

March 14, 1950

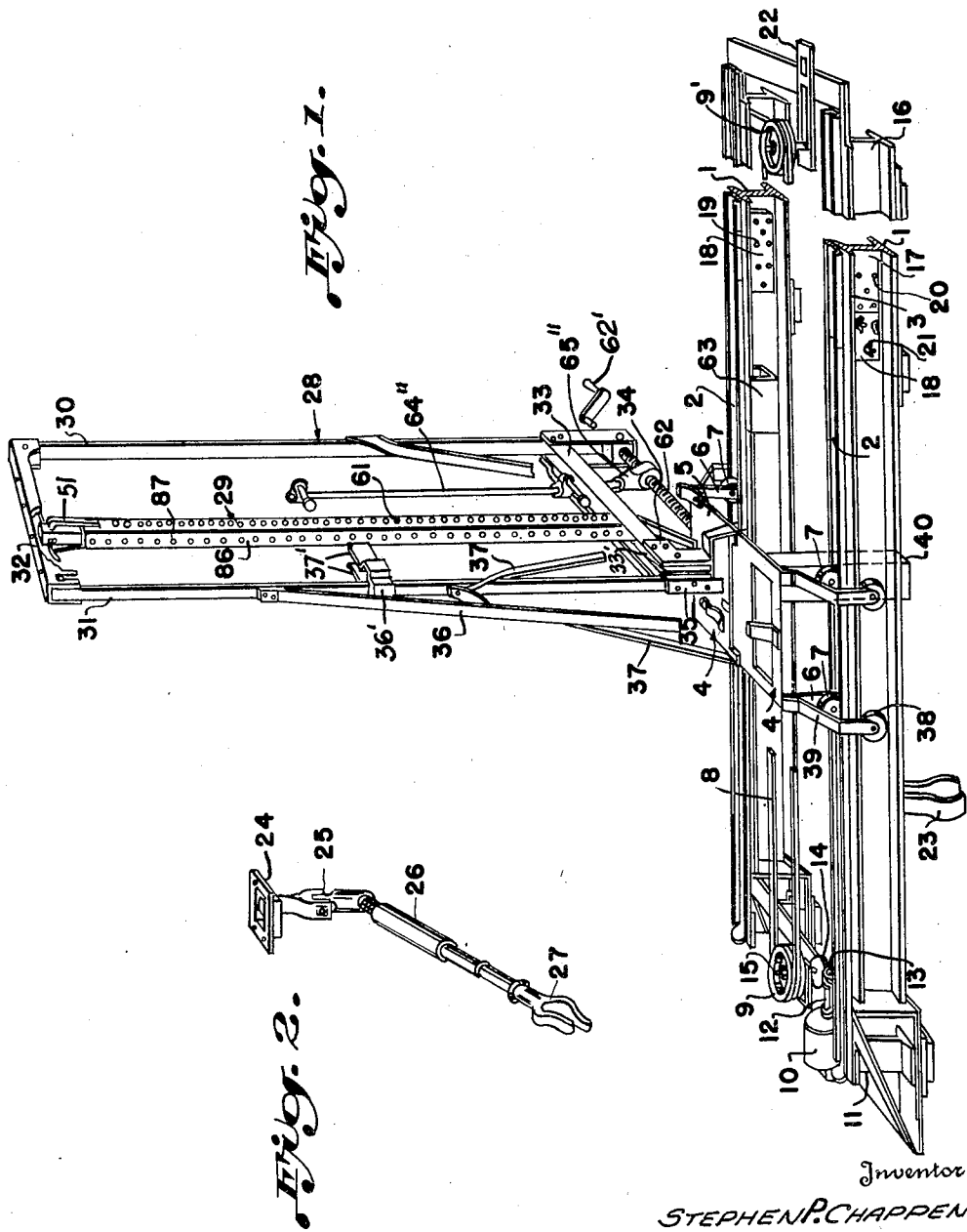
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2,500,660

SURFACE TREATMENT MEANS SUPPORT ARRANGEMENT

Filed Oct. 18, 1948

6 Sheets-Sheet 1



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6 Sheets-Sheet 2

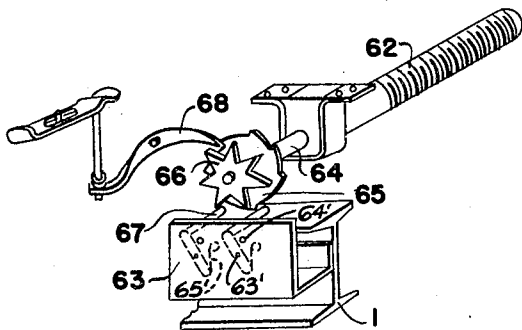
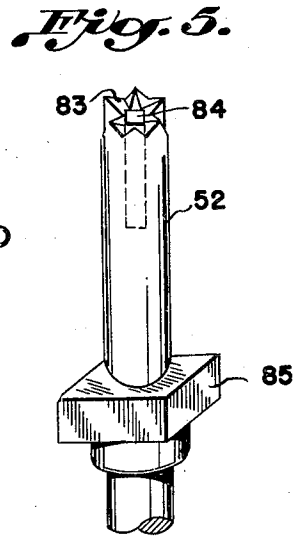
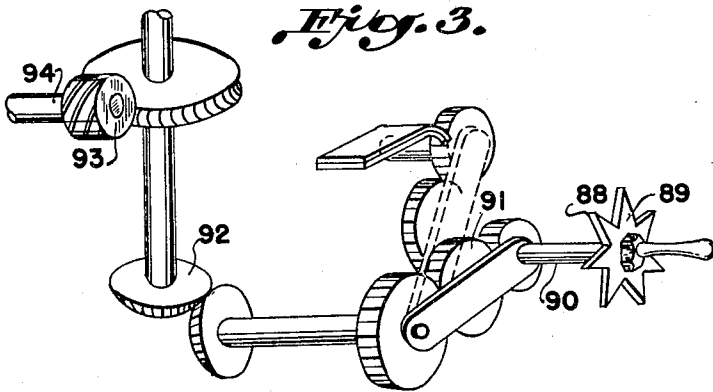
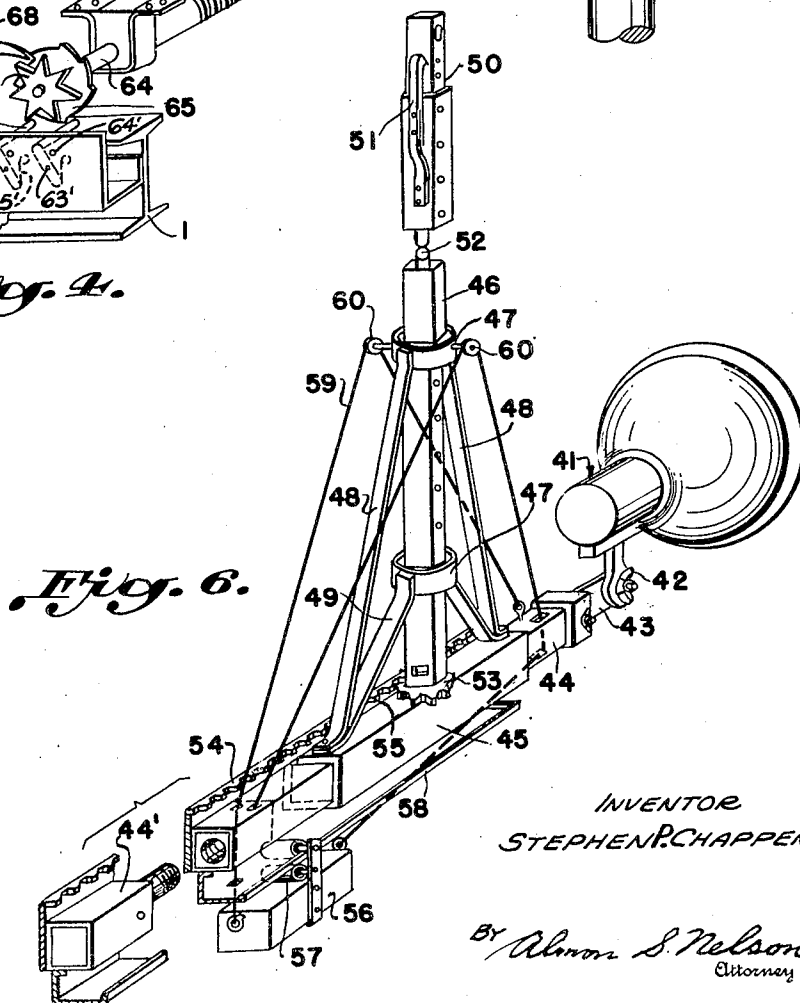


Fig. 4.



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6 Sheets-Sheet 3

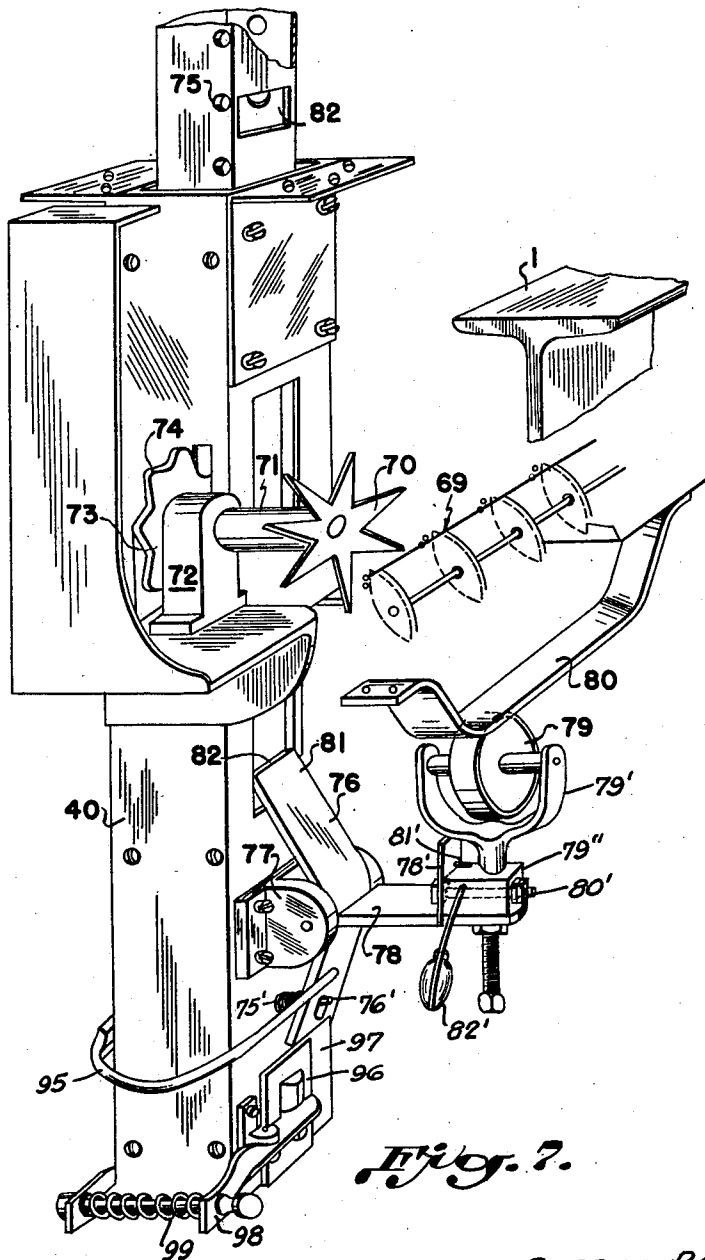


Fig. 7.

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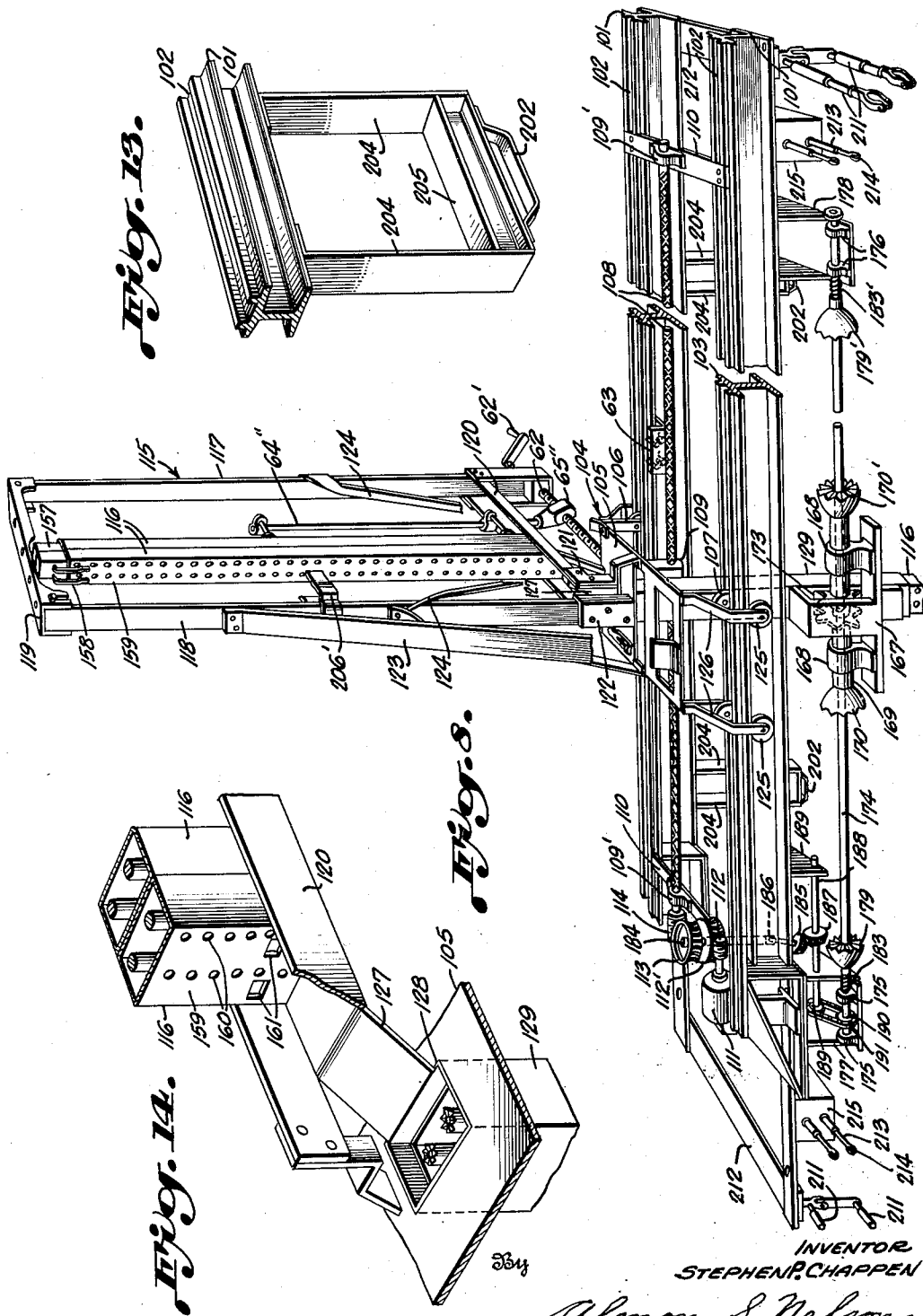
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Fig. 10.

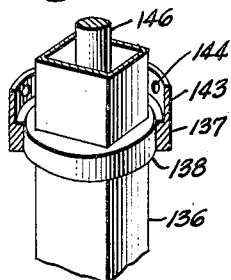


Fig. 9.

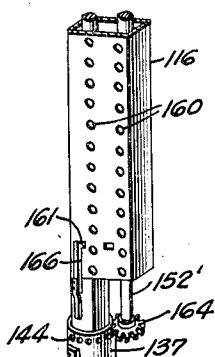


Fig. 18.

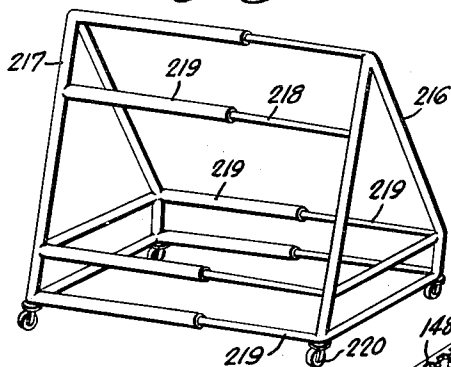


Fig. 11.

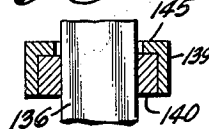


Fig. 21.

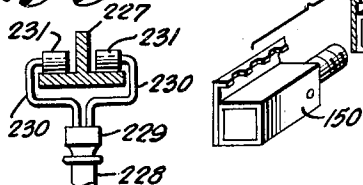


Fig. 19.

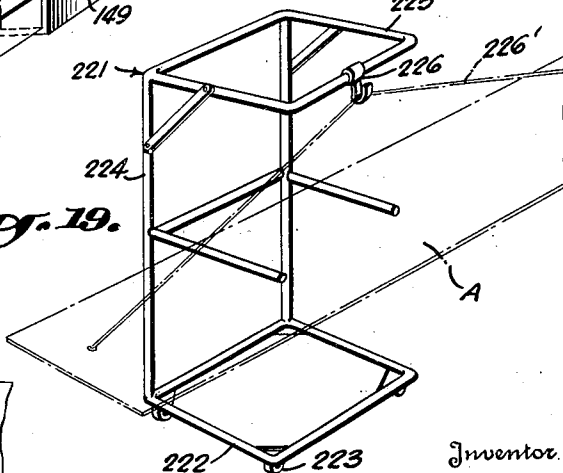
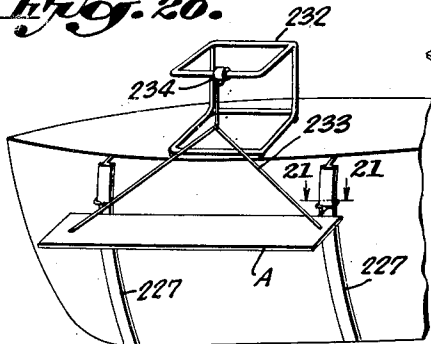


Fig. 20.



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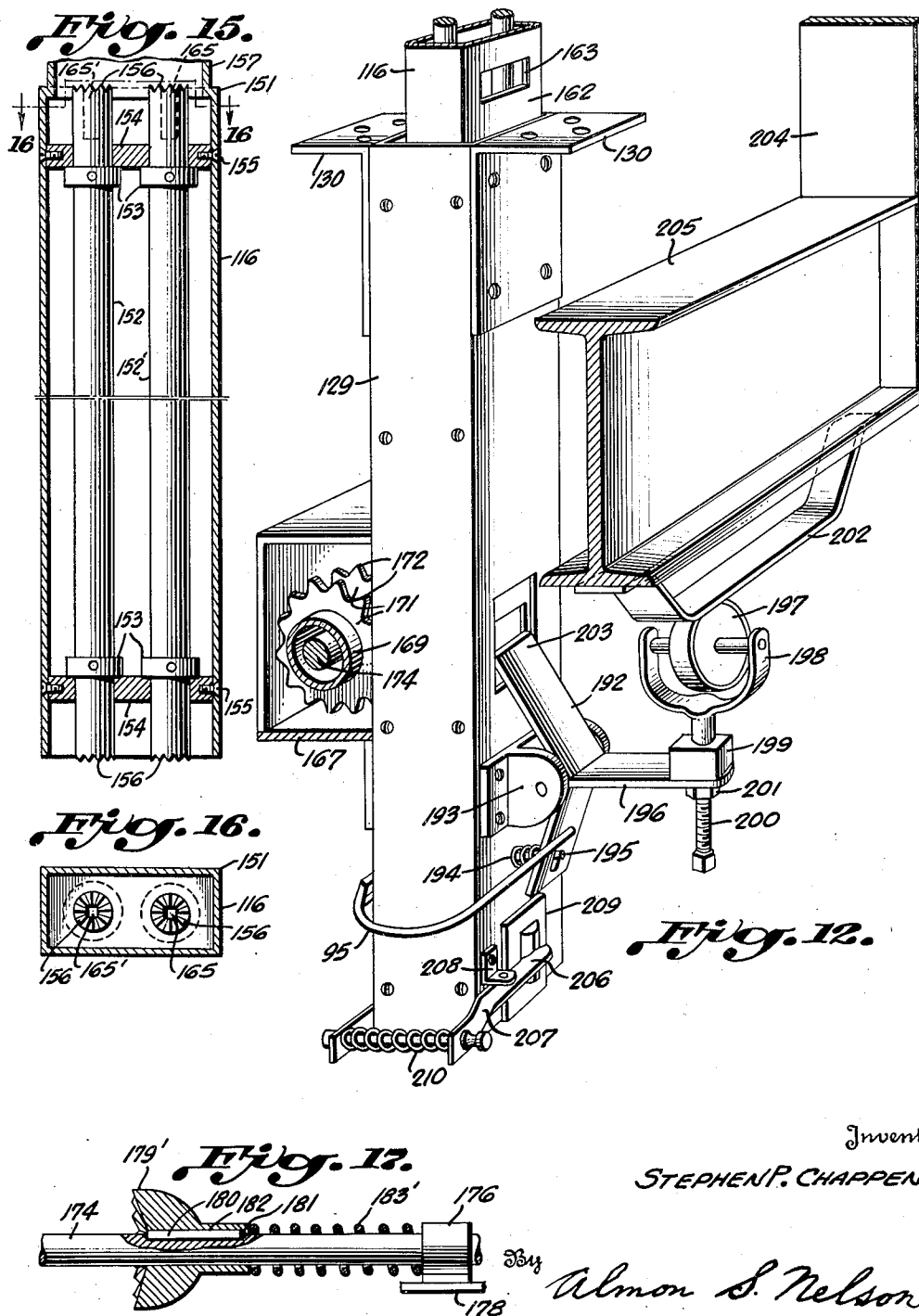
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SURFACE TREATMENT MEANS SUPPORT ARRANGEMENT

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6 Sheets-Sheet 6



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2,500,660

SURFACE TREATMENT MEANS SUPPORT
ARRANGEMENT

Stephen P. Chappen, Carbondale, Pa.

Application October 18, 1948, Serial No. 55,081

16 Claims. (Cl. 91—18)

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My invention relates to an apparatus for painting, sand blasting, steam cleaning, chipping, brushing or polishing surfaces and more particularly to an apparatus for performing these and similar surface treatment operations on ships, buildings, and the like.

An object of my invention is to provide an improved apparatus for performing the aforementioned operations on the exterior and interior surfaces of ships, buildings, and the like.

Another object of my invention is to provide an improved apparatus wherein the surface treatment means is adapted to be automatically moved vertically and transversely of the surface to be treated.

Yet another object of my invention is to provide surface treatment apparatus having improved means for automatically projecting the support for the surface treatment means a predetermined distance vertically of the surface to be treated when the said means reaches the limit of its travel transversely of said surface.

Still another object of my invention is to provide surface treatment apparatus constructed and arranged whereby the exterior surfaces of the hull portions of a ship, including bow and stern, and other irregular surfaces, may be painted or otherwise subjected to treatment while the ship is afloat.

A further object of my invention is to provide an improved apparatus for use in connection with the surface treatment of ships, buildings, and the like, designed to eliminate the necessity of using scaffolds, stagings, ladders, or similar temporary support devices, even though the treatment of irregular surfaces be involved.

A still further object of my invention is to provide improved portable apparatus for use in connection with the surface treatment of ships, buildings, and the like, wherein the surface treatment means assembly is supported by a slidable and extensible support, the said means being adapted to move in a direction or plane substantially perpendicular to the axis of the support, either inwardly and outwardly, or in rotation and inwardly and outwardly.

With these and other objects in view, which may be incident to my improvements, the invention consists in the parts and combinations to be hereinafter set forth and claimed, and it is to be understood that my invention may be varied in construction, proportions and arrangements, without departing from the spirit and scope thereof.

In order to make my invention more clearly

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understood, I have shown in the accompanying drawings means for carrying the same into practical effect, without limiting the improvements in their useful applications to the particular constructions, which for the purpose of explanation, have been made the subject of illustration.

In the drawings:

Fig. 1 is an elevational view in perspective of the trackway and carriage arrangement of one form of my invention used to support the surface treatment means in desired position for performing surface treatment operations on a ship, building, or the like.

Fig. 2 is a perspective view of a bracket or clamp used to support the trackway on a rail such as the rail of a ship or the like.

Fig. 3 is a detail view of the arrangement for raising the support for the surface treatment means.

Fig. 4 is a detail view of the trip mechanism and feed device used to advance the support sections for the surface treatment means to operative supporting position.

Fig. 5 is a detail view of one end of a shaft provided in each support section.

Fig. 6 is a perspective view of the surface treatment means assembly.

Fig. 7 is a detail view showing a trip device and associated mechanism for projecting the surface treatment means support when the carriage reaches the limit of its travel, lengthwise of the trackway.

Fig. 8 is an elevational view in perspective of the trackway and carriage arrangement of a second form of my invention.

Fig. 9 is a perspective view of the surface treatment means assembly and is a continuation of Fig. 8.

Fig. 10 is a detail view of a part of the assembly.

Fig. 11 is a sectional view taken along the line 11—11 of Fig. 9 looking in the direction of the arrows.

Fig. 12 is a detail view showing the chute and a portion of the means used for projecting the surface treatment means support when the carriage reaches the limit of its travel lengthwise of the trackway.

Fig. 13 is a detail view of a cam and its support means.

Fig. 14 is a fragmentary detail view of the lower channel member of the magazine.

Fig. 15 is a vertical sectional view of a support section used in connection with the modified form of my apparatus.

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Fig. 16 is a sectional view taken along the line 16—16 of Fig. 15.

Fig. 17 is a detail view, partly in section, of one of the clutch elements used in connection with the second form of my invention.

Fig. 18 and 19 illustrate supports which may be used in connection with either of the forms of my invention.

Fig. 20 illustrates a structure which may be applied to an outwardly or inwardly curving surface for use in connection with either of my devices; and

Fig. 21 is a detailed sectional view taken along the line 21—21 of Fig. 20 looking in the direction of the arrows.

The apparatus of the present invention consists essentially of a trackway adapted to be horizontally supported in spaced relationship with respect to the surface to be treated, a carriage movable lengthwise of the trackway, an extensible support arrangement for a surface treatment means mounted upon the carriage, means to move the carriage longitudinally of the trackway, and means to automatically project the surface treatment means assembly support a predetermined distance vertically along the surface to be treated, when the carriage reaches the end of its travel lengthwise of its trackway. In both forms of the apparatus disclosed herein, the trackway is adapted to be supported from the rail of a ship, rail of a building, or other means, and the extensible support means for the surface treatment means assembly comprises a plurality of unit sections adapted to be moved to operative supporting position, and extended a predetermined distance vertically of the surface being treated, when the carriage reaches the end of its travel fore and aft. The immediate support for the surface treatment means is slidably mounted at the end of the extensible support means, or at the base of the aforesaid assembly, and is adapted to move in a direction substantially perpendicular to the axis of the extensible support means. In the modified form of the invention disclosed, the surface treatment means assembly is also rotatable about the axis of the extensible support means.

When the carriage is moved lengthwise of the trackway, a comparatively narrow band or strip of the surface is treated, and after the carriage reaches the limit of its travel, fore or aft, the surface treatment means assembly support is projected a predetermined distance less than the width of the treated band or strip of the surface, whereby the surface is treated in successive overlapping strips as the carriage moves along the trackway. When it is desired to treat curved surfaces such as the hull and stern surfaces of a ship, the surface treatment means may be maintained a constant distance from the curved surfaces thereof through the medium of the slidable connection between the surface treatment means and its support at the end of the extensible members, or by other means to be later described.

The device of the present invention may be used to paint, or otherwise treat as indicated above, a ship's hull when underway at sea, at anchor, moored to a dock, dry-docked or in a shipyard. Weather conditions permitting, the ship's hull and a considerable portion of the deck structure may be painted while loading or discharging cargo. The device may be used ashore for painting, or otherwise treating as indicated above, the walls and ceilings of oil storage tanks, barns, silos, houses and other buildings.

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Referring to the drawings and more particular to Fig. 1, the surface treatment means support arrangement comprises a pair of bars such as I-beams 1, having tracks 2, or equivalent means, on or attached to the top flanged portions 3 of the beams. A carriage designated generally by numeral 4, adapted to be moved lengthwise of the trackway, comprises a rectangular member 5 having legs 6 provided with wheels or rollers 7 adapted to seat in the tracks 2. Movement of the carriage lengthwise of the trackway is effected by means of a drive arrangement comprising a belt 8, connected at one point to the carriage, pulleys 9 and 9' and motor 10. The motor is mounted upon a bracket or other suitable support 11 attached to the end of one of the beams, shaft 12 of the motor being connected through suitable gears 13 and 14 to the spindle 15 of pulley 9. Means, not shown, are provided for automatically reversing the motor or the driving gears associated therewith, when the carriage reaches the limit of its travel in the vicinity of the opposite ends of the trackway.

In order to accommodate the applicator support arrangement to desired units of length of the surface to be treated, the trackway and supporting beams are constructed and arranged for longitudinal adjustment. The end portion 16 of the support, for example, is designed for telescopic engagement with portion 17. Suitable plates 18, formed with apertures 19, adapted to register with apertures 20, in the web portion of the I-beam, together with fastening devices 21, are used to securely hold the parts in adjusted position. Belt adjustment is effected by means of the slidable support 22 of pulley 9, belt sections being added or removed as required. The surface treatment means support, as above described, is adapted to be positioned in the vicinity of deck level of a ship, for example, on the ship's rail or other suitable support as will be later described, by means of clamp devices 23 attached at spaced points on the underside of the bottom flange portion of the inner I-beam. Brackets 24 of the type shown in Fig. 2, comprising a base 24 adapted for attachment to the bottom flange of the outer I-beam, swivel joint 25, extensible arm 26 and clamp member 27, designed for engagement with the hull of a ship, provide additional support for the trackway, in overhanging relationship with a hull portion of a ship.

Attached to the carriage and movable therewith is a housing or magazine designated generally by numeral 28, adapted to contain a plurality of unitary support members 29. The housing comprises vertical side pieces 30 and 31, having top and bottom channeled members 32 and 33 respectively, secured thereto. The housing is rigidly attached to the carriage 4 by means of brackets 34 and 35, brace 36 and braces 37. In order to prevent accidental tipping of the carriage, due to the weight of the housing or magazine 28, wheels or rollers 38, attached to brackets 39, are provided. The rollers 38, as shown, are adapted to ride on the overhanging top flange portion of the inner beam. In the vicinity of the lower end of vertical member 31 of the housing, the base of channel member 33 is inclined downwardly as indicated at 33' (see also Fig. 14) and thence cut away to form an opening which registers with a chute member 40, through which support units 29 are projected, as will be described hereinafter.

Referring to Fig. 6, the surface treatment means assembly comprises in this instance a spray gun

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designated generally by numeral 41, pivotally mounted as at 42, to member 43, attached to a bar 44 adapted for sliding movement in a housing or casing 45, having a vertical hollow member 46, rigidly supported thereon by means of collars 47, and braces 48 and 49. The upper end of member 46 is reduced as at 50, and opposite faces of the member are provided with spring hooks 51 or other suitable fastening devices, the purpose of which will be described hereinafter.

Rotatably mounted within member 46 is a shaft 52 having a gear 53 keyed to its lower end, adapted for engagement with a rack 54 or the like projecting from the casing 45 through an elongated slot 55 and secured to the bar 44. It will thus be seen that when gear 53 is rotated, rack 45 and bar 44 to which the spray gun 41 is attached, moves lengthwise of the casing 45.

Under certain conditions of operation, it may be found necessary to extend the gun or other treatment device a substantial distance outwardly from the housing and, accordingly, additional sections 44' may be added. In order to counter-balance the weight of the spray gun or other treatment device, when in extended position, a suitable counter-weight 56 is provided. The weight, as shown, is supported by rollers 57 adapted to seat in a flanged member 58 positioned below the housing 45. A suitable cord 59 or other flexible member, threaded over pulleys 60, has its free ends attached to opposite faces of the weight. By means of this arrangement the weight is moved to counter-balancing position when the spray gun or other device is extended outwardly of the housing.

Referring to Figs. 1 and 6, the surface treatment means assembly is supported in operative position by inserting housing 46 in the chute member 40, associated with the carriage 4, the reduced end 50 of member 46 being adapted to seat in the lower end of one of the unitary support members 29 contained within the magazine 28. When member 46 is thus positioned, the spring hooks 51 seat in apertures 61 formed longitudinally of the opposite faces of the support members 29. The magazine 28 is designed to contain a plurality of unitary support members 29, each unit being approximately 4 feet long. When the carriage is caused to move lengthwise of the trackway, the support sections are advanced a predetermined distance of the magazine 28 in the direction of the inclined surface 33' and the opening leading to the chute 40, by means of a feed screw 62 adapted to be actuated by a trip member 63 mounted on the trackway. When feed screw 62 is rotated a pusher bar arrangement 64'', attached to member 65'' which is in threaded engagement with the feeder screw, contacts the outside face of the endmost support section, and thus advances all of the sections within the magazine 28, in the direction of operative supporting position in the chute 40.

Referring to Fig. 4, it will be noted that the end of the feeder screw 62 is provided with an extension 64 having a ratchet wheel 65 and star wheel 66 attached thereto. Rotation of the feeder screw is effected by means of the star wheel which is adapted to contact members 67 of the trip device, as the carriage moves over the trip during its passage in one direction lengthwise of the trackway. The members 67 are pivoted at 63', and pins 64' limit rotational movement of the members 67 in a clockwise direction as viewed in Fig. 4. Springs 65' nor-

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mally urge the members 67 into engagement with the pins 64'. Thus when the carriage is moved in one direction relative to the trip means 63, star wheel 66 is rotated to rotate the feeder screw 62. When the carriage is moved in the reverse direction, reverse movement of the screw is prevented by means of a dog 68 arranged to contact the teeth portions of the ratchet wheel, the members 67 pivoting more or less freely against the pressure of springs 65' to move in a counterclockwise direction to permit star wheel 66 to pass thereover.

In order to project a support section 29 from the housing, trip means similar to the trip means 63 are supported by and provided at opposite ends of the trackway. Referring to Fig. 7, a trip device comprising four contact members and designated generally by numeral 69, is adapted to contact a star wheel 70 attached to a rotatable shaft 71 supported in a bearing member 72, the shaft having a toothed wheel 73 keyed thereto. The toothed wheel is positioned so that a portion of its periphery extends into a slot or other aperture formed in one of the faces of the chute member, the teeth 74 of the wheel being adapted for engagement with apertures 75 formed in one of the faces of the housing of a support section. It will thus be seen that when the star wheel 70 contacts the trip device, wheel 73 is rotated and the support section is advanced from the housing.

Means are provided to check the downward drop of the support section, after it has been advanced, as above described, comprising a dog 76 pivotally mounted upon a bracket 77 attached to the chute member. The lower end of the dog 76 is spring pressed outwardly by means of a coil spring 75' supported by a pin 76' connected to the chute 40, and rigidly connected to the dog 76 is an arm 78 provided with an outer upstanding portion 78'. A wheel 79 rotatably mounted in a bracket 79' provided with a supporting block 79'' is pivotally connected to the portion 78' as by means of a bolt 80' and movement of the block 79' in a counterclockwise direction is limited by a pin 81'. Counter-weight 82' normally urges the wheel to an upright position. The wheel 79 is arranged to contact cam extension 80 secured to or associated with each end portion of one of the beams 1. The end portion 81 of the pivotally mounted member 76 is adapted to seat in one of a plurality of recesses 82 formed longitudinally of the front face of the housing of the support sections 29, and spring 75' normally urges the end portion 81 to seating position. In one direction of movement of the carriage along the trackway, right to left, Fig. 1, roller 79 contacts both members 80 causing the end 81 of member 76 to be withdrawn from the aperture in the housing, thus freeing the support section for downward movement when wheel 73 is rotated by the trip device 69. In movement of the carriage in the opposite direction, roller 79 is moved downwardly about its pivot at the bolt 80' and the dog 76 is not withdrawn from the aperture in the section 29, counterweight 82' functioning to normally maintain the bracket 79' in upright position.

In the operation of the device, so far described, when the motor 10 is operated, carriage 4 through the medium of belt 8 is moved back and forth over the trackway. When the carriage moves from left to right (Fig. 1) it passes over the trip devices at both the left and right ends of the trackway without actuating the feed mechanism 75 (including the dog 76) for the surface treatment

means support, however, when the carriage returns to the left (dog 76 is actuated and) it contacts the trip device at the right end of the trackway causing the vertical extension members 29 which are connected to the surface treatment means support, to extend a suitable distance from the magazine, thus enabling the spray gun or other treatment device to reach a new surface. When the carriage almost reaches the limit of its travel to the left of the trackway, dog 76 is again actuated and contact is made with the trip at the left end of the trackway and the extension is again extended a suitable distance.

After the carriage 4 has moved from right to left and from left to right several times, the section 29 will have been dropped substantially throughout its length, and if additional length is required for the surface treatment means support another section 29 is added so that a more distant surface can be reached by the surface treatment means. When the downward drive of the first extension member 29 has been substantially completed, the next extension 29 has been moved within the magazine 28 into position whereby it will slide down the incline 33' into the chute 40 so that it automatically becomes rigidly and securely fastened to the top length of the section which has been projected from the magazine, by means of the spring hooks 51 engaging in the apertures 61. The second vertical extension is thus brought into position ready for locking, by the feed screw 62 and associated feeder bar 64'', which moves a constant distance each time the first extension drops a suitable or desired distance. A bracket 36' comprising spaced inwardly directed arms 37' is provided substantially midway of the member 31 to help guide the members 29 in their sliding movement down the incline 33'.

Referring to Fig. 5, it will be noted that the end of the shaft 52 within the tubing 46 is formed with a clutch gripping or hexagonal shaped end 83. The purpose of this arrangement is to assure proper contact between adjacent shafts 52 when the individual support sections 29 are moved into operative supporting position. Each of the extensions 29 is also provided with a shaft 52, rotatably mounted in bearings 85 (see also Fig. 15), and the several rods 52 are automatically connected whereby rotation of the uppermost of the rods by applying a wrench or other tool provided with a key fitting keyway 84 causes rotation of gear 53, thus moving the spray gun support outwardly or inwardly from the housing 45, to conform with the contour of the surface being treated, for example, the hull portion of a ship.

Referring to Fig. 3, there is shown a detailed view of the arrangement used to raise the surface treatment means assembly after the painting operation has been completed, that is to say, after the sections 29 have been projected from the magazine and the surface treatment means assembly is in its lowermost position. The face 86 of each of the unitary support sections (Fig. 1), is provided with a plurality of longitudinally spaced apertures 87 adapted to receive the teeth 88 of a star wheel 89. The star wheel is mounted upon a suitable shaft 90 adapted to be rotated through the medium of gears 91, 92 and 93, the latter gear being mounted upon a shaft 94 associated with a source of power, not shown. When it is desired to raise the surface treatment means support sections, power is applied to shaft 94 and through the medium of star wheel 89, which engages with the apertures 87, the extensions are moved upwardly to a position at which they may

be manually disconnected one from the other and stored in the magazine 28. While the support sections are being so raised, the dog 76 may be rendered inoperative by means of a U-shaped clip 95 (Fig. 7) adapted to embrace the lower end of the chute 40 and the lower end of the dog 76 to maintain the upper end 81 thereof withdrawn against the force of the spring 75'. This device for raising the sections 29 may be supported from the tracks 1.

The predetermined distance the sections 29 are projected each time may readily be varied by changing the number of contact members in the trip devices 63 and 69, and by changing the length of the cam members 80.

In order to control the friction between the extension elements 29 and the chute 40 a friction element 96 (Fig. 7) may be provided in a suitable opening 97 provided in the chute. The friction element is supported on an arm 98 pivotally mounted on the chute 40 and a spring 99 resiliently urges the friction element or block 96 into engagement with the sections 29. The force exerted by the spring 99 may be made adjustable in any well known manner.

Referring now to Figs. 8 to 17, a modified form of my invention is shown in these figures which differs from the first form of the invention in several particulars. In the first place, the means for moving the carriage back and forth along the trackway is different. Also the means for projecting the extensible section members is different, and, in addition, the extensible section members are differently constructed in that each is provided with two rotatable shafts mounted therein whereby the surface treatment means assembly may be provided with rotational movement throughout 360° or more in addition to the movement back and forth of the surface treatment means.

Referring now more particularly to Fig. 8, as before, the surface treatment means support arrangement comprises a pair of bars such as I-beams 101 having tracks 102 or equivalent means on or attached to the top flanged portions 103 of the beams. A carriage designated generally by numeral 104 adapted to be moved lengthwise of the trackway comprises a rectangular member 105 having legs 106 provided with wheels or rollers 107 adapted to seat in the tracks 102. Movement of the carriage lengthwise of the trackway is effected by means of a drive arrangement comprising a reversely threaded screw 108 which passes through a nut 109 secured to and depending from the carriage. The screw 108 is mounted in bearings 109' at each end thereof, said bearings being mounted on transverse brackets 110 extending between and secured to the tracks 101.

A motor 111 is supported adjacent one end of the tracks 101 and the motor 111 through suitable gears 112, 112', 113 and 114 drives the screw 108. From the foregoing it will be obvious that as the motor 111 turns the screw 108 in a single direction that the carriage when it reaches each end of its movement lengthwise of the trackway will automatically be returned to the other end thereof.

Attached to the carriage and movable therewith is a housing or magazine designated generally by numeral 115 adapted to contain a plurality of unitary support sections or members 116. The magazine comprises vertical side members 117 and 118 having top and bottom channel members 119 and 120 respectively secured thereto.

The magazine is rigidly attached to the carriage 104 by means of brackets 121 and 122, brace 123 and braces 124. In order to prevent accidental tipping of the carriage due to the weight of the magazine 115, wheels or rollers 125 attached to brackets 126 are provided. The rollers 125 as shown are adapted to ride on the overhanging top flange portion of the inner beam. In the vicinity of the lower end of the vertical member 118 the base of the channel member 120 is inclined downwardly as indicated at 127 (see also Fig. 14) and thence cut away or terminated at an opening 128 provided in the rectangular member 105 of the carriage. The opening 128 registers with a chute member 129 supported by the carriage through which the support units 116 are projected as will be described hereinafter. The chute member 129 is secured to member 105 of the carriage as by means of brackets 130 (Fig. 12) and rivets, bolts, or the like.

Referring to Fig. 9 the surface treatment means assembly comprises in this instance a spray gun designated generally by numeral 131, pivotally mounted as at 132 to member 133 attached to a bar 134 adapted for sliding movement in a housing or casing 135. The housing 135 is supported by and rotatably connected with a vertical hollow member 136 by means of collars 137, 138, 139, and 140. Braces 141 connect the collar 137 with the housing 135 and braces 142 connect the collar 139 with the housing 135. Referring also to Figs. 10 and 11 it will be noted that the collar 138 is rigidly secured to the rectangular hollow member 136 and that the collar 137 is rotatably mounted on the collar 138. The collar 137 has an upward extension 143 provided with apertures 144 defining a gear, the function of which will be more fully described. The collar 139 has a radially inwardly directed upper flange 145 which rests upon the upper face of the collar 140 which is rigidly secured to the member 136 and thus supports the housing 135 and its associated structure. Rotatably mounted in the member 136 is a shaft 146 having a gear 147 keyed to its lower end adapted for engagement with a rack 148 or the like projecting from the casing 135 through an elongated slot 149 and secured to the bar 134. It will thus be seen that as in the first modification when the gear 147 is rotated, rack 148 and bar 144 to which the spray gun 131 or other surface treatment device is attached moves lengthwise of the casing 135. Additional sections 150 may be added as desired in the manner described above in connection with the first form of the invention.

Referring now more particularly to Figs. 15 and 16 it will be seen that the support members 116 each comprises a rectangular housing 151 in which a pair of shafts 152 and 152' are rotatably mounted. The shafts 152 and 152' are identical in construction with the shafts 52 and are similarly supported in the housing 151. The shafts 152 and 152' are provided with thrust bearing collars 153 adjacent each end thereof and outwardly of the collars 153 in the casing 151 bearing plates 154 are provided. The bearing plates may be secured to the housing 151 by means of screws 155. Each end of each shaft 152 and 152' is provided with a clutch element 156 and it will be noted that the clutch elements 156 are so terminated relative to the ends of the housing 151 as to engage corresponding clutch elements of superposed telescoping sections 116, and the clutch element 156 of the lowermost shaft 152 engages a similar clutch element pro-

vided at the upper end of the shaft 146. The upper end of each of the sections 116 is inwardly offset as indicated at 157 and spring hooks 158 (Fig. 8) are provided on opposed sides of the housing 151. One wall 159 of each housing 151 is provided with two parallel series of apertures 160 and this wall 159 adjacent its bottom is also provided with two spaced apertures 161 adapted to receive the spring hooks 158. The wall 162 of the housing 151 opposite the wall 159 is similarly provided with the apertures 161. In addition, the wall 162 is also provided with a series of spaced rectangular apertures 163 for a purpose to be later described.

The lowermost of the sections 116 (Fig. 9) differs slightly in construction from the other sections in that the shaft 152' (Fig. 9) is extended and provided with a gear 164 adapted to co-act with the apertures 144 whereby a wrench or other tool having a key adapted to be inserted in the keyways 165 provided in the upper ends of the shafts 152', may be inserted in the uppermost such keyway to rotate the paint spray 131, housing 135, braces 141 and 142 through 360° or more. Similarly, a wrench or other tool having a key adapted to be inserted in the keyways 165' provided in the upper ends of the shafts 152, may be inserted in the uppermost such keyway to actuate the gear 147 and rack 148 to move the paint spray back and forth as described previously in connection with the first form of the invention.

Referring to Figs. 8 and 9 the surface treatment means assembly is supported in operative position by inserting housing 136 in the lowermost section member 116 supported in or by the chute 40. When member 136 is thus positioned, the spring hooks 166 seat in apertures 161.

As previously described in connection with the first form of the invention the magazine 115 is designed to contain a plurality of unitary support members 116 and when the carriage is caused to move lengthwise of the trackway the support sections are advanced a predetermined distance of the magazine 115 in the direction of the inclined surface 127 and the opening 128 leading to the chute 129 by means of a feed screw 62 actuated by a trip member 63 mounted on the trackway, exactly as described in connection with the first form of the invention.

It is pointed out here that the inclined surface 127 of the channel 120 as well as the inclined surface 33' of the channel 33 functions in an obvious manner to prevent jamming of the unitary support sections before it is time for a section to be fed into its respective chute. Thus as one section is moved along its respective chute until such time as it slides down the inclined surface of the channel member, the preceding section has been fed downwardly to such point within its respective chute that it is ready to receive such next succeeding section. In this manner no jamming of the sections in the magazines occurs and it is obvious, of course, that the operation of the screw 62 is so regulated as to correspond with the downward projecting movement of the sections.

When the members 65' and the pusher bar 64 have reached the end of their inward movement they may be returned to their outermost positions by means of a crank 62'.

Referring to Figs. 8, 12, 13 and 17, the means to project a support section 116 from the housing or chute 129 comprises a support 167 secured to the lower end portion of the chute 129. Spaced bearings 168 are mounted upon the support 167 and a tubular shaft 169 is rotatably mounted in

said bearings. The shaft 169 is relatively short and provided at the ends thereof with clutch elements 170 and 170' rigidly connected thereto. Spaced star wheels 171 are secured to the shaft 169 substantially centrally thereof, and the teeth 172 of the star wheels project through an opening 173 provided in the chute 129 to engage the apertures 160 provided in the support sections 116.

An elongate shaft 174 extends through and is rotatable relative to the tubular shaft 169. The shaft 174 is rotatably mounted in bearings 175 and 176 supported at opposite ends of the tracks 101 on supports 177 and 178 depending from and secured to one of the tracks 101. At points adjacent the ends of the shaft 174, clutch elements 179, 179' are slidably mounted thereon. The clutch elements 179, 179' are identical in construction and each is keyed to the shaft 174 by means of an elongate key 180 (Fig. 17) which also functions to limit the inward movement of said clutch elements by engaging a shoulder 181 provided at the outer ends of the keyways 182. Coil springs 183, 183' surround the shaft 174 between the innermost bearings 175, 176 and clutch elements 179, 179' respectively, and said springs normally urge the clutch elements 179, 179' inwardly of the shaft 174.

The shaft 174 is driven by the motor 111 through shaft 184 on which gears 112', 113 are mounted, by extending the same downwardly, bevel gear 185 connected to shaft 184 by a universal joint 186, bevel gear 187 meshing with gear 185 and keyed to a shaft 188 rotatably mounted in support 177 and an additional support 189 depending from a track 101, sprocket wheel 189 on the outer end of shaft 188, sprocket wheel 190 keyed to the shaft 174 between the bearings 175, and chain 191 trained over sprocket wheels 189 and 190.

As stated above, the teeth 172 in the star wheels 171 engage the apertures 160 provided in the support sections 116, and thus when the carriage 104 approaches the vicinity of the limit of its travel in both directions, either the clutch elements 170' and 179', or 170 and 179, become engaged, thereby causing rotation of the shaft 169 and star wheels 171 to project a support section 116 downwardly of the chute 129 a predetermined distance. The position of the clutch elements 179 and 179' on the shaft 174, and the extent of their movement with the carriage, determines the distance the support section is projected.

The motor 111 may be reversed to feed the support sections 116 upwardly if desired, for example, after the surface treating operation is completed, each of said sections being manually disconnected from the one therebelow as it is fed into the magazine, and may be stored therein.

Means are provided to check the downward drop of the support section 116 in the chute 129 after it has been advanced as above described comprising a dog 192 pivotally mounted upon bracket 193 attached to the chute. The lower end of the dog 192 is spring pressed outwardly by means of a coil spring 194 supported by a pin 195 connected to the chute 129 and rigidly connected to the dog 192 is an outwardly directed arm 196. A wheel 197 rotatably mounted in a bracket 198 provided with a supporting block 199 is supported upon the outer end of the arm 196. The bracket 198 is adjustably secured to the arm 196 by means of a bolt 200 threaded into the block 199 and a lock nut 201. It will be noted that in this form of the invention the support 198 for

the wheel 197 is not pivotally mounted. As before, however, the wheel 197 is arranged to contact a cam extension 202 associated with each end portion of one of the beams 101. The end portion 203 of the pivotally mounted member 192 is adapted to seat in one of the plurality of recesses 163 formed in the face 162 of each of the support sections 116 and spring 194 normally urges the end portion 203 to seating position.

The cam members 202 are supported by means of paired, spaced depending supports 204 preferably removably and adjustably secured along and to one of the I-beams 101. An I-beam 205 is secured to the lower ends of each pair of members 204 and the cam 202 is secured to the I-beam 205 in any suitable manner.

From the foregoing it will be obvious that as the carriage 104 approaches the vicinity of each end of its movement the cam 202 will engage the wheel 197 to withdraw the dog 192 from the aperture 163. At substantially the same time that this action is taking place clutch elements 170' and 179' or 170 and 179 will engage to advance the section 116 by means of the star wheels 171 as previously described. After the direction of movement of the carriage is reversed, the clutch elements will become disengaged, and the dog 192 through the spring 194 will again engage in an aperture 163.

In the operation of this form of the device when the motor 111 is operated, carriage 104 through the medium of the reversible screw 108 is moved back and forth lengthwise of the trackway (Fig. 8), wheel 190 is cammed downwardly by the cam 202 to withdraw the dog 192 from an aperture 163 and clutch element 170' engages clutch element 179' moving clutch element 179' outwardly along the shaft 174 against the force of the spring 183'. The direction of movement of the carriage is shortly thereafter reversed and the clutch element 179' is then moved inwardly by spring 183' to maintain its engagement with clutch element 170' until the limit of its inward travel is reached. At this point wheel 190 moves back off cam 202 and dog 192 engages another aperture 163. During the time that the clutch elements 170' and 179' are engaged the section element 116 in the chute 129 will be lowered a predetermined distance due to rotation of the shaft 169 and the star wheels 171.

A similar action takes place at the other end of the trackway at which time the support section 116 is again lowered a predetermined distance. After the carriage 104 has moved from right to left and from left to right several times, the section 116 will be dropped substantially throughout its length and if additional length is required for the surface treatment means support, another section 116 is added so that a more distant surface can be reached by the surface treatment means. The additional extension member 116 is added automatically due to the fact that it has been moved by the arm 50' to a position whereby it will slide down the incline 127 and the lower end thereof automatically slides over the reduced upper end portion 157 of the lower, adjacent extension member and becomes connected therewith by the spring hooks 158. A bracket 206' is provided substantially midway of the member 118 which aids in guiding the sliding movement of the support sections 116 down the incline 127.

The predetermined distance the sections 116 are projected in the chute 129 may be readily varied by varying the innermost positions of the

clutch elements 179 and 179' on the shaft 174, corresponding changes being made with respect to the positions of the cam elements 202 along the trackway and the number of contact members in the trip mechanism 63. The innermost positions of the clutch elements 179 and 179' may be varied, for example, by moving the keys 180 from one position to another in the keyway provided therefor in the shaft 174, or by substituting keys having different lengths.

Referring again to Fig. 12 it will be noted that the chute 129 is provided with a friction means to regulate the friction exerted upon the section 116 therein comprising as before a block 206 carried by an arm 207 pivotally mounted on the chute by means of a bracket 208 and forced inwardly through a suitable aperture 209 in the chute by means of a coil spring 210.

Means are provided to support the entire apparatus including the tracks comprising bracket or clamp members 211 secured to suitable brackets 212 which are in turn suitably secured to and supported by the tracks 101. The clamp members 211 preferably comprise telescopic members whereby the lengths thereof may be adjusted and in the form of the invention chosen for illustration are particularly adapted to be secured to means such as rails or the like. Additional supports may be provided in the form of telescoping members 213 provided at their outer ends with rollers 214 adapted to contact the surface of the wall being treated. The members 213 are also suitably supported from the tracks 101 by means of supports 215.

It will of course be understood that in the use of both forms of my invention the tracks will be supported generally in overhanging relationship to the surface being treated. Variations in the curvature of such surfaces below the tracks may make it desirable or necessary to either move the surface treatment means inwardly or outwardly relative to such surface. The rack 54 and gear 53 or rack 148 and gear 147 make it possible for the surface treatment means to be so moved. Sometimes it may be desirable to lower the surface treatment means itself below an outwardly projecting or bulging surface to apply treatment therebelow and in such event in the second form of my apparatus the surface treatment means may be rotated through 90°, for example, whereby such bulging portion of the surface may be passed. In addition, the rotational feature of the second form of my invention may be of value in treating relatively short laterally extending surfaces.

In many instances the decks of ships and the tops of buildings are not provided with rails or other means suitable for the support of my device. In such event a support such as disclosed in Fig. 18, for example, may be used. The support disclosed in Fig. 18 comprises two trapeziform end members 216 and 217 provided with a plurality of inwardly extending telescoping members 218 and 219 respectively. At each corner of the base of the structure wheels or casters 220 may be provided. It will be obvious that the members 211 (Fig. 8) or the members 27 (Fig. 2) may be utilized to secure either of my devices to this support means.

Fig. 19 illustrates another support means which may be utilized to support my device when other suitable means are not provided. The support 221 comprises a base member 222 movably mounted on wheels or casters 223, a vertical framework 224 secured to the rear of the base

member 222, and an upper framework 225 projecting forwardly of the framework 224. A hook 226 is provided at the forward end of the framework 225 and a cable, hoist or other means may be supported by the hook 226 and connected to the track structure in any suitable manner. The broken lines indicate how the device A (illustrated diagrammatically) may be supported by a cable 226'.

Figs. 20 and 21 illustrate another manner in which my device A (illustrated diagrammatically) may be utilized in treating either outwardly or inwardly curved surfaces. In utilizing my device as illustrated in these figures, spaced tracks 227 are secured to the surface to be treated and in the form illustrated the tracks 227 are T-shaped in cross section although other shapes might be used. In utilizing the tracks 227 a roller structure is substituted for the clamps 211. The roller structure is illustrated in Fig. 21 and comprises a tubular member 228 and a member 229 connected thereto by means of a knuckle or universal joint. Bifurcated members 230 are connected to the member 229 and the members 230 have inwardly directed ends provided with rollers 231 which engage the flange of the T-shaped member 227. The surface treatment apparatus may be supported by means of the wheeled support 232 and a cable 233 may be connected to a hoist 234 or the like which can lower or raise the surface treatment apparatus as desired.

In utilizing my apparatus in the manner disclosed in Fig. 20 it will not usually be desirable to lower the support sections 29 or 116, although they may be lowered if desired. In the first form of my invention this operation may be eliminated by removing the trip mechanism 69, and in the second form of my invention this lowering operation may be omitted by moving the clutch elements 179 and 179' outwardly and securing the same in such a position that they will not engage the clutch elements 170 and 170'.

Although in the foregoing disclosure of my apparatus specific reference has been made to a painting apparatus and paint spray means has been specifically illustrated in the drawing, it is to be clearly understood that for the paint spray means 41 or 131, I may substitute a sand blasting device, a steam cleaning device, a chipping device, rotatable brush means or the like, and perform in addition to painting, any one or more of these additional surface treatment operations on ships, buildings and the like, on vertical surfaces, curved surfaces, and horizontal surfaces. Additionally, it may be pointed out that although the present disclosure relates primarily to supporting my device on rail structures, any suitable means may be used to support the track structure and the said track structure may be supported on its side in the treatment of horizontal surfaces such as floors and ceilings. When supported on its side, with the axis of the chute 40 or 129 extending horizontally, the releasable holding means for the sections 29 or 116; i. e., the dog 76 or dog 192, are ordinarily unnecessary and may, if desired, be rendered inoperative by the U-shaped clips 95. In a device constructed for the treatment of horizontal surfaces only, the dogs 76, 192 and associated actuating structure might be omitted entirely. It will also be obvious that when the axis of the chute 40 or 129 is extended substantially horizontally that the support sections will not be fed automatically to the chutes. However, they may be fed to the chutes manually as and if required.

From the foregoing I believe that it will be obvious that I have provided apparatus which will clearly perform all of the functions set forth earlier herein in the objects of the invention, and it is further pointed out that the apparatus of the present invention is compact, light, can be readily assembled or disassembled, can be conveniently stored or shipped, and when started in operation it may operate automatically to perform the desired surface operation with a minimum of expense.

While I have shown and described the preferred embodiments of my invention it is to be understood that I do not confine myself to the precise details of construction herein as set forth by way of illustration, as it is apparent that many changes and variations may occur to those skilled in the art without departing from the spirit of the invention.

This application is a continuation-in-part of my copending application, Serial No. 737,841, filed March 28, 1947.

I claim:

1. In a surface treatment means support arrangement, the combination comprising a trackway, a carriage on said trackway, motor means for moving said carriage back and forth along said trackway, a housing secured to said carriage, an elongate support section in said housing, automatic means for projecting said support section a predetermined distance outwardly of said housing, means for actuating said projecting means responsive to the movement of the carriage on the trackway and operative when the carriage is in the vicinity of each end of its movement back and forth along the trackway, and a support for surface treatment means carried by said support section.

2. In a surface treatment means support arrangement, the combination comprising a trackway, a carriage on said trackway, means for moving said carriage back and forth along said trackway, a housing secured to said carriage, a hollow support section in said housing, means for projecting said support section a predetermined distance outwardly of said housing, an elongate support for surface treatment means carried by said support section, and means including a shaft rotatably mounted in said support section for moving said treatment means support in a direction substantially perpendicular to the longitudinal axis of said support section.

3. In a surface treatment means support arrangement, the combination comprising a trackway, a carriage on said trackway, means for moving said carriage back and forth along said trackway, a housing secured to said carriage, a hollow support section in said housing, means for projecting said support section a predetermined distance outwardly of said housing, an elongate support for surface treatment means carried by said support section, and means including a shaft rotatably mounted in said support section for rotating said treatment means support about the longitudinal axis of said support section.

4. In a surface treatment means support arrangement, the combination comprising a trackway, a carriage on said trackway, means for moving said carriage back and forth along said trackway, a housing secured to said carriage, a hollow support section in said housing, means for projecting said support section a predetermined distance outwardly of said housing, an elongate support for surface treatment means carried by said support section, and means including a pair of

shafts rotatably mounted in said support section for moving said treatment means support in a direction substantially perpendicular to the axis of said support section and in rotation about said axis.

5. In a surface treatment means support arrangement, the combination comprising a trackway, a carriage on said trackway, motor means for moving said carriage back and forth along said trackway, a housing secured to said carriage, an elongate support section in said housing, a series of apertures in said support section, automatic means including a star wheel in engagement with said apertures for projecting said support section a predetermined distance outwardly of said housing, means for actuating said projecting means responsive to the movement of the carriage on the trackway and operative when the carriage is in the vicinity of each end of its movement back and forth along the trackway, and a support for surface treatment means carried by said support section.

6. In a surface treatment means support arrangement, the combination comprising a trackway, a carriage on said trackway, means for moving said carriage back and forth along said trackway, a chute secured to said carriage, an elongate support section in said chute, releasable means for holding said support section in said chute, means for projecting said support section a predetermined distance outwardly of said chute, means for releasing said holding means while said projecting means is functioning, and a support for surface treatment means carried by said support section.

7. In a surface treatment means support arrangement, the combination comprising a trackway, a carriage on said trackway, means for moving said carriage back and forth along said trackway, a chute secured to said carriage, a hollow support section in said chute, releasable means for holding said support section in said chute, means for projecting said support section a predetermined distance outwardly of said chute, means releasing said holding means while said projecting means is functioning, an elongate support for surface treatment means carried by said support section, and means including a shaft rotatably mounted in said support section for moving said treatment means support in a direction substantially perpendicular to the longitudinal axis of said support section.

8. In a surface treatment means support arrangement, the combination comprising a trackway, a carriage on said trackway, means for moving said carriage back and forth along said trackway, a chute secured to said carriage, a hollow support section in said chute, releasable means for holding said support section in said chute, means for projecting said support section a predetermined distance outwardly of said chute, means releasing said holding means while said projecting means is functioning, an elongate support for surface treatment means carried by said support section, and means including a shaft rotatably mounted in said support section for rotating said treatment means support about the longitudinal axis of said support section.

9. In a surface treatment means support arrangement, the combination comprising a trackway, a carriage on said trackway, means for moving said carriage back and forth along said trackway, a chute secured to said carriage, a hollow support section in said chute, releasable means for holding said support section in said chute, means

for projecting said support section a predetermined distance outwardly of said chute, means releasing said holding means while said projecting means is functioning, an elongate support for surface treatment means carried by said support section, and means including a pair of shafts rotatably mounted in said support section for moving said treatment means support in a direction substantially perpendicular to the longitudinal axis of said support section and in rotation about said axis.

10. In a surface treatment means support arrangement, the combination comprising a trackway, a carriage on said trackway, means for moving said carriage back and forth along said trackway, a chute secured to said carriage, an elongate support section in said chute, a series of apertures in said support section, releasable means for holding said support section in said chute, means including a star wheel in engagement with said apertures for projecting said support section a predetermined distance outwardly of said chute, means for releasing said holding means while said projecting means is functioning, and a support for surface treatment means carried by said support section.

11. In a surface treatment means support arrangement, the combination comprising a trackway, a carriage on said trackway, means for moving said carriage back and forth along said trackway, a magazine for a plurality of support sections supported by said carriage, a housing secured to said carriage with one end thereof in communication with said magazine whereby said support sections may be moved into operative position in said housing, means for projecting a support section in said housing a predetermined distance outwardly thereof, co-acting means on said support sections automatically connecting the same to each other as they are moved into said housing, and a support for surface treatment means carried by the support sections in operative position.

12. In a surface treatment means support arrangement, the combination comprising a trackway, a carriage on said trackway, means for moving said carriage back and forth along said trackway, a magazine for a plurality of support sections supported by said carriage, said magazine comprising a lower channel member having an inclined end portion, a chute secured to said carriage with its upper end in communication with said inclined end portion of said magazine, a plurality of support sections in said magazine, means for moving said support sections in said magazine toward said inclined end portion and into operative position in said chute, releasable means for holding said support sections in said chute, means for projecting a support section in said chute a predetermined distance outwardly thereof, means releasing said holding means while said projecting means is functioning, co-acting means on said support sections automatically connecting the same to each other as they are moved into said chute, and a support for surface treatment means carried by the support sections in operative position.

13. In a surface treatment means support arrangement, the combination comprising a trackway, a carriage on said trackway, means for moving said carriage back and forth along said trackway, a magazine for a plurality of support sections supported by said carriage, said magazine comprising a lower channel member having an inclined end portion, a chute secured to said

carriage with its upper end in communication with said inclined end portion of said magazine, a plurality of hollow support sections in said magazine, means for moving said support sections in said magazine toward said inclined end portion and into operative position in said chute, releasable means for holding said support sections in said chute, means for projecting a support section in said chute a predetermined distance outwardly thereof, means releasing said holding means while said projecting means is functioning, co-acting means on said support sections automatically connecting the same to each other as they are moved into said chute, a support for surface treatment means carried by the support sections in operative position, and means including a shaft rotatably mounted in each of said support sections for moving said treatment means support in a direction substantially perpendicular to the longitudinal axis of the support sections in operative position.

14. In a surface treatment means support arrangement, the combination comprising a trackway, a carriage on said trackway, means for moving said carriage back and forth along said trackway, a magazine for a plurality of support sections supported by said carriage, said magazine comprising a lower channel member having an inclined end portion, a chute secured to said carriage with its upper end in communication with said inclined end portion of said magazine, a plurality of hollow support sections in said magazine, means for moving said support sections in said magazine toward said inclined end portion and into the operative position in said chute, releasable means for holding said support sections in said chute, means for projecting a support section in said chute a predetermined distance outwardly thereof, means releasing said holding means while said projecting means is functioning, co-acting means on said support sections automatically connecting the same to each other as they are moved into said chute, a support for surface treatment means carried by the support sections in operative position, and means including a shaft rotatably mounted in each of said support sections for rotating said treatment means support about the longitudinal axis of the support sections in operative position.

15. In a surface treatment means support arrangement, the combination comprising a trackway, a carriage on said trackway, means for moving said carriage back and forth along said trackway, a magazine for a plurality of support sections supported by said carriage, said magazine comprising a lower channel member having an inclined end portion, a chute secured to said carriage with its upper end in communication with said inclined end portion of said magazine, a plurality of hollow support sections in said magazine, means for moving said support sections in said magazine toward said inclined end portion and into operative position in said chute, means for projecting a support section in said chute a predetermined distance outwardly thereof, means releasing said holding means while said projecting means is functioning, co-acting means on said support sections automatically connecting the same to each other as they are moved into said chute, a support for surface treatment means carried by the support sections in operative position, and means including a pair of shafts rotatably mounted in each of said support sections for moving said treatment means support in a direction substantially perpendicular to the longitu-

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dinal axis of the support sections in operative position and in rotation about said axis.

16. In a surface treatment means support arrangement, the combination comprising a trackway, a carriage on said trackway, means for moving said carriage back and forth along said trackway, a magazine for a plurality of support sections supported by said carriage, said magazine comprising a lower channel member having an inclined end portion, a chute secured to said carriage with its upper end in communication with said inclined end portion of said magazine, a plurality of support sections in said magazine, a series of apertures in each of said support sections, means for moving said support sections in said magazine toward said inclined end portion and into operative position in said chute, releasable means for holding said support sections in said chute, means including a star wheel in engagement with said apertures for projecting a support section in said chute a predetermined distance outwardly thereof, means releasing said holding means while said projecting means is functioning, coacting means on said support sec-

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tions automatically connecting the same to each other as they are moved into said chute, and a support for surface treatment means carried by the support sections in operative position.

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