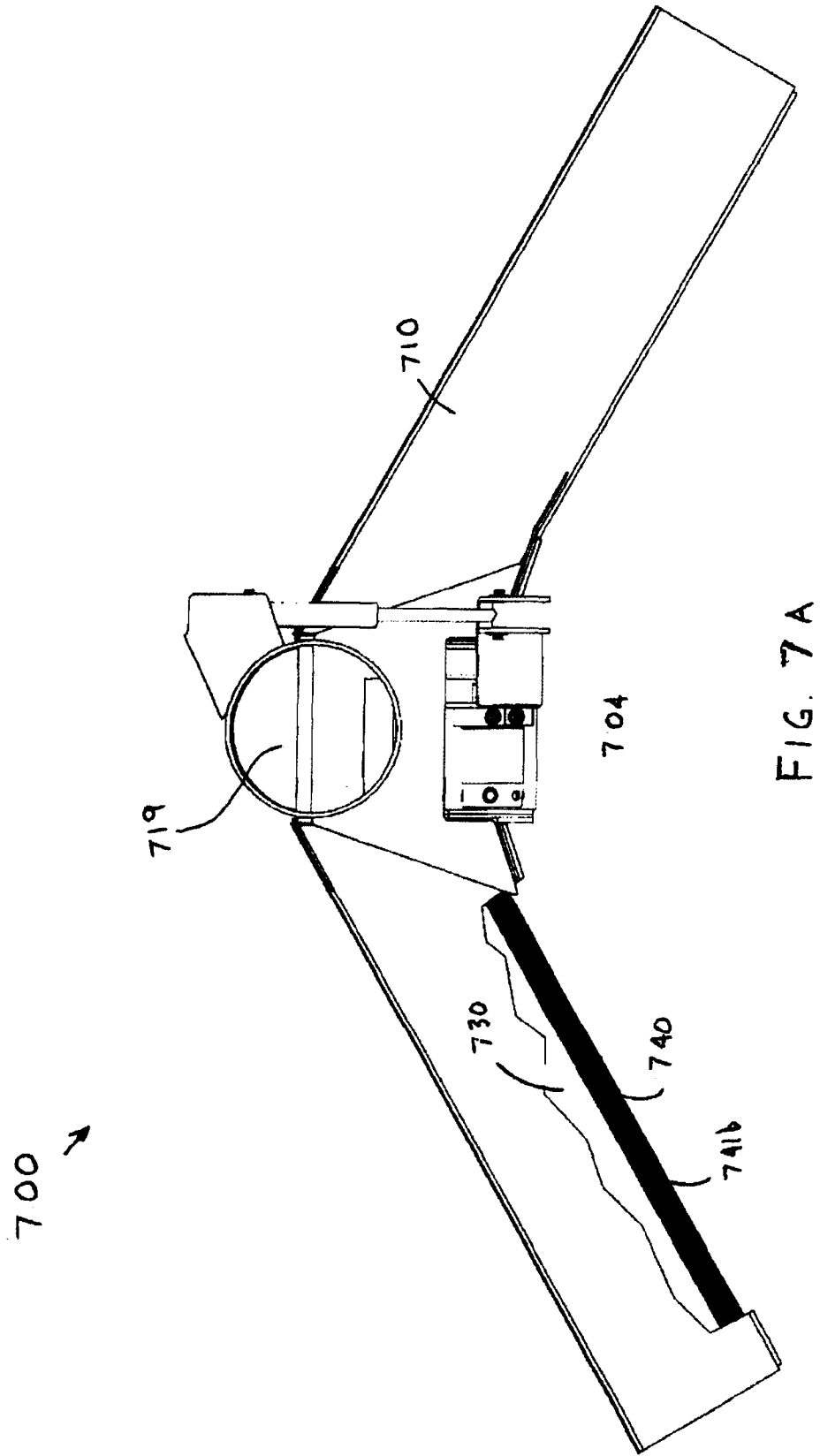


FIG. 7A

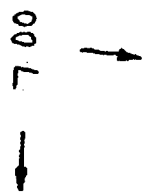
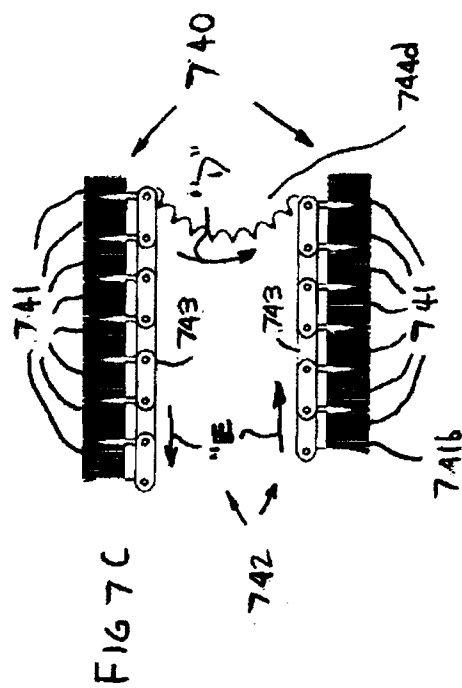
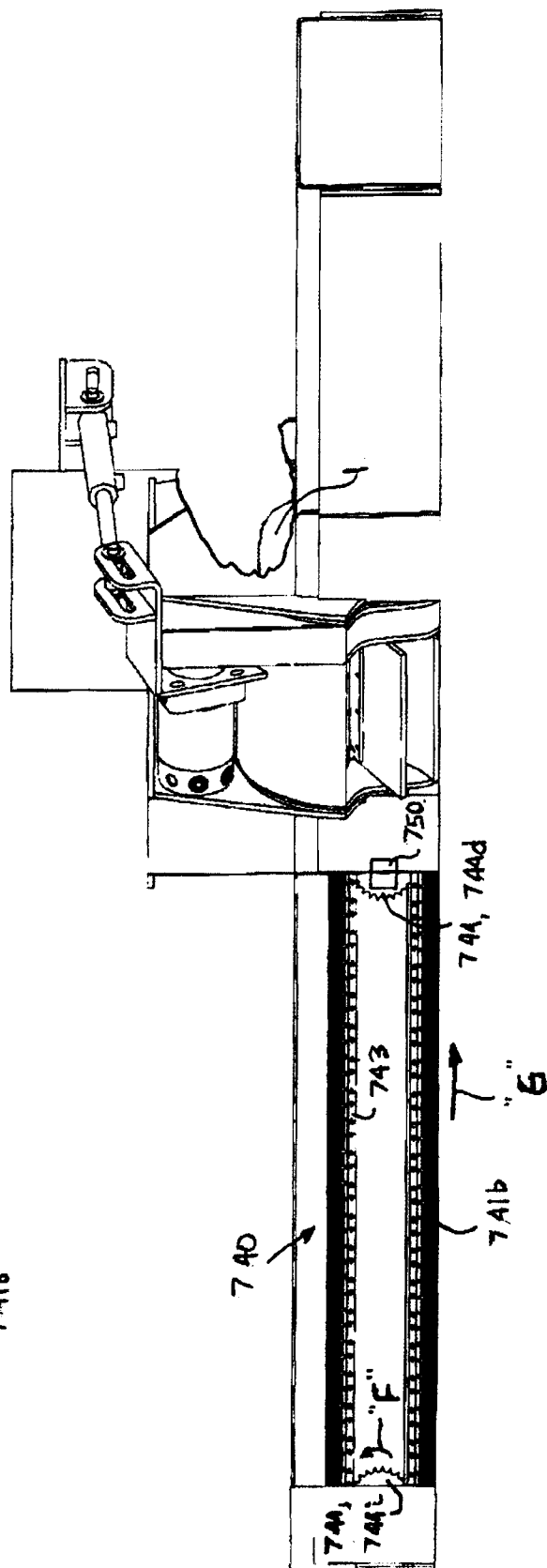
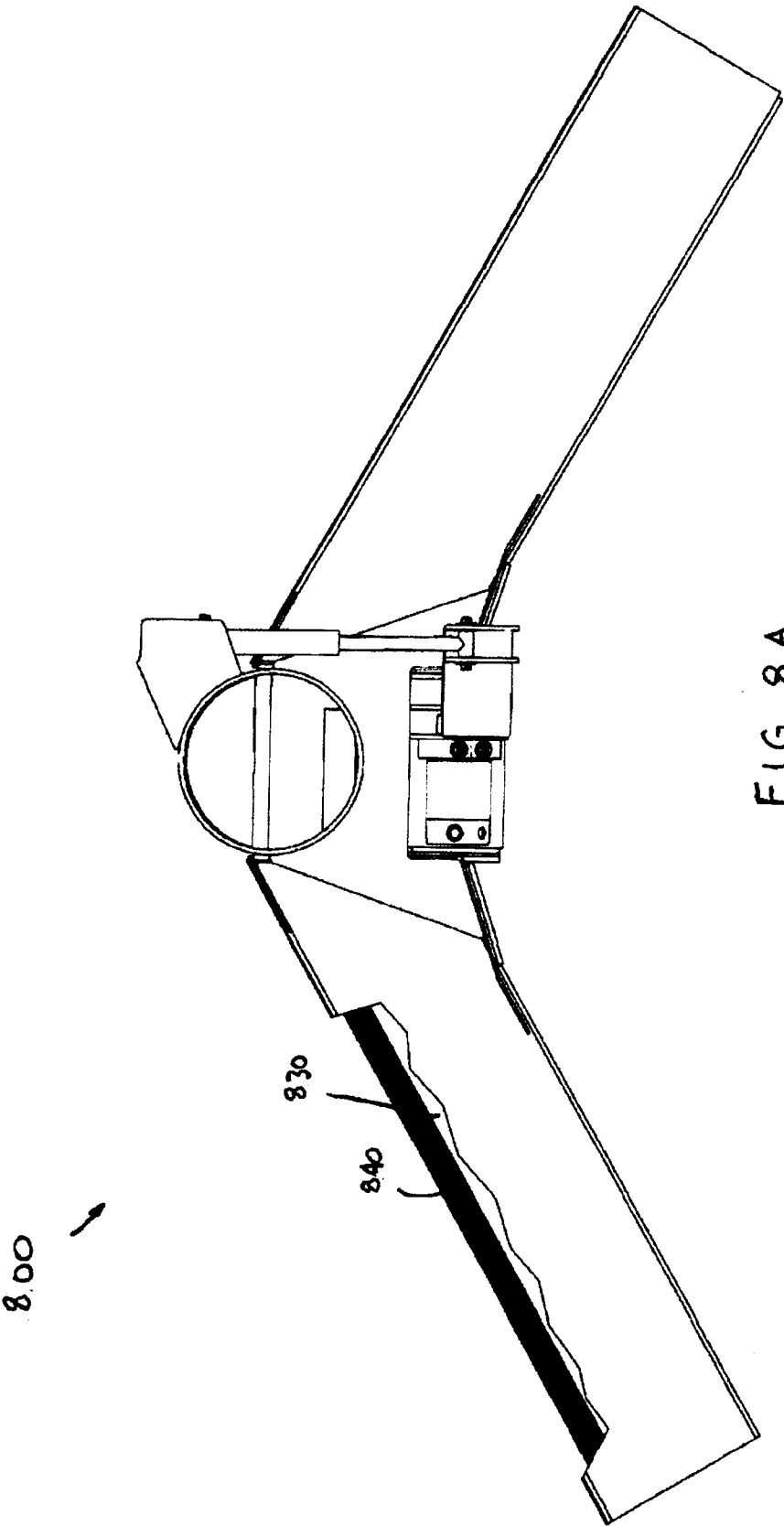


FIG 7B





900 →

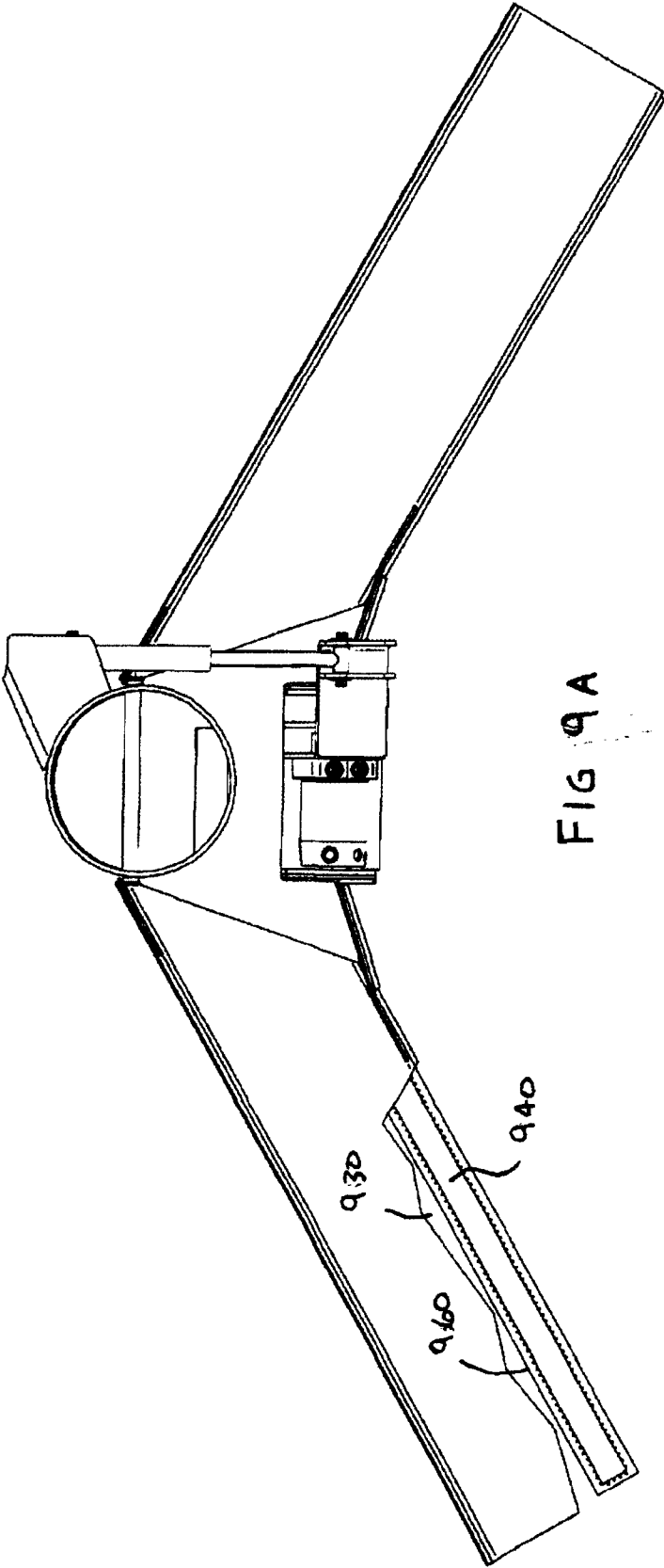


FIG 9A

1000 ↗

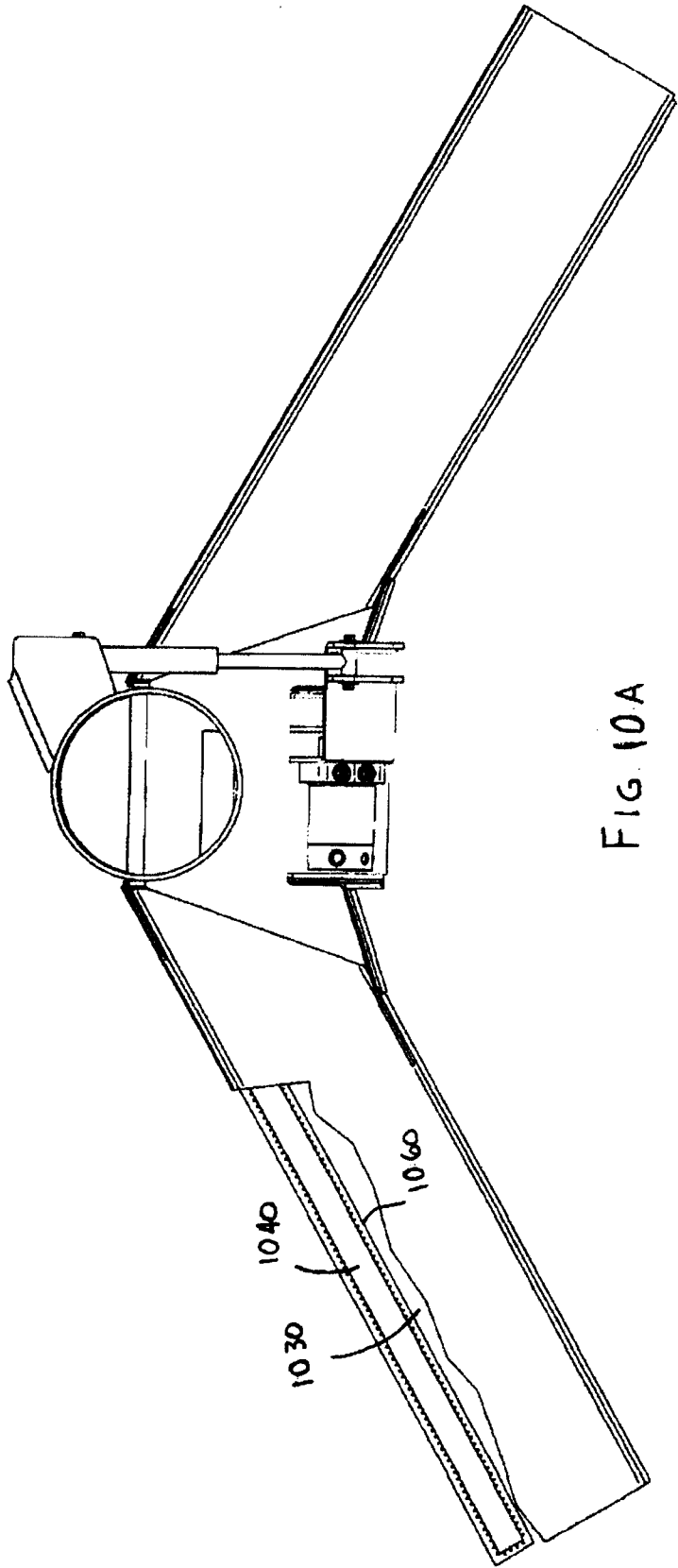
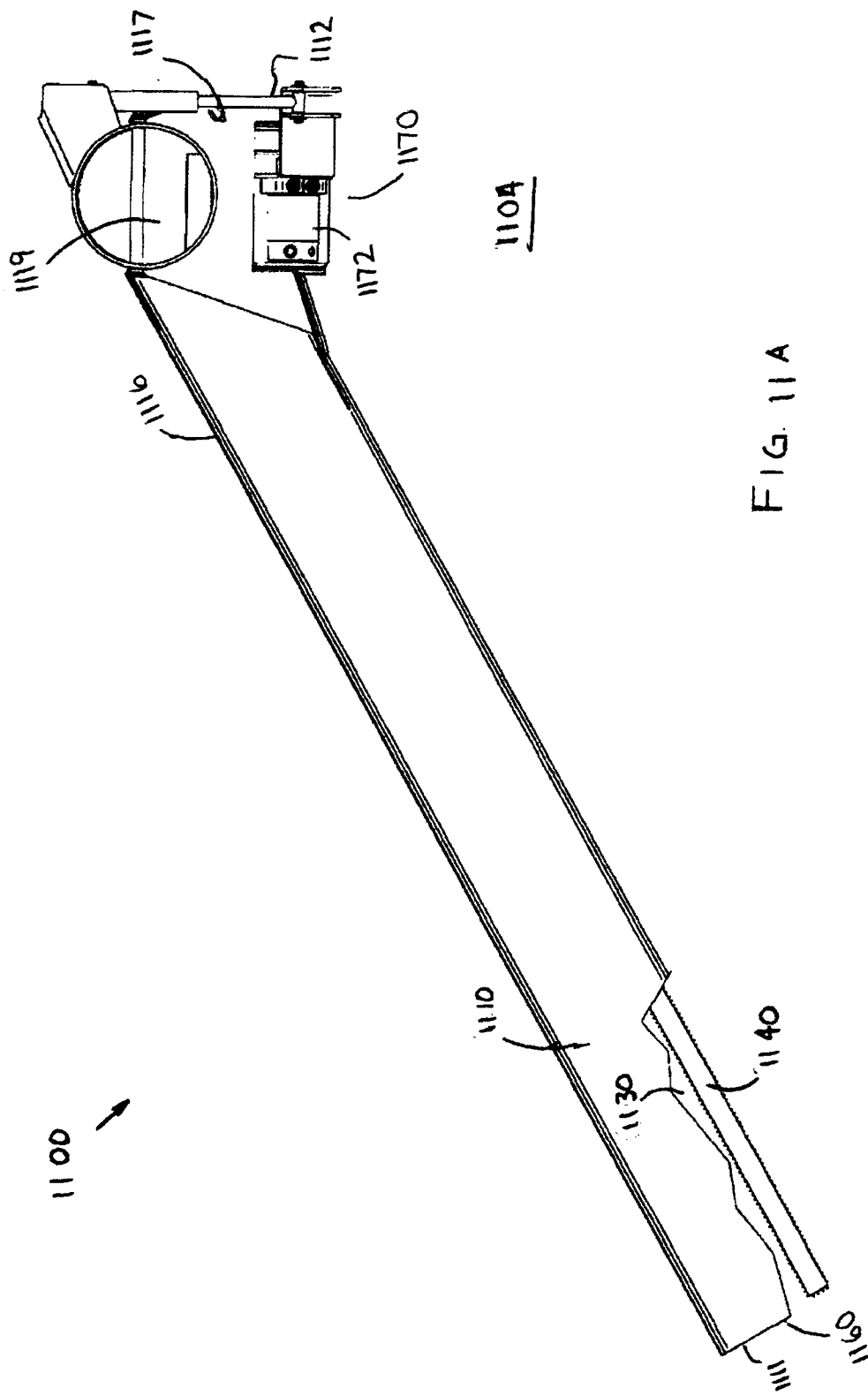
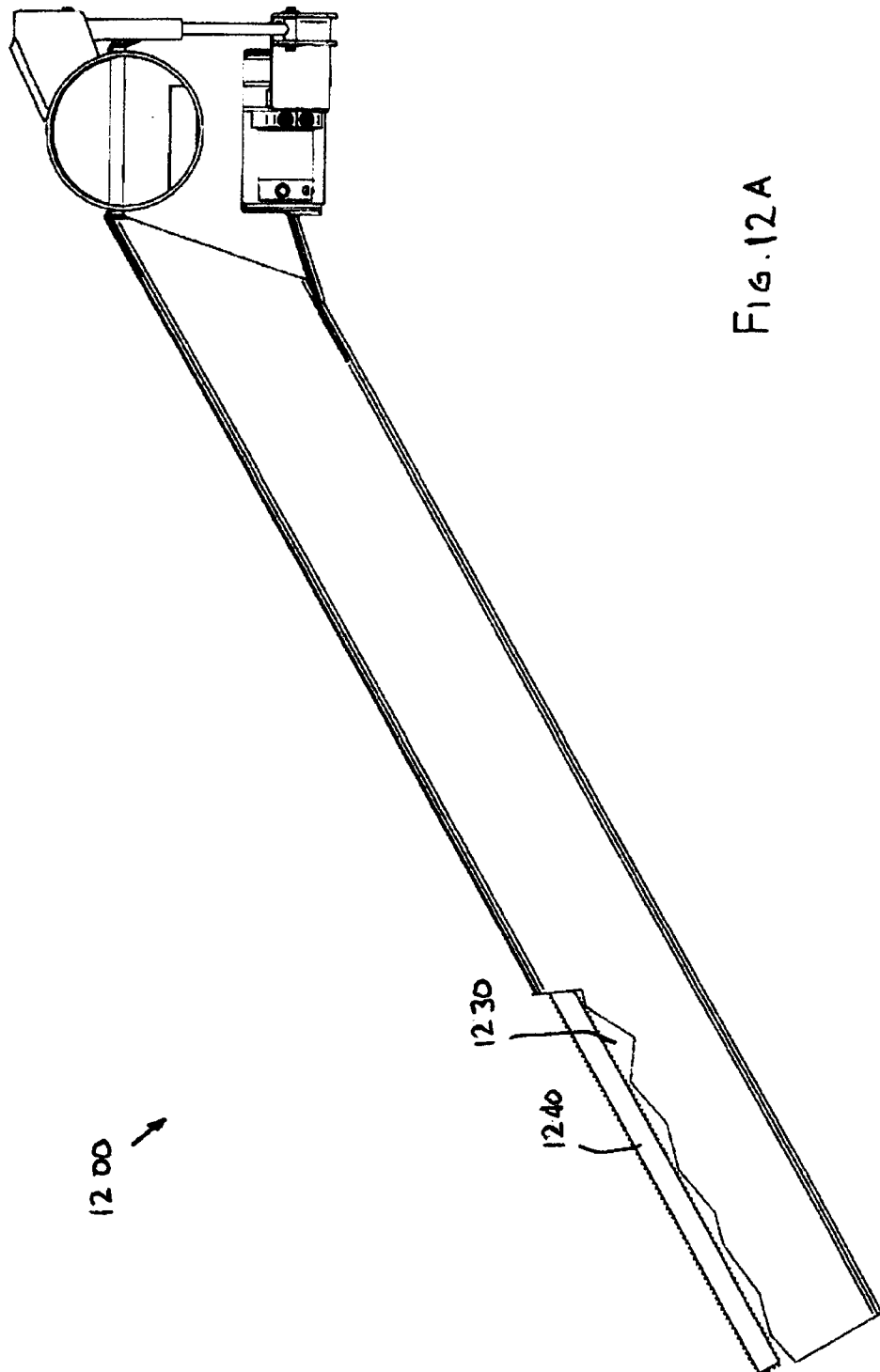


FIG 10A





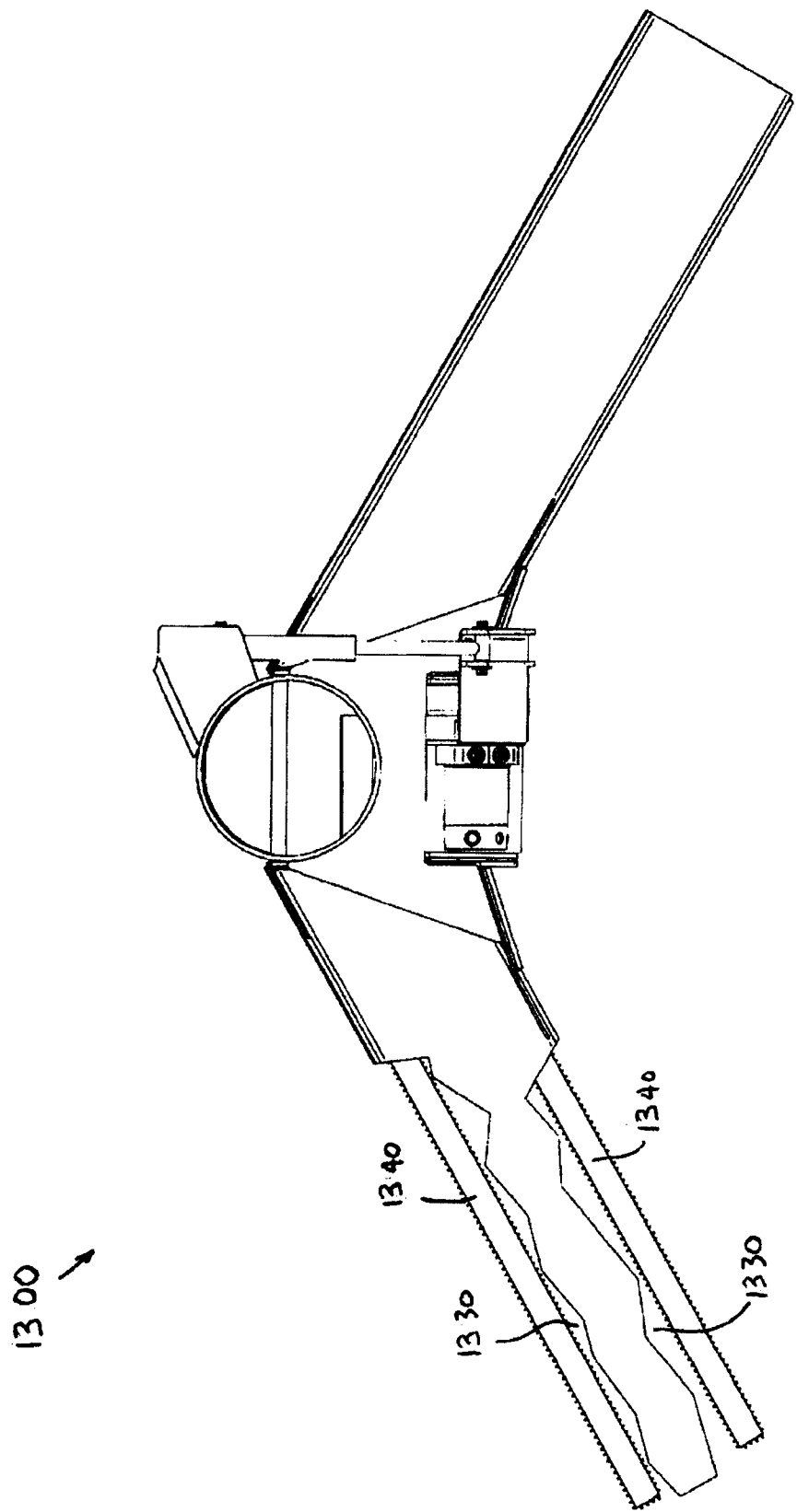


FIG. 13A

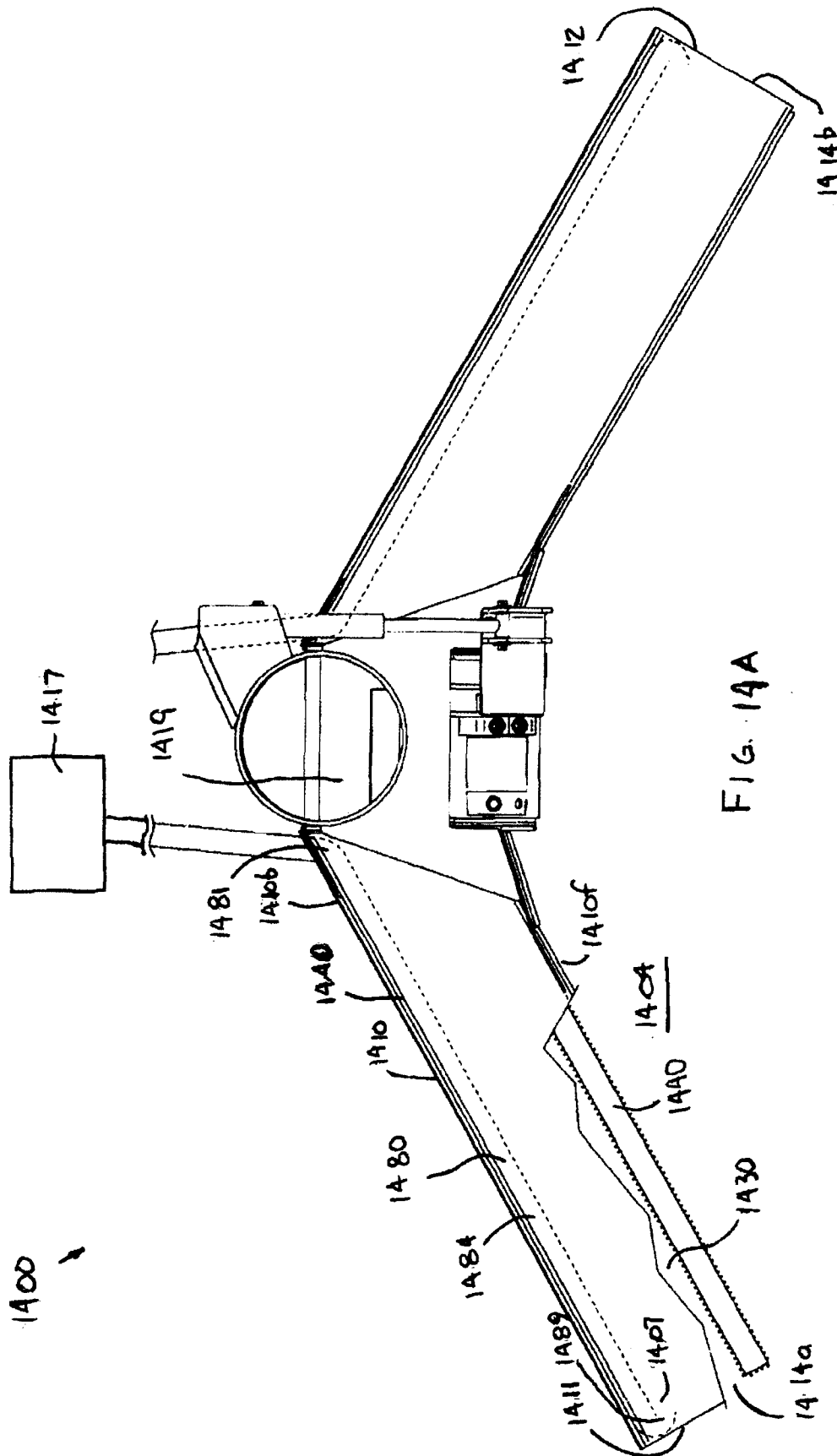
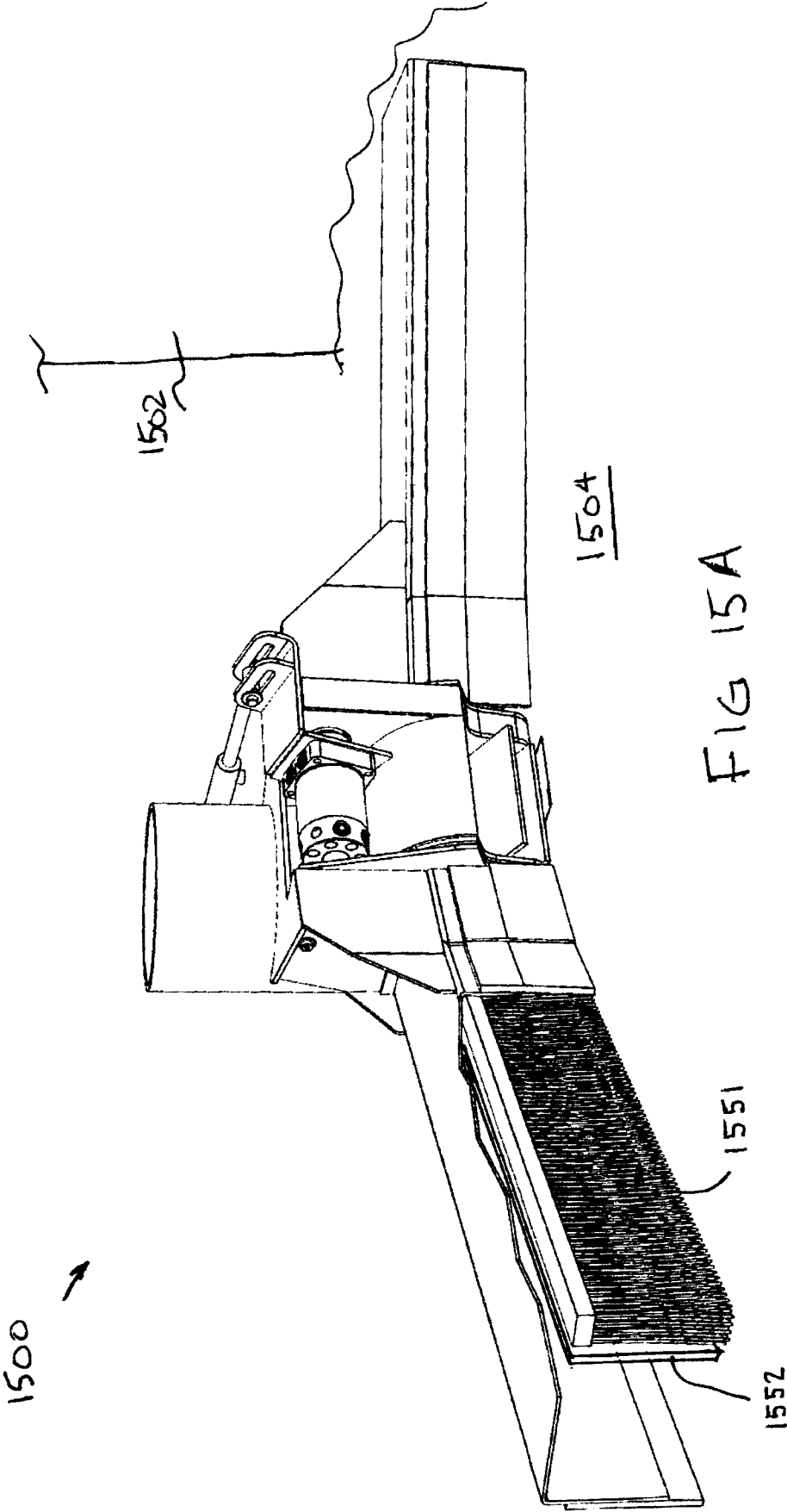


FIG. 14A



INTERNATIONAL SEARCH REPORT

International application No.
PCT/CA2012/000579

A. CLASSIFICATION OF SUBJECT MATTER

IPC: **E01H 1/08** (2006.01) , **A01G 1/12** (2006.01) , **A47L 11/24** (2006.01) , **A47L 7/02** (2006.01) ,
E01H 1/02 (2006.01) , **E01H 15/00** (2006.01)

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC : E01H 1/02, 1/08, 15/00; A01G 1/12; A47L 7/02, 11/24; E01H 15/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic database(s) consulted during the international search (name of database(s) and, where practicable, search terms used)

DATABASES : EPODOC (via EPOQUE), English full text (via EPODOC), Canadian Patent Database

KEYWORDS : brush+, broom+, sweep+, bristle+, loosen+, suction+, vac+, non_rotat+, fixed, stationary

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2009/0089963 A1 (VANDERLINDEN) 9 April 2009 (09-04-2009) * see whole document	1-30
A	US 6,088,865 A (TRUAN et al.) 18 July 2000 (18-07-2000) * see whole document	1-30
A	US 6,584,640 B2 (VANDERLINDEN) 1 July 2003 (01-07-2003) * see whole document	1-30
A	US 2002/0014259 A1 (HAHNI) 7 February 2002 (07-02-2002) * see whole document	1-30
A	JP 11 269835 (SATO) 5 October 1999 (05-10-1999) * see whole document	1-30
A	CH 603 915 (SOMMER) 31 August 1978 (31-08-1978) * see whole document	1-30

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E" earlier application or patent but published on or after the international filing date	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&" document member of the same patent family
"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search

13 September 2012 (13-09-2012)

Date of mailing of the international search report

10 October 2012 (10-10-2012)

Name and mailing address of the ISA/CA
Canadian Intellectual Property Office
Place du Portage I, C114 - 1st Floor, Box PCT
50 Victoria Street
Gatineau, Quebec K1A 0C9
Facsimile No.: 001-819-953-2476

Authorized officer

Casey Thomas (819) 934-3417

INTERNATIONAL SEARCH REPORTInternational application No.
PCT/CA2012/000579

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 7,802,343 B2 (GREY) 28 September 2010 (28-09-2010) * see whole document	1-30

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CA2012/000579

Patent Document Cited in Search Report	Publication Date	Patent Family Member(s)	Publication Date
US2009089963A1	09 April 2009 (09-04-2009)	CA2738702A1 EP2203598A2 US2009089971A1 US8108964B2 WO2009039623A2 WO2009039623A3	02 April 2009 (02-04-2009) 07 July 2010 (07-07-2010) 09 April 2009 (09-04-2009) 07 February 2012 (07-02-2012) 02 April 2009 (02-04-2009) 22 May 2009 (22-05-2009)
US6088865A	18 July 2000 (18-07-2000)	CA2228926A1	05 August 1998 (05-08-1998)
US6584640B2	01 July 2003 (01-07-2003)	US2002133903A1	26 September 2002 (26-09-2002)
US2002014259A1	07 February 2002 (07-02-2002)	AT4373U1 EP1160381A2 EP1160381A3 PL347795A1	25 June 2001 (25-06-2001) 05 December 2001 (05-12-2001) 06 August 2003 (06-08-2003) 03 December 2001 (03-12-2001)
JP11269835 A	05 October 1999 (05-10-1999)	NONE	
CH603915A5	31 August 1978 (31-08-1978)	ATA418477A AT351209B BR7704189A CH603944A5 DD131485A5 DE2726577A1 DE2726577B2 DE2726577C3 FR2356788A1 FR2356788B1 GB1584962A IT1080194B JP53002954A JP62032309B JP1421437C SE433758B SE433758C SE7706852A SE7706852L US4154680A	15 December 1978 (15-12-1978) 10 July 1979 (10-07-1979) 21 February 1978 (21-02-1978) 31 August 1978 (31-08-1978) 28 June 1978 (28-06-1978) 11 May 1978 (11-05-1978) 19 February 1981 (19-02-1981) 19 November 1981 (19-11-1981) 27 January 1978 (27-01-1978) 08 July 1983 (08-07-1983) 18 February 1981 (18-02-1981) 16 May 1985 (16-05-1985) 12 January 1978 (12-01-1978) 14 July 1987 (14-07-1987) 29 January 1988 (29-01-1988) 12 June 1984 (12-06-1984) 20 September 1984 (20-09-1984) 29 December 1977 (29-12-1977) 29 December 1977 (29-12-1977) 15 May 1979 (15-05-1979)
US7802343B2	28 September 2010 (28-09-2010)	CA2555626A1 CA2555626C CN101002667A CN101002667B EP1810603A1 GB0601047D0 GB2419278A GB2419278B US2007163076A1	19 July 2007 (19-07-2007) 01 June 2010 (01-06-2010) 25 July 2007 (25-07-2007) 01 December 2010 (01-12-2010) 25 July 2007 (25-07-2007) 01 March 2006 (01-03-2006) 26 April 2006 (26-04-2006) 10 January 2007 (10-01-2007) 19 July 2007 (19-07-2007)