

Feb. 9, 1937.

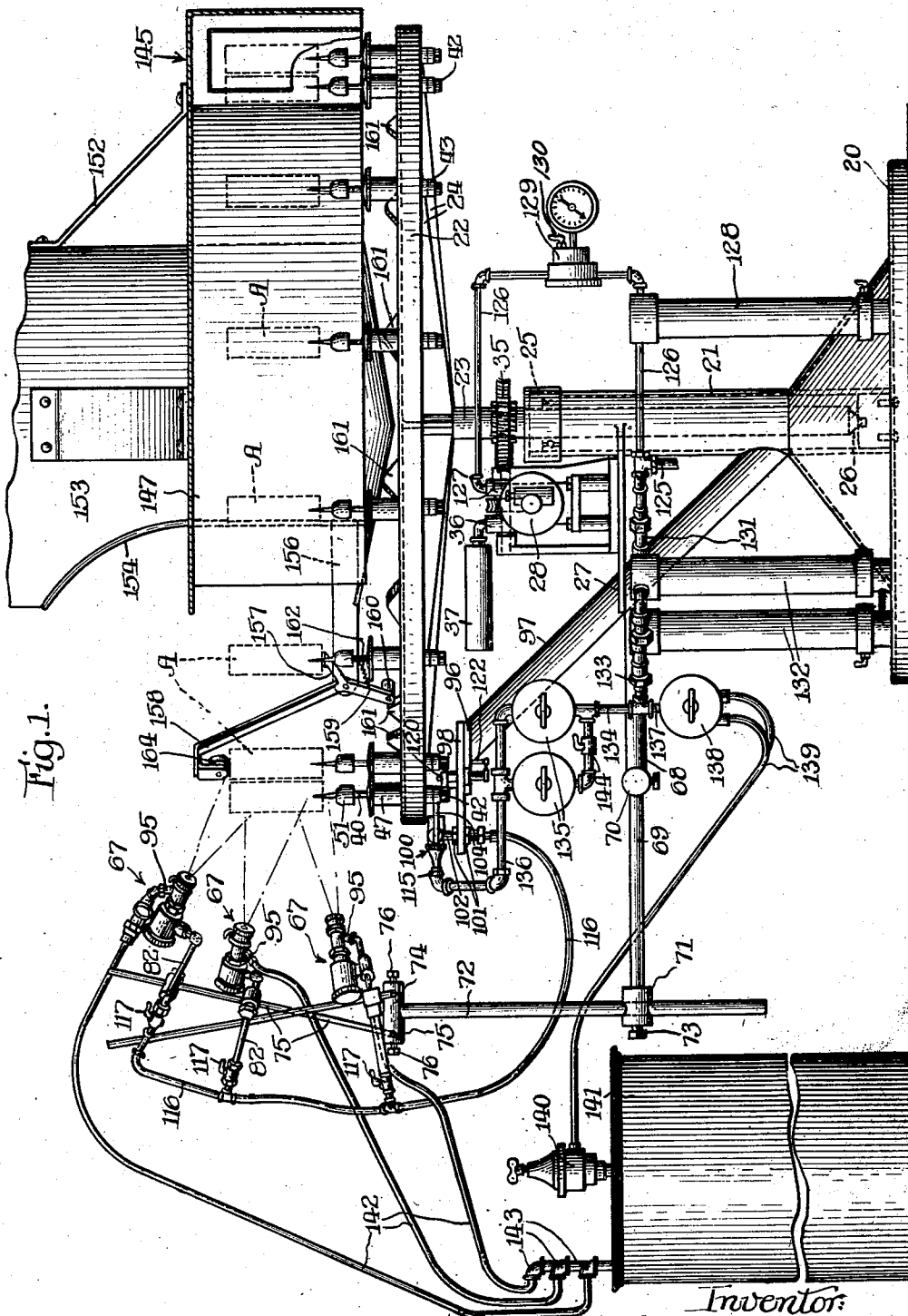
J. A. PAASCHE

2,069,844

PAINT APPLYING MACHINE

Filed March 18, 1931

3 Sheets-Sheet 1



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3 Sheets-Sheet 2

Fig. 2.

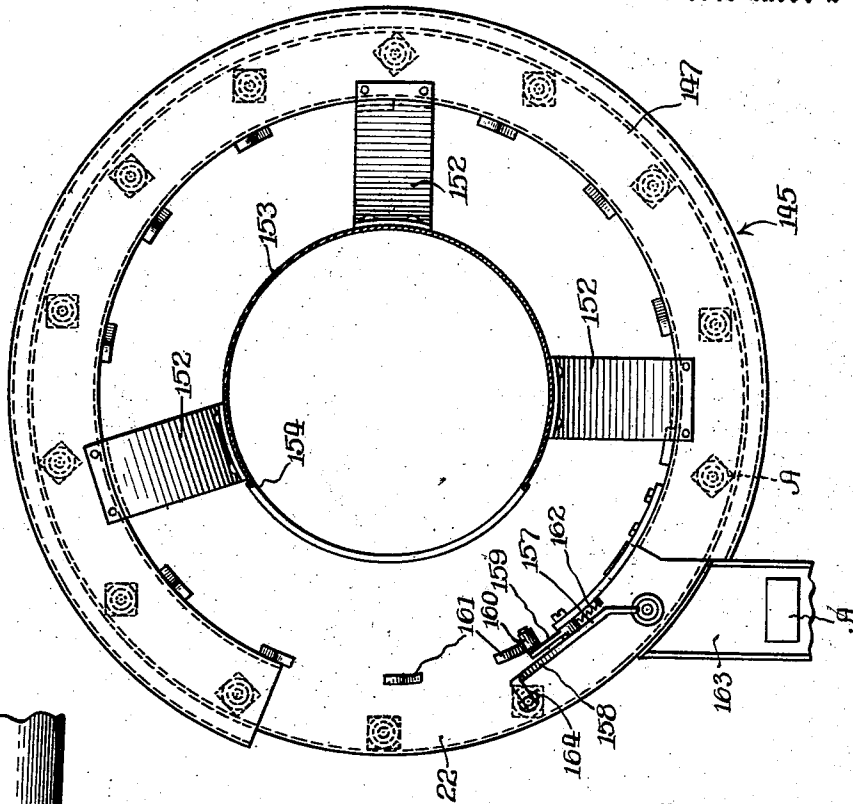


Fig. 3.

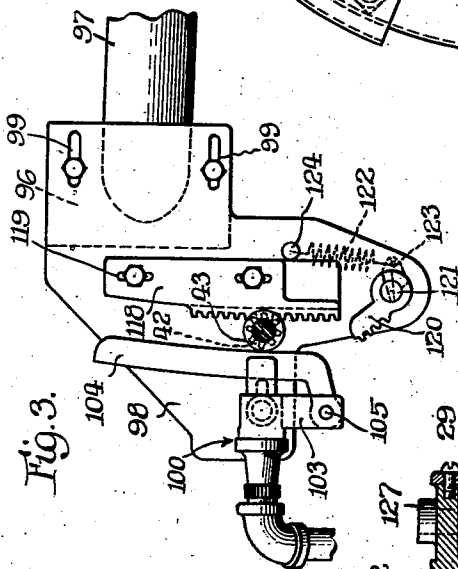


Fig. 4.

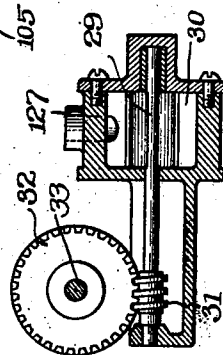
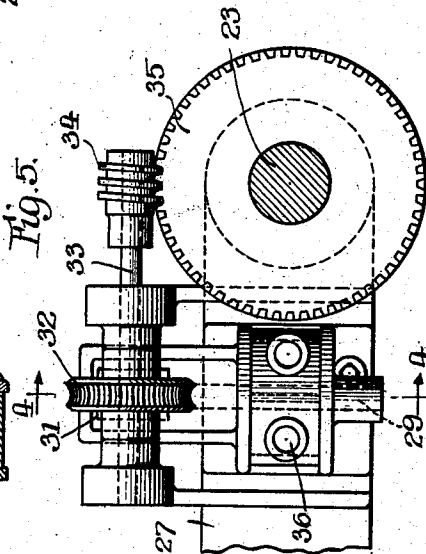


Fig. 5.



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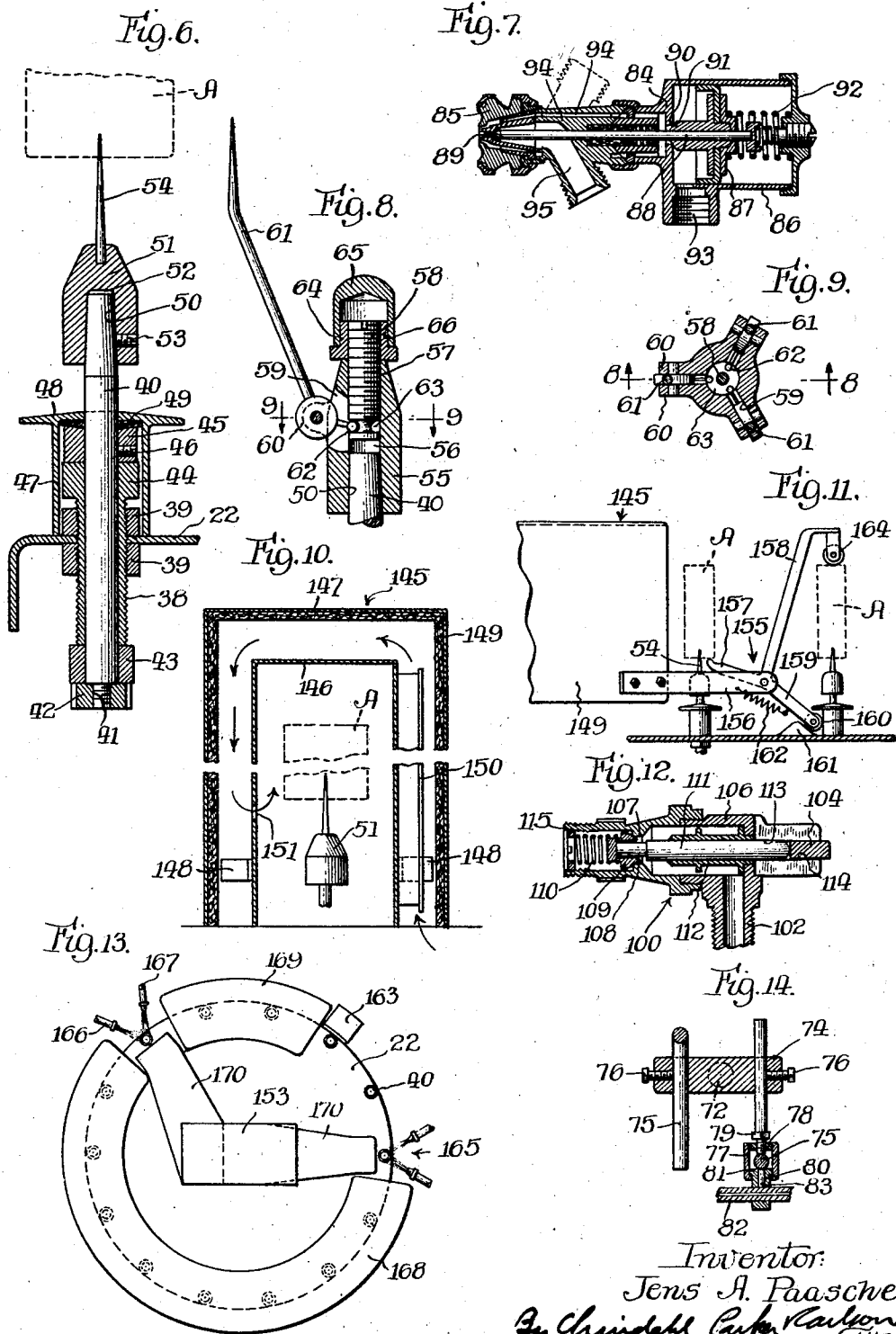
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PAINT APPLYING MACHINE

Filed March 18, 1931

3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

2,069,844

PAINT APPLYING MACHINE

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Application March 18, 1931, Serial No. 523,393

21 Claims. (Cl. 91—45)

The invention refers generally to paint-applying machines and more particularly to a machine for automatically applying one or more coats of paint to a succession of articles.

A general object of the invention is to provide a machine of this character which is simple in construction, convertible, functions automatically, is fireproof, and is efficient in operation.

Another object is to provide a new and improved paint-applying or coating machine in which a succession of objects have relative movement to one or more air brushes, such relative movement being produced by fluid pressure driven means whereby the power application is flexible and the machine is fireproof.

Another object of the invention is to provide, in a machine of this character, novel means for producing relative movement between a succession of articles to be painted and a paint-applying means and for effecting the application of paint to an article when the said relative movement positions the article and paint-applying means in juxtaposed relation.

A further object of the invention resides in the provision of an article-carrying means having movement past a paint-applying means in combination with mechanism for effecting operation of the paint-applying means only while the article-carrying means is within the effective range thereof.

Another object of the invention is to provide, in a machine of this character, a series of normally idle members on which the articles to be treated are mounted, and means operable, in the movement of said members past a paint-applying mechanism, to effect successive turning of the members.

More specifically stated, an object is to provide a rotating support having a series of article-carrying spindles thereon arranged to move successively past a battery of one or more air brushes, and mechanism, operable by the movement of the support relative to said battery of brushes, to produce successive rotating movement of each spindle and operation of said brushes while an article carried by a spindle is within the effective range of the brushes.

A further object is to provide a new and improved mechanism for automatically loading and unloading articles from a machine of this character.

A further object is to provide a novel machine of this character embodying a moving support on which articles are carried while being painted and means for subsequently drying said articles

before another coat of paint is applied or before the object is ejected from the machine.

Another object is to provide in a machine of the character described rotatable article supporting means which includes improved readily removable means for protecting its bearing mechanism against the entrance of paint or other foreign matter that might hamper free operation thereof.

Other objects reside in the provision of new and improved means for controlling and synchronizing the machine operation; and of a novel and simple conduit system for supplying air under pressure to the operating mechanisms.

Other objects and advantages will become apparent in the following description and from the accompanying drawings, in which:

Figure 1 is a side elevation, partially fragmentary, of a machine embodying the features of the invention.

Fig. 2 is a plan view thereof, certain parts being omitted to clarify the view.

Fig. 3 is a fragmentary plan view of the spindle-actuating and paint brush controlling mechanism.

Fig. 4 is a sectional view of a detail of the driving mechanism and is taken substantially on the line 4—4 of Fig. 5.

Fig. 5 is a plan view of the driving mechanism.

Fig. 6 is a detail view showing one of the article-supporting spindles in axial section.

Fig. 7 is a fragmentary view showing an air brush device in axial section.

Fig. 8 is a view in axial section taken on the line 8—8 of Fig. 9 of an adjustable article-holding means.

Fig. 9 is a transverse section of said article-holding means taken as indicated by the line 9—9 of Fig. 8.

Fig. 10 is a detail view showing the drying chamber in transverse section.

Fig. 11 is an elevational view of the automatic article-loading and unloading mechanism.

Fig. 12 is an axial section through the device for controlling the operation of the paint brushes.

Fig. 13 is a diagrammatic plan view of a painting machine embodying more than one paint-applying station.

Fig. 14 is a sectional view of a detail of one of the members for mounting a paint brush for universal adjustment.

While the invention is susceptible of various modifications and alternative constructions, I have shown in the drawings and will herein describe in detail the preferred embodiment, but it

is to be understood that I do not thereby intend to limit the invention to the specific form disclosed, but intend to cover all modifications and alternative constructions falling within the spirit and scope of the invention as expressed in the appended claims.

In a broad sense, the invention contemplates the provision of an article-supporting means, such as a bed, platform, chain conveyer, or table, associated with which is a battery of one or more (depending upon the nature of the work) paint or coat-applying devices, herein illustrated as air brushes actuated by compressed air. The article-supporting means carries a plurality of spaced work-supporting members, each having a work holder thereon, and suitable driving means are provided for effecting relative movement between the supporting means and the battery of paint-applying devices. Such relative movement causes said members successively to pass the paint-applying devices and the machine embodies means actuated by and operating synchronously with said relative movement for turning each member to expose the desired surfaces of the article toward the paint-applying devices and at the same time to actuate the paint-applying devices only while each member and the article carried thereby is within the effective range thereof.

The invention further includes automatic loading and unloading means, as well as various features of adjustment and control which impart to the machine a substantially universal adaptability for treating articles of various sizes, shapes, and contours.

With particular reference to Fig. 1 of the drawings, the present machine embodies a suitable base 20 having a vertically disposed tubular pedestal 21 secured thereon. A supporting member 22, which hereinafter will be referred to as a table, is substantially circular in form and has a shaft 23 extending axially therefrom. Spider arms 24, or the like, strengthen the connection between the shaft and the table. The shaft 23 is receivable within the tubular pedestal 21 for rotational movement relative thereto and the assembly preferably includes suitable antifriction elements 25 and a thrust bearing 26 which permit of a substantially free and frictionless movement of the table.

In paint-applying machines and particularly in machines in which paint, varnish, lacquer or similar fluids are sprayed onto an article, the fire hazard is exceedingly great. For this reason, the use of ordinary types of prime movers, such as electric motors, is disadvantageous in that they materially increase the fire hazard. This disadvantage is overcome in the present machine by employing an air motor as the prime mover for driving the article conveyer. Thus, referring to Figs. 1, 4, and 5, the pedestal 21 has a horizontally extending and preferably integrally formed platform 27 thereon positioned near the upper end of the pedestal. An air motor 28 of the rotating vane type is rigidly secured on the platform 27. The drive between the motor and the shaft comprises a motor shaft 29 (Fig. 4) to which the air driven vanes 30 of the motor are secured, said shaft 29 being journaled in the walls of the casing. An outwardly extending end of the shaft 29 carries a worm 31 arranged to engage a worm wheel 32 supported on a suitably journaled shaft 33 which, in turn, carries a worm 34 disposed adjacent the upper end of the shaft 23. The worm 34 meshes with a worm wheel 35 which is rigidly secured to the shaft 23. Preferably, the outlet side of the motor 36 (Fig. 1) has a silencer 37

connected thereto for rendering the operation of the motor silent. The operative connections for supplying motive power to the motor will be hereinafter described.

Means, mounted on the table, are provided for supporting an article to be painted while said article moves with the table through the various cycles of operation. To this end (see Figs. 1, 2, and particularly 6), the table is apertured at spaced intervals about and near the periphery thereof to receive a series of spindles. Since the construction of these spindles is substantially the same and the assembly thereof with the table is similar, only one will be described. Each of the spaced apertures receives a tubular bushing 38 (Fig. 6) which extends through the aperture and is externally screw-threaded to receive locking nuts 39 disposed on opposite sides of the table and serving adjustably to hold the bushing in place. A spindle 40 extends through said bushing for a substantial distance on either side thereof.

The lower end of the spindle is of restricted size, as at 41, and is externally screw-threaded to engage internal screw threads formed on a pinion 42. A collar 43 encircles the spindle and is interposed between the pinion 42 and the lower end of the bushing 38. The purposes of the pinion and collar will become apparent as the description proceeds. At its upper end, the bushing 38 is formed to provide an enlarged head 44, and a sleeve 45, rigidly connected to the spindle 40 by such means as a set screw 46, is arranged to bear against the upper surface of the head 44. Thus, the pinion 42 and collar 43 on the one hand, and the sleeve 45 on the other hand, maintain the spindle against axial movement relative to the bushing 38.

Preferably, the parts of the spindle assembly, which are located on the upper side of the table, are protected against the entrance of paint or other foreign matter thereinto. This end is suitably attained by a tubular housing 47 adapted to fit about or to encase the parts of the spindle assembly on the upper side of the table. An end closure 48 on the housing is axially apertured to fit snugly about the spindle 40 and a gasket 49, or the like, of suitable packing material is preferably interposed between the closure 48 and the upper face of the sleeve 45 to retain lubrication therein and to prevent the entrance of the sprayed material which otherwise would clog the assembly. This construction provides a spindle assembly, in which the spindle is freely rotatable but is rigidly held against axial movement. Further, the construction allows the spindle to be adjusted axially or to be removed entirely so that articles of various sizes can be handled on the same unit.

In the instant machine, the upper end of the spindle, which projects through the end closure of the housing 47, is slightly tapered as at 50 to receive an article-holder. In Fig. 6, one form of article-holder is shown as comprising a head 51 having an axial recess 52 which is tapered to form the complement of the tapered end 50 of the spindle. A set screw 53, or the like, may be provided whenever it is deemed necessary to prevent accidental displacement of the article-holder from the spindle. The end of the article-holder, opposite the recess 52, carries an axially extending article-engaging member 54 in the form of a sharply pointed prong. This type of article holder is intended for a machine which is to apply paint to an article fashioned from wood or the like and where the penetration of the ar-

file by the prong 54 is not objectionable. Such articles are herein diagrammatically illustrated as rectangular blocks designated A, and the articles are mounted for treatment by impaling them on the prongs 54.

In providing a machine which is substantially universal in character, and, with few alterations, can be adapted for many different types of articles, the present embodiment employs article-holders of other types than that shown in Fig. 6, said article-holders being adapted for interchangeable use on the spindles 40. Figs. 8 and 9 illustrate a modified type of article-holder of this nature which comprises an elongated head 55 which has an axial bore 56 therein, tapered at one end to fit snugly upon the tapered end 50 of the spindle 40. The other end of the bore 56 is screw-threaded, as at 57, to receive a headless screw 58. Apertures 59 are formed at transversely spaced intervals about the head intermediate the ends thereof, which apertures are elongated and extend longitudinally of the head. Three such apertures are shown in this instance and each has a pair of outstanding ears 60 formed on the transverse sides thereof.

Elongated prongs 61 are supported for pivotal movement by the ears 60 to extend outwardly and beyond the screw-threaded end of the head. Each prong carries an angularly disposed finger 62 which extends through its corresponding aperture 59 into engagement with an annular recess 63 formed in the inner end of the screw 58. Adjustable movement of the screw axially of the head, consequently, produces swinging movement of the prongs 61 toward and away from each other to adapt the article-holder to receive articles of different sizes, shapes and contours. Preferably, a lock nut 64 is provided on the outer end of the screw 58 to maintain the screw and the prongs in any desired position of adjustment and a cap 65, arranged to fit snugly into a rabbeted groove 66 formed on the head of the nut, prevents the entrance of paint into the assembly. This type of article-holder is employed where articles of peculiar surface characteristics are to be treated and where it is undesirable or impossible to mount the article by impaling it on a prong. It will be evident that these two types of article-holders are readily interchangeable and that the machine may, therefore, be quickly adapted to accommodate different types of articles.

The means by which paint is applied to the articles is in the present instance of the general type known as air brushes and which are characterized in operation by the creation and discharge of a more or less finely atomized spray of paint by compressed air. In Fig. 1, three sets of air brushes, indicated generally at 67, are arranged as a group or battery of paint-applying devices, it being understood that the number of such devices necessary will depend entirely upon the surface characteristics of the article to be treated, as well as upon the nature of the coat or coats of material to be applied. Preferably, the air brushes are of a type which is convertible in order that the individual air brushes may apply coats of different characters as required.

Means is provided for mounting each of the air brushes 67 adjacent the periphery of the table, which means is arranged to permit of independent and universal adjustment of each air brush so that the sprays from said air brushes may be directed toward the article at the proper angle to obtain the most efficient and thorough coating of the article. In one form (see Fig. 1), such a

means for mounting the brushes comprises a pair of transversely extending, telescopically arranged members 68 and 69, one of which, in this instance the member 68, is rigidly secured to the pedestal 21. Any well-known type of locking means 70 is provided to secure the members 68 and 69 in any of their relative positions of adjustment.

The free end of the member 69 carries a head 71 having a substantially vertical bore therein through which a supporting rod 72 extends slidably, the relative position of said head 71 and rod 72 being fixed by a set screw 73 or the like. The upper end of the rod 72 carries an elongated member 74 which is transversely bored to receive one or more L-shaped rods 75, two of such rods being shown. Preferably, the rods extend from opposite sides of the members 74 and set screws 76 adjustably secure the rods in place.

The air brushes are preferably mounted on the rods 75 for longitudinal and swinging adjustment relative thereto and a suitable form of means for mounting the air brushes in this manner is shown in Fig. 14. In this form, a small casing 77 is apertured to permit the rod 75 to extend somewhat loosely therethrough. One end of the casing is closed by a plug 78 which carries a set screw 79 arranged to be moved into binding engagement with the rod 75. Oppositely of the plug 78, the casing is apertured to receive a short sliding rod 80 having an internally disposed head 81 engaging the wall of the casing through which the rod extends. The outer end of the rod 80 is transversely bored to receive a tubular member 82. The rod 80 is also axially bored from the headed end thereof to receive a pin 83 arranged to be engaged by the rod 75. Thus, when the set screw 79 is turned to bind the rod 75 against the head 81, the rod 75 will be pressed against the pin 83, thereby forcing said pin against the tubular member 82 and securing said member against movement relative to the rod 80.

The tubular member 82 is rigidly connected at one end to the air inlet side of the air brush, and serves the dual function of supporting the device and of providing a connection between the brush and a source of air. It will be apparent that this assembly allows the air brushes to be adjusted, both as a unit and individually. Thus, all of the brushes may be simultaneously moved toward and away from the articles carried by the table and may also be adjusted vertically as well as pivotally. The rod 75 may carry one or more brushes which are adjustable together by movement of the rod and separately by individual movement relative to the rod.

In the present machine, the air brush, which is preferably employed is one in which the operation thereof is pneumatically controlled. That is to say, the air brush is one in which pneumatic pressure is not only used to create and discharge a spray of paint but is also employed as a control actuating means for starting and stopping the operation of the brush. With reference to Fig. 7, 84 designates generally a tubular air brush casing having at one end a discharge nozzle 85. The opposite end of the casing is enlarged to provide a cylinder 86 within which a piston 87 is mounted for reciprocatory movement. The piston carries a piston rod 88 extending substantially axially of the casing and terminating at its forward end in a needle valve 89 arranged to control the passage of fluid through a discharge aperture in the nozzle.

An annular internal wall 90, positioned intermediate the piston 87 and discharge nozzle, forms a valve seat for a valve 91 carried by the piston 87. The needle valve 89 and internal valve 91 are normally maintained in seated condition by a spring 92 interposed between the piston 87 and the end of the cylinder. An air inlet 93 on the casing opens into the cylinder between the piston 87 and the internal wall 90 so that when air under pressure is admitted, through the inlet 93, the piston 87 will be moved rearwardly to open the valves 89 and 91. A passageway 94 leads forwardly of the casing from the valve aperture controlled by the valve 91 to the discharge nozzle to conduct air under pressure to the nozzle where it functions in the usual manner to create a spray of paint. Paint is supplied to the brush through a fluid inlet 95 which communicates with the discharge aperture in the nozzle. The air inlet 93 provides the connection with the tubular member 82 by which the device is mounted on its adjustable support. A more detailed description of the construction and operation of this type of device will be found in my copending application for patent Serial No. 551,137 filed July 16, 1931, now Patent No. 2,059,706 issued November 3, 1936.

Operation of the air brushes is controlled by means actuated by the relative movement between the table and air brushes. The present control means is best seen in Figs. 1 and 3. A horizontal plate 96 is supported by a stationary standard 97 immediately below the table and on the side thereof adjacent the battery of air brushes. The plate 96 carries a second plate 98 secured thereto for adjustment radially of the table by such means as an elongated slot and bolt connection 99. The plate 98 carries a valve mechanism, generally designated 100, which is mounted thereon by a pair of lock nuts 101 (Fig. 1) engaging external screw threads formed on the valve outlet 102 (Figs. 1 and 12). The valve casing carries a transversely extending arm 103 (Fig. 3) to the outer end of which a cam member 104 is pivotally secured, as at 105. The arrangement of parts is such that the cam member is below and adjacent the peripheral edge of the table and extends in a general direction substantially paralleling the line of movement of the table.

The valve mechanism is operated by movement of the cam member 104. Thus (see Fig. 12) a preferred form of valve mechanism comprises a tubular casing 106 having an annular internal shoulder 107 which forms a valve seat. A valve passageway 108 through the seat is normally closed by a tapering valve 109 which is held against the seat by a spring 110. A plunger 111, slidably mounted in the casing 106 and supported for reciprocal movement therein by a suitable bearing sleeve 112, has a loose engagement at one end with the valve 109. This engagement allows the valve freely to seat itself on the valve seat and thus adjust itself as the parts become worn.

The opposite end of the plunger 111 extends through a bore 113 which communicates with a transverse slot 114 in which the cam member 104 is disposed. Consequently, movement of the cam member 104 toward the valve casing unseats the valve 109 to allow air to pass through the valve inlet 115 into the casing 106 and out through the valve outlet 102. When the parts are assembled, the disposition is such that the cam surface of the member 104 lies in the path de-

scribed by the collars 43 carried by the spindles 40 in the movement thereof with the table. Consequently, as each spindle moves into a position adjacent the battery of air brushes, the collar 43 thereon will engage the cam surface of the cam member 104 to move said cam member and open the valve 109. The cam member is arranged to be replaced by another of different length in order that the length of time required to coat an article and the length of time that the air brushes are operated may be the same. This permits the machine operation to be adjusted according to the size and coating requirements of articles of different sizes.

The valve outlet 102 (Fig. 1) is connected by a suitable conduit 116 with the free ends of the tubular members 82, valves 117 being interposed in each connection to permit of selective operation of the air brushes. This construction, therefore, effects operation of the air brushes as the table carries each spindle past said brushes and, by properly predetermining the length of the cam member 104, operation of the air brushes is produced only while the spindle is traveling through the effective range of the air brushes. As a result of this intermittent action of the air brushes, waste of paint and compressed air is substantially eliminated.

During the application of the paint to the articles, in many instances it will be desirable to expose more than one surface of the articles to the paint spray. One form of means for accomplishing this purpose is illustrated herein as comprising a rack 118 (Fig. 3) which is rigidly mounted on the plate 98 to extend substantially in the direction of travel of the table. Preferably, the rack is oppositely disposed with respect to the cam member 104 and is positioned for engagement by the pinions 42 mounted on the lower end of the spindles 40. An elongated slot and bolt connection 119, for securing the rack 118 to the plate 98, permits limited longitudinal adjustment of the rack 118.

The present arrangement embodies means for producing a properly meshed engagement between the pinion 42 and the rack 118 as the table carries the pinion into contact therewith. For this purpose a relatively short rack segment 120 is mounted on a pivot pin 121 for swinging movement in the plane of the rack 118. The rack segment 120 is positioned adjacent the advance end of the rack 118 (as that end of the rack first engaged by the pinion may be designated) in such manner that in one position the segment engages and forms a continuation of the rack 118. The segment, however, is normally projected into and is yieldingly held in the path of an advancing pinion 42 by suitable resilient means, such as a spring 122 extending between an arm 123 rigid with the pivot pin and a stationary part 124 of the assembly.

In operation, as the table rotates to move the collar 43 on the spindle 40 into engagement with the cam member 104, the pinion 42 on the spindle moves into engagement with the rack segment 120. The angular projection of the rack segment into the path of the gear, as well as the movable nature of the segment, insures a properly meshed engagement of the teeth on the segment and the pinion. Continuing movement of the spindle swings the rack segment into alignment with the stationary rack 118 to permit the pinion to move without interruption from its engagement with the segment into engagement with the rack. Consequently, as the pinion moves across the

segment and rack, rotational movement is imparted to the spindle to turn an article during the time that it passes through the effective range of the air brushes. It will be apparent that the rack and pinion engagement can be readily replaced by other types of engagements when other movements of the spindle are desired. Moreover, if only one surface of the article is to be treated, the rack 118 and segment 120 may be removed from the assembly or they may be adjusted to an out-of-the-way position.

The system of conduits for supplying compressed air to the machine will now be described. Numeral 125 (Fig. 1) designates a conduit or pipe line which is connected to a suitable source (not shown) of air under pressure. The conduit 125, in turn, is connected to a pipe line 126 which leads to the intake side 127 of the air motor 28. Preferably, an oil and water separator 128, of any suitable construction, is interposed in the pipe 126 and a pressure regulator 129, controlled by a manually operated valve 130, is also connected in the pipe 126. This arrangement provides clean, dry air to the air motor, the effective pressure of which is controllable by the air regulator to drive the air motor at any desired rate of speed. The conduit 125 also communicates with a pipe 131 which leads to a group of one or more oil and water separators 132, the number of which depends upon the volume of air required to operate the battery of air brushes.

From the oil and water separators 132, a pipe 133 and branch pipe 134 conduct air to one or more automatically operating air pressure regulators 135, from which the air is conducted through a pipe 136 to the valve inlet 115 of the air brush control valve mechanism 100. A second branch pipe 137 connects the pipe 133 to an air pressure regulator 138 similar to the regulators 135. From the regulator 138, air passes through one or more conduits 139 to an inlet head 140 on a paint tank 141. The capacity of the paint tank 141 will, of course, be determined by the general character and capacity of the machine and is shown as being of the type from which paint is fed by air pressure. Preferably, each air brush 67 is individually connected to the paint tank through conduits 142 extending between the paint inlets 95 on the air brushes and headers 143 on the paint tank.

This simple arrangement of parts permits of ready control and accurate adjustment of every operating part. The speed of the air motor, as has been mentioned, is directly responsive to adjustments of the control valve 130. The separators 132 allow only clean, filtered air to pass to the brushes and paint tank and the automatic air pressure regulators 135 and 138 are of the type which are adjustable automatically to supply air under a predetermined pressure to the brushes and paint tank. If more than one air pressure regulator 135 is used, a properly arranged valve 144 permits one of the regulators to be shut off when less than the total number of air brushes are used.

In many adaptations of the machine, it will be desirable to dry the applied coat of paint on the article before it is removed from the article-holder. One form of dryer is illustrated in Figs. 1, 2, and 10 as comprising a substantially annular casing, generally indicated at 145, formed of inner and outer U-shaped sections 146 and 147 (Fig. 10) respectively. The casing sections have open bottom faces and are secured together in any suitable manner, as by spacing

brackets 148. The dryer 145 is so disposed relative to the table that the inner casing section 146 defines a passageway through which the upper portion of the spindle, the work-holder thereon, and the treated article may move. The outer casing section 147 carries a facing 149 of a suitable heat-insulating material, and a heating element 150, of any well-known construction, is interposed between the inner and outer casing sections on the side of the dryer nearest the center of the table.

When the heating element 150 is in operation, air is drawn from below into the space between the inner and outer casing sections where it passes over the heating element and thence continues through the casing. The side wall of the inner casing section, opposite the heating element, has a plurality of apertures 151 therein through which heated air may flow into the article passageway after it has substantially traversed the space between the inner and outer casing sections. Thus, a coated article will be thoroughly and rapidly dried during the continued movement of the table after the coat of paint has been applied. As may be seen in Fig. 2, the casing is interrupted adjacent the battery of air brushes to permit paint to be applied to the article.

The dryer casing may be supported in any suitable manner and, in this instance, is rigidly connected by brackets 152 to a large centrally located conduit 153 which depends from an overhead support (not shown). The conduit 153 has an opening 154 in the lower end thereof which faces the battery of air brushes, and the conduit is connected to a suitable suction creating means (not shown) for withdrawing excess paint discharged by the brushes.

An automatic loading and unloading device is provided for placing articles on the article-holders prior to the operation of the air brushes and for removing said articles from the article-holders after the articles pass from the dryer. Referring to Figs. 1, 2, and 11, one form of device for this purpose comprises a member 155 mounted on a stationary bracket 156 for pivotal movement on a horizontal axis. The member 155 has three radial arms 157, 158, and 159 extending in different directions from the pivotal center of the member. The arm 157 constitutes an unloading or ejector arm so arranged that, when the pivotal center of the member 155 is substantially intermediate adjacent spindles, the arm may be swung upwardly into engagement with the lower surface of an article on the rear one of the spindles.

The arm 158 is the loading arm and extends from the pivotal center of the member 155 to a position in which it overlies the upper surface of an article carried by the forward one of the adjacent spindles. The third arm 159 is the actuating arm and extends from the pivotal center in the direction of movement of the table into a position overlying and adjacent the upper surface thereof. This arm carries a cam roller 160 arranged to be successively engaged by a series of properly spaced cams 161 affixed to the table. A spring 162 extending between the stationary part and the arm 159 exerts a tension normally to move the arm 159 toward the table. It is preferred, however, that the spring be so arranged that a slight movement of the arm 159 upwardly is permitted before the spring is placed under tension.

As the table rotates, the cams 161 are successively moved into engagement with the cam roller 75

160 on the cam arm 159 to swing said arm upwardly and retract the arms 157 and 158 away from the article-engaging position thereof. The cams 161 are so formed that, after the cam roller 160 passes from the rising surface of the cam, the arm 159 is released and is swung sharply toward the table by the spring 162. This swinging movement causes the arm 157 to swing sharply against the bottom surface of the article and knock the article upwardly from the article-holder and laterally outwardly from the table. A suitable receptacle 163 (Fig. 2) or conveyor may be positioned at the side of the table to receive the articles as they are ejected. The same swinging movement of the member 155 causes the arm 158 to swing downwardly toward the table and sharply strike an object which has been properly positioned by the operator relative to the article-holder on the forward spindle. The arm 158, therefore, strikes the article and impales it firmly on the prong of the article-holder. Preferably, the arm 158 carries a roll 164 for engagement with the article so that the article may move freely out of engagement with the arm 158 after it has been mounted on the article-holder. This construction increases the speed of operation of the machine, since it is only necessary for an operator to position articles in proper relation to the article-holders as the articles are successively ejected from the machine.

The present machine is well adapted to apply successive coats of paint to an article. A machine of this character is diagrammatically illustrated in Fig. 13 and embodies a table construction similar to that which has been previously described. Two or more batteries of spray brushes are disposed at spaced intervals about the periphery of the table, each battery of brushes being operated and controlled as has been described. Three sets of batteries are illustrated in Fig. 13 and are designated 165, 166, and 167. These batteries may apply successive coats of one color or may apply a first coat of one color and successive partial coats of one or more different colors. For example, the battery of brushes 165 is arranged to apply a color coat to the entire surface of the article, after which the article is conveyed through a drying chamber 168. The article is next acted on by the battery of brushes 166 and 167 to apply two different and relatively narrow color stripes to the article, and the article is then conveyed through a second and shorter drying chamber 169. Thus, without interruption, a complete paint-applying operation can be performed. In this type of machine, the exhaust conduit 153 has branches 170 extending to points adjacent each paint-applying position.

It will be apparent from the foregoing that a new and improved paint-applying machine has been provided which is highly efficient in operation, is economical in its use of material, and which may be simply and accurately controlled. The articles are rotated or otherwise moved only while they are passing through the effective range of the paint-applying device, which are operated only while the articles are within said range. The air motor drive substantially eliminates all fire hazard and is capable of being easily regulated to vary the speed of movement of the table according to the type of article being treated. Moreover, the drive is flexible even to the extent that movement of the table will stop should the table be loaded beyond a predetermined capacity, or should the movement thereof be impeded in any manner. The automatic loading and unload-

ing device permits of an uninterrupted succession of articles to be treated without idle or wasted periods of machine operation. And, as a further and important advantage, the various adjustments of individual parts and control elements permits the machine to be readily adapted for treating many types of articles.

I claim as my invention:—

1. A paint-applying machine comprising, in combination, a moving table, a plurality of spindles journaled in spaced relation on said table, an air brush having control means for actuating said brush, a cam operably connected to said control means, cam followers carried by said spindles to engage and actuate said cam in the movement of said table, a rack mounted adjacent the path of movement of said spindles as they are carried by the table, and pinions rigid with said spindles for engaging said rack substantially at the time said cam and cam follower are engaged.

2. In a device of the character described, the combination of a table having driven movement, a series of article presenting means on said table each including an article engaging element, a paint applying device positioned successively to treat articles during the travel thereof with said table, and means for automatically loading and unloading articles from said elements comprising a pivoted member disposed adjacent the path of movement of said presenting means, an arm on said member arranged to engage the upper surface of an article on one element, a second arm adapted to engage the lower surface of an article on a following element, a third arm extending toward said table, a series of cams on the table arranged to engage said third arm and swing said other two arms away from the article engaging position thereof, and resilient means connected to said member to exert a force producing a snap return movement of said arms upon disengagement of said third arm from a cam, whereby the first arm moves to effect engagement of an article with one element and the second arm ejects an article from another element.

3. A paint applying machine comprising, in combination, a rotating table, a plurality of article presenting means mounted on said table for movement therewith, a plurality of air brushes positioned in spraying stations at spaced intervals about the periphery of said table to apply successive coats of paint to the articles, and drying chambers interposed between said spraying stations for drying the articles after each successive coat has been applied, said drying chambers being widely spaced at one drying station to permit loading and unloading of said article presenting means prior to entrance thereof into the range of the air brushes for applying the first coat of paint and the spacing between drying chambers at the succeeding spraying station being more limited and for spraying purposes only.

4. A paint applying machine comprising, in combination, a movable support having article-presenting means thereon, an air operated motor for driving said support, an air brush for applying paint to the articles, said brush having a pneumatically actuated controller, a paint supply tank connected to said brush, a conduit connecting said motor with a source of air under pressure, a pipe leading from said conduit to said paint tank, a valve for controlling the flow

of air to said brush, means for intermittently actuating said valve by the movement of said support, pipes connecting said valve to said pneumatically actuated controllers and to said conduit, air pressure regulators interposed in certain of said pipe connections, and oil and water separators interposed in certain of said pipe connections.

5. A paint-applying machine comprising, in combination, a movable table, an article supporting spindle journaled on said table with a part of said spindle extending below the table, a pinion on said spindle below the table, a stationary rack engageable by said spindle in the movement thereof to effect rotation of the spindle, and a coat applying device including an actuator therefor engageable by said spindle to operate the device substantially during the time said spindle engages said rack.

6. A paint-applying machine comprising, in combination, a moving table, a plurality of spindles journaled in spaced relation on said table, an air brush having control means for actuating said brush, a cam operably connected to said control means, and anti-friction sleeves mounted on said spindles for engagement with said cam in the passing movement of said spindles.

7. A paint-applying machine comprising, in combination, a moving table, a plurality of spindles journaled therein and extending above and below said table, article supporting means on the upper end of said spindles, an air brush having control means for actuating said brush, a cam operably connected to said control means, cam rollers mounted on the spindles below the table for engagement in actuation of said cam during table movement, a rack, and pinions on said spindles below said table for engaging said rack during the time said cam and cam follower are engaged.

8. A paint-applying machine comprising, in combination, a support having a plurality of holding means for presenting articles to be painted, paint applying mechanism, driving means for effecting relative movement between said support and said mechanism, control means for said mechanism including a cam actuator pivotally mounted on a stationary part of the machine and presenting a cam face of substantial length normally disposed in the path of movement of said holding means, and a cam follower on each holding means adapted operatively to engage said cam actuator when an article is in position to be painted.

9. A paint-applying machine comprising, in combination, a rotating table, a plurality of article presenting means mounted on said table for movement therewith, a plurality of air brushes positioned at spaced intervals about the periphery of said table to apply successive coats of paint to the articles, means for actuating said air brushes only when an article has been brought into a position to receive paint from an air brush, and drying chambers interposed between said air brushes for drying the articles after each successive coat has been applied, said drying chambers being of different lengths and being substantially unequally spaced between their opposite ends so as to permit loading of articles on said presenting means while moving through the greatest spacing.

10. A paint-applying or like machine comprising in combination, a paint applicator, a table movable adjacent to said applicator, a series of normally idle article-presenting spindles mounted

on said table for continuous movement therewith past said applicator, a pinion carried by each spindle, a stationary rack positioned to be successively engaged by said pinions as said spindles pass said applicator, a movable rack segment pivoted at its advance end and in one position forming a continuation of the advance end of said stationary rack, and resilient means for yieldingly maintaining said segment normally projecting into the path of an advancing pinion for insuring proper engagement between said segment and each pinion so that the pinion will pass to said rack in properly meshed engagement as said segment is moved into said one position.

11. A paint-applying or like machine comprising, in combination, a paint applicator, a conveyer movable adjacent to said applicator, a series of normally idle article-presenting spindles mounted on said conveyer for movement therewith past said applicator, a pinion carried by each spindle, means positioned to be engaged by the pinions as said spindles pass said applicator including a rack member pivoted adjacent its advance end, and resilient means for normally maintaining the trailing end of said rack member in the path of said pinions for yielding engagement with said pinions to insure proper meshing thereof.

12. A paint-applying machine comprising, in combination, a moving conveyer, a plurality of spindles journaled in spaced relation on said conveyer, an air brush having control means for controlling spray from said brush, a cam operably connected to said control means, cam followers carried by said spindles to engage said cam and operate said control means in the movement of said conveyer, means adjacent said cam for rotating said spindles, and means rigid with said spindles for engaging said aforementioned means at substantially the time said cam and cam follower are in engagement.

13. In a paint-applying machine, the combination of a movable conveyer, an article supporting means embodying a rotatable spindle having a fixed axial position on said conveyer and having a part extending below said conveyer including a cam follower, and an air brush for delivering a coat of material to an article supported by said article supporting means and including a pivotally mounted spray controlling cam normally partially disposed in the path of movement of said part during rotation of said table and engageable by said cam follower in the movement of said table for actuating said air brush.

14. In paint-applying or like apparatus, a moving conveyer, bearing means carried by said conveyer, an upright spindle rotatably mounted in said bearing means and having a part thereof extending above said conveyer, means on said part for supporting an article, means adjacent said conveyer for treating an article carried by said supporting means, the lower end of said spindle extending below said conveyer and having a pinion fixedly secured thereto, means adjacent the path of said lower end for engaging said pinion to rotate said spindle, a freely rotatable antifriction roller between said pinion and the lower end of said bearing means and limiting upward axial movement of said spindle, and means forming part of said treating means and adapted to engage said roller for activating the treating means at given intervals during movement of said conveyer.

15. In paint-applying or like apparatus, means mounted in fixed position and adapted for treat-

ing an article brought into operative relation therewith, a moving conveyer for bringing an article into said operative relation, an upright spindle journaled on said conveyer, a part of said spindle extending below said conveyer and having engageable means fixedly secured thereto, means engageable with said means for rotating the spindle, a freely rotatable antifriction roller adjacent said engageable means, means forming part of said treating means and adapted to engage said roller for activating the treating means at given intervals during movement of said conveyer, the upper part of said spindle extending above said conveyer for supporting an article, and a protective casing fitted about the parts of the spindle assembly above the conveyer and extending short of the upper end of the spindle adapted to prevent the entrance of foreign matter between the relatively moving parts of the spindle assembly.

16. In a paint-applying or like machine, the combination of spraying mechanism, a moving conveyer, upright spindles rotatably carried by said conveyer and adapted to be moved adjacent said spraying mechanism, said spindles being mounted to extend substantially above the conveyer, bearing mechanism rotatably supporting said spindles and protruding partially above the conveyer, removable casing means comprising a tubular housing having an open end to receive the protruding part of the bearing mechanism and extending from the conveyer well up about the spindle for excluding spray material from said bearing mechanism, the opposite end of said housing having an apertured enclosing wall arranged to fit snugly about the spindle, and means within the housing adjacent to said wall to prevent the entrance of spray material along the spindle into the housing.

17. In combination in a paint-applying or like machine, article treating means, a revolving conveying means having a plurality of rotary article supporting members in spaced relation thereon and adapted for successively presenting said members with the articles carried thereby to said treating means, means for automatically operating said treating means, means for rotating said members as an incident to movement of the latter through the operative range of said treating means, means for securing the articles upon said members including a movable member positively engageable with an article carried by one of said supporting members to force the article securely thereupon, roller means connected with said movable member and movable therewith, and a cam mounted so as to be engaged by said roller means as an incident to a defined interval of movement of said table for effecting successive raising and lowering movement of said movable member relative to the adjacent supporting member whereby in raised position said movable member will be substantially out of contact with the article and in lowered position in engagement with the article.

18. In a paint-applying or like machine the combination of a revolving table, spaced upright rotary spindles mounted near the margin of said table and having article carrying means upon their upper ends, a drier mounted over a portion of said table and adapted for successively receiving said spindles and articles carried thereby during the rotation of said table, spraying means positioned to treat the articles carried by said spindles before the same enter said drier, means for securing the articles upon the carrying means on said spindles including a member overlying an

article and engageable therewith for positively urging the same into position on the carrying means, means coacting with said member for imparting thereto a biasing force to maintain the member in article-engaging position, and a cam element operable as an incident to a predetermined interval of rotary movement of the table when the article is beyond the range of the spraying means for successively raising said member above the top of the article and then allowing the member to descend forcibly upon the article, said last mentioned means being continuously operative to exert said biasing force in opposition to said cam element to return said member to article-engaging position instantaneously after the cam element allows said member to descend.

19. In a paint-applying or like machine, the combination of treating mechanism, a moving conveyer, means on said conveyer for supporting an article to be treated and having upstanding sharpened means adapted to hold the article by impaling the same from below, movable means adapted forcefully to secure an article upon said supporting means including a movable contact member engageable with the upper surface of the article and adapted to be moved alternately into and out of engagement position, and means coacting with said movable means during the movement of said conveyer for moving the contact member positively out of engagement with a supported article and thereafter permitting said movable means to descend forcefully to impale the article upon said sharpened means.

20. In a paint-applying or like machine, the combination of treating mechanism, a moving conveyer, means on said conveyer for supporting an article to be treated, means for securing an article upon said supporting means including an arm with an overlying portion carrying a contact element near its end and disposed in a zone above the article and adapted for engagement with the latter, a follower including a roller disposed in a zone substantially below the plane in which the article is carried by said supporting means, and cam means engageable by said roller as an incident to movement of said conveyer and arranged to cause said roller while riding in engagement therewith to move said arm to carry said contact means into a position out of engagement with the article and after a predetermined movement of said conveyer separating from said roller to allow said contact element forcefully to engage the article.

21. In a coating machine, a conveying member having a plurality of article supporting spindles rotatably mounted in upright position thereon with a major portion above said member and a part below said member, pinions rigid with the lower part of the spindles, a pneumatically actuated coating device adjacent said member and adapted to coat articles carried by said spindles as the same are carried thereby by said member, a pivoted rack below said member and having one end swingable substantially into the path of the lower part of the spindles and adapted to be successively engaged by said pinions to rotate the spindles, a valve of the normally closed type for regulating the delivery of compressed air to said device, and a valve actuating cam arm disposed normally in the path of movement of the lower part of said spindles and being moved to one side of said path by engagement with the spindles whereby to open said valve.