United States Patent

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[54] SPRAY COATING APPARATUS

11 Claims, 10 Drawing Figs.

[52] U.S. Cl. **118/301,** 118/322
[51] **Int. Cl.** **B05c 5/00**
[50] **Field of Search** 118/301, 320, 322, 324, 316

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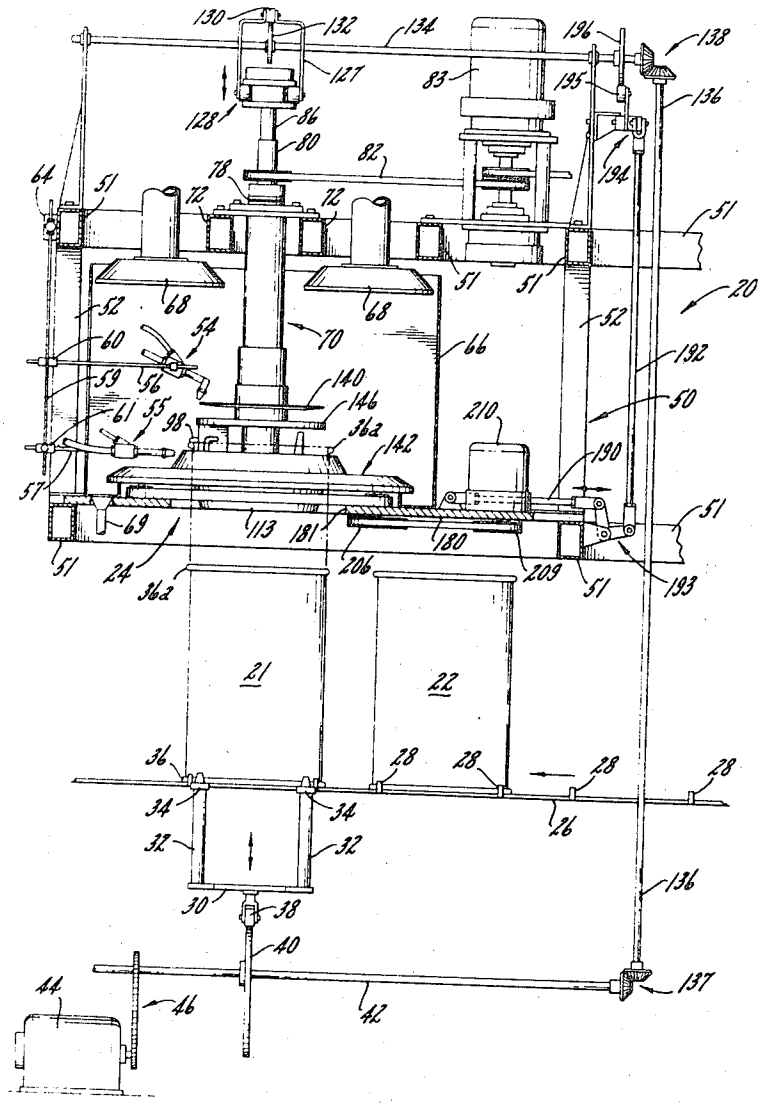
ABSTRACT: Apparatus for masking articles having the shape of a cylindrical shell. Means are provided for raising the article from a conveyor and rotating it within a surrounding masking member. The mask is rotatable and movable transversely to the article and serves to mask areas of the article from spray guns placed adjacent the exterior of the article.



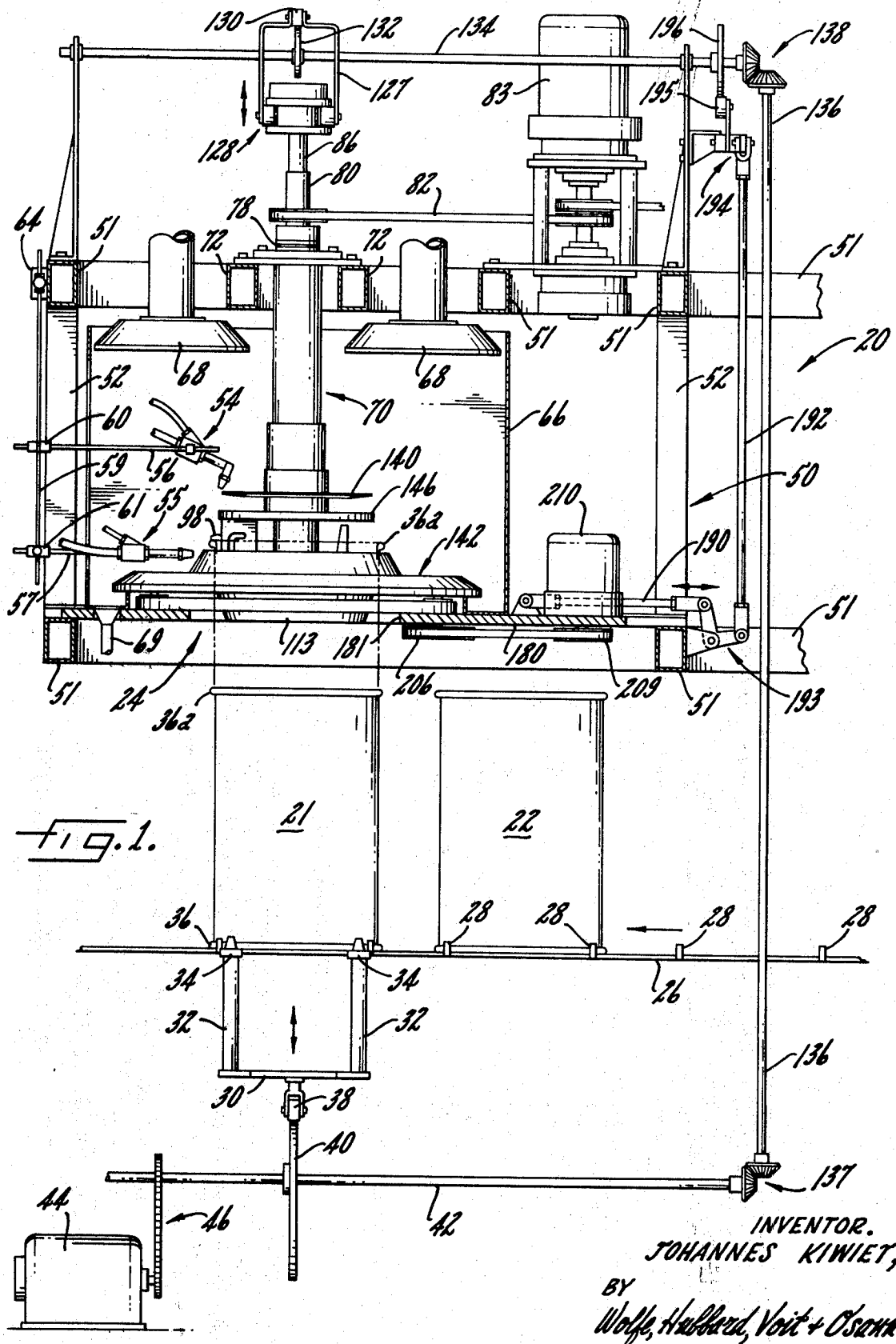


Fig. 1.

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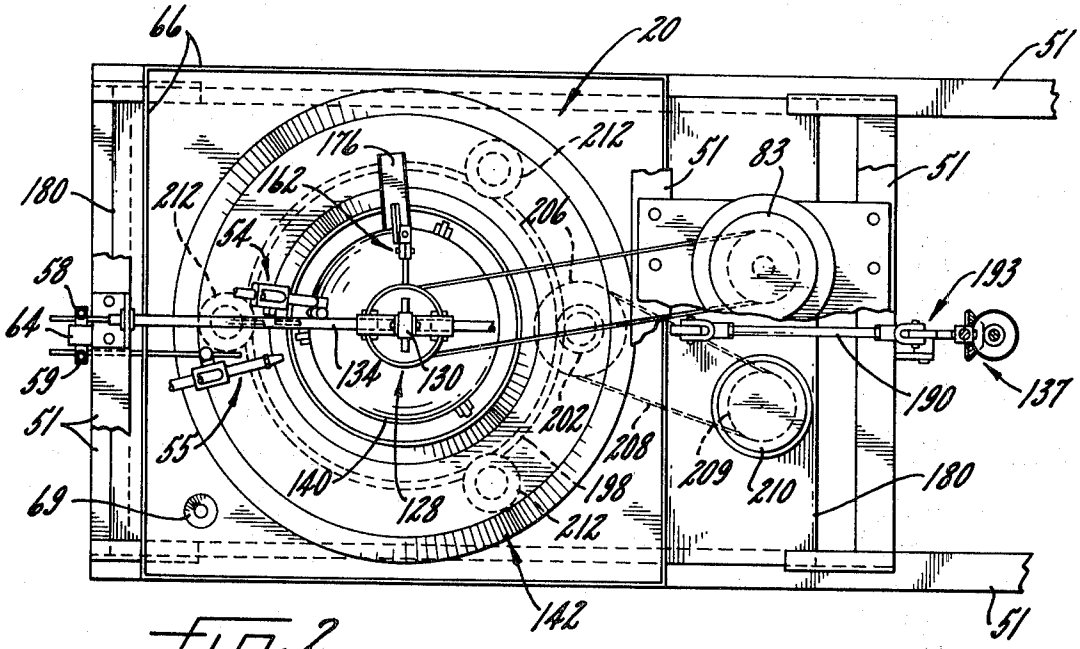

Fig. 2.

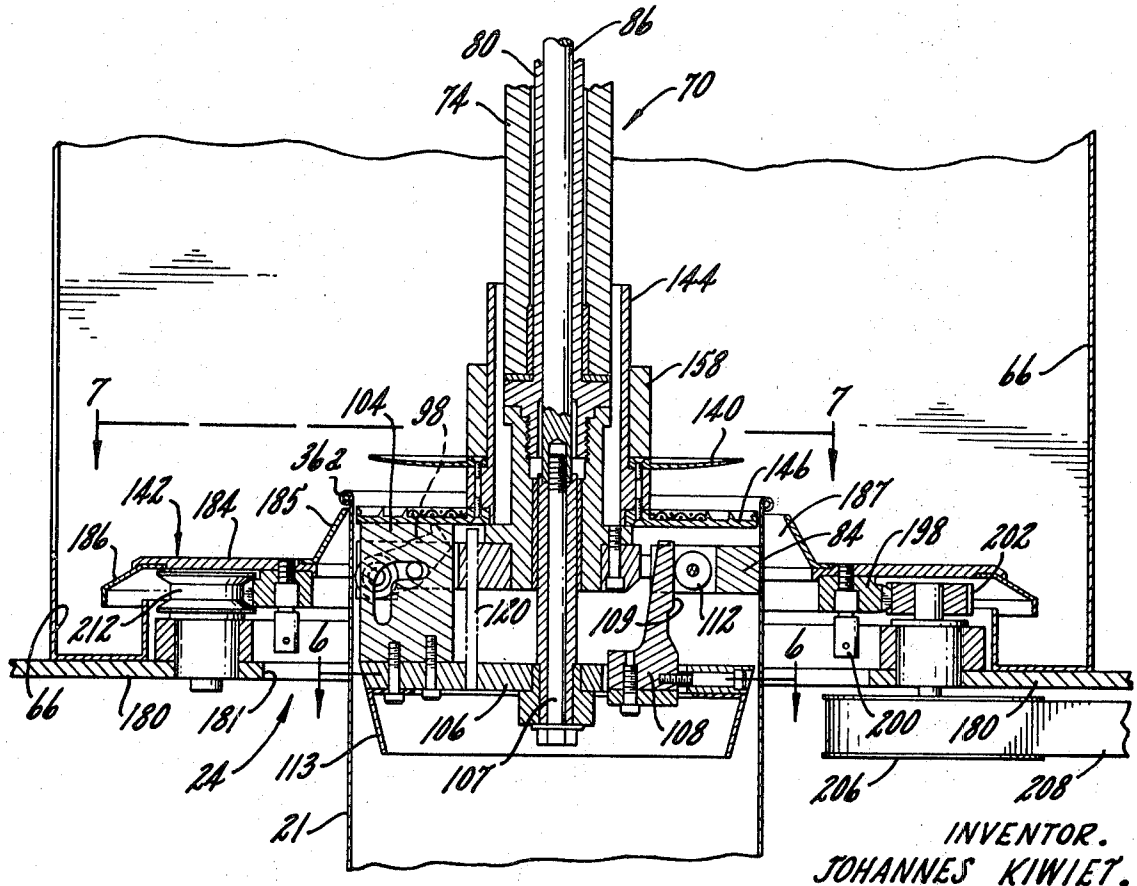

Fig. 4.

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Fig. 3.

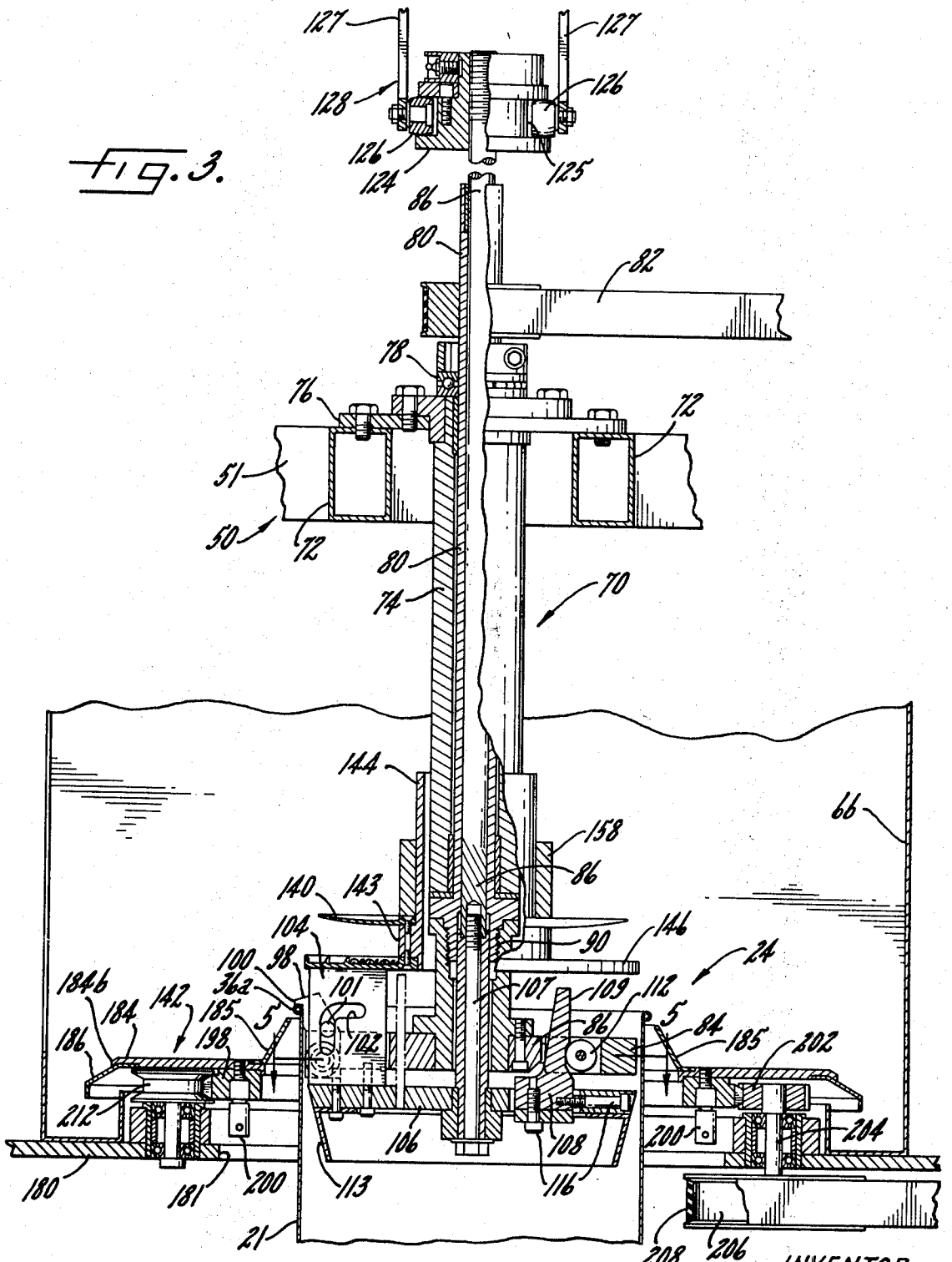

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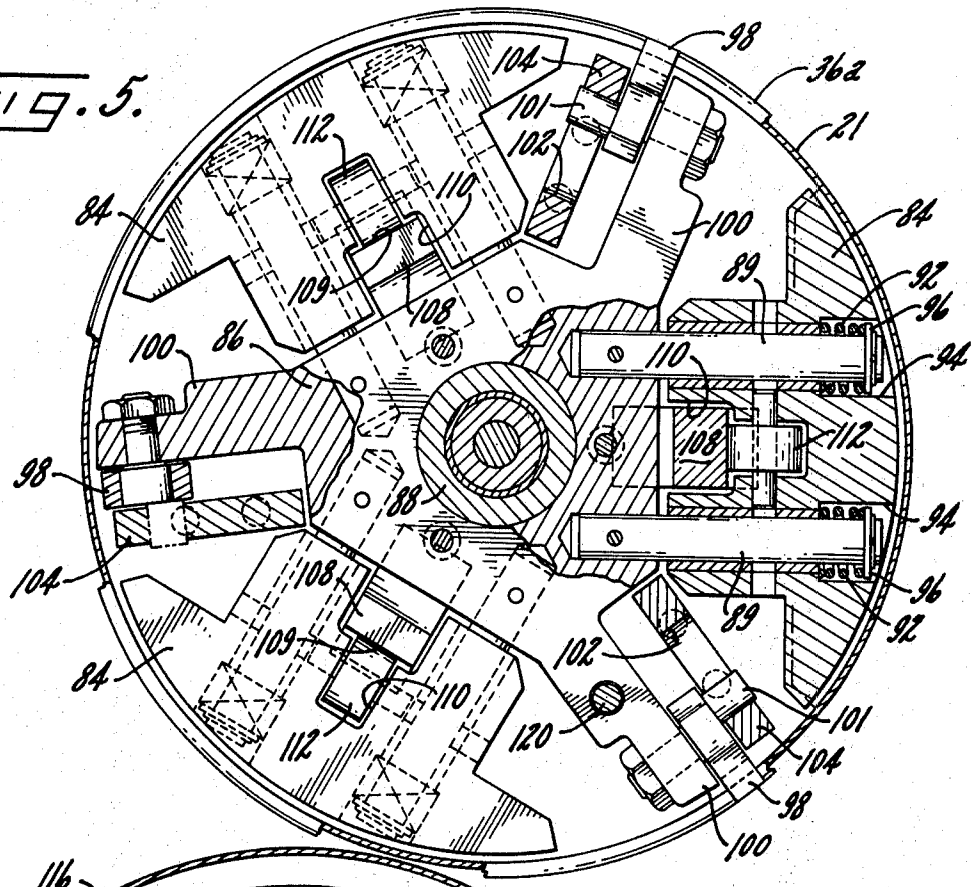
Fig. 5.



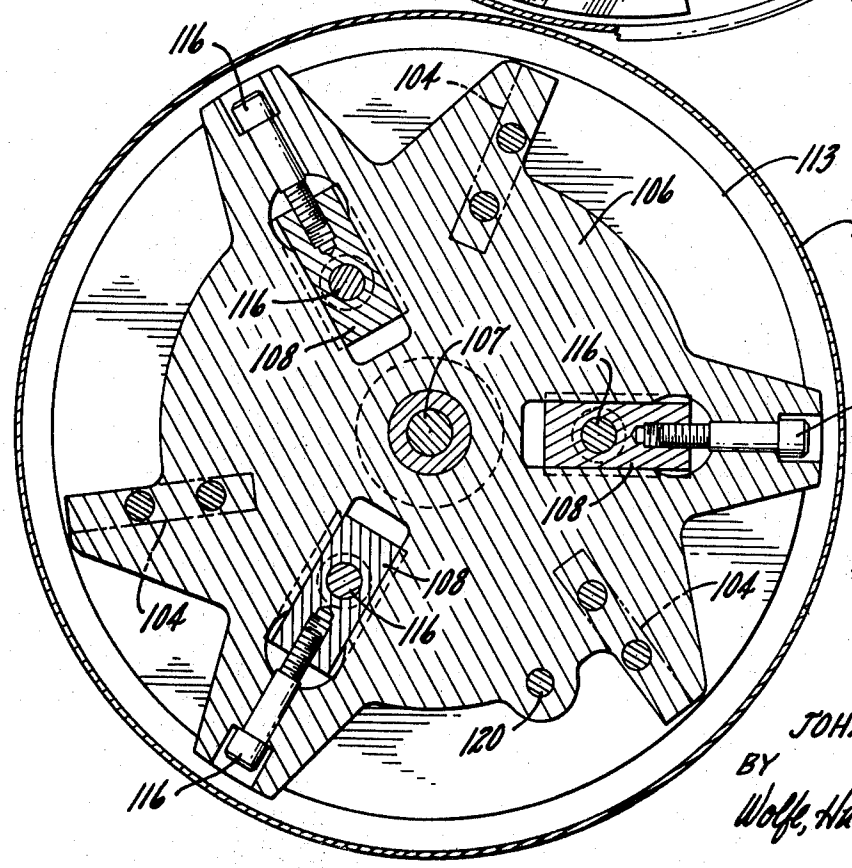


Fig. 6.

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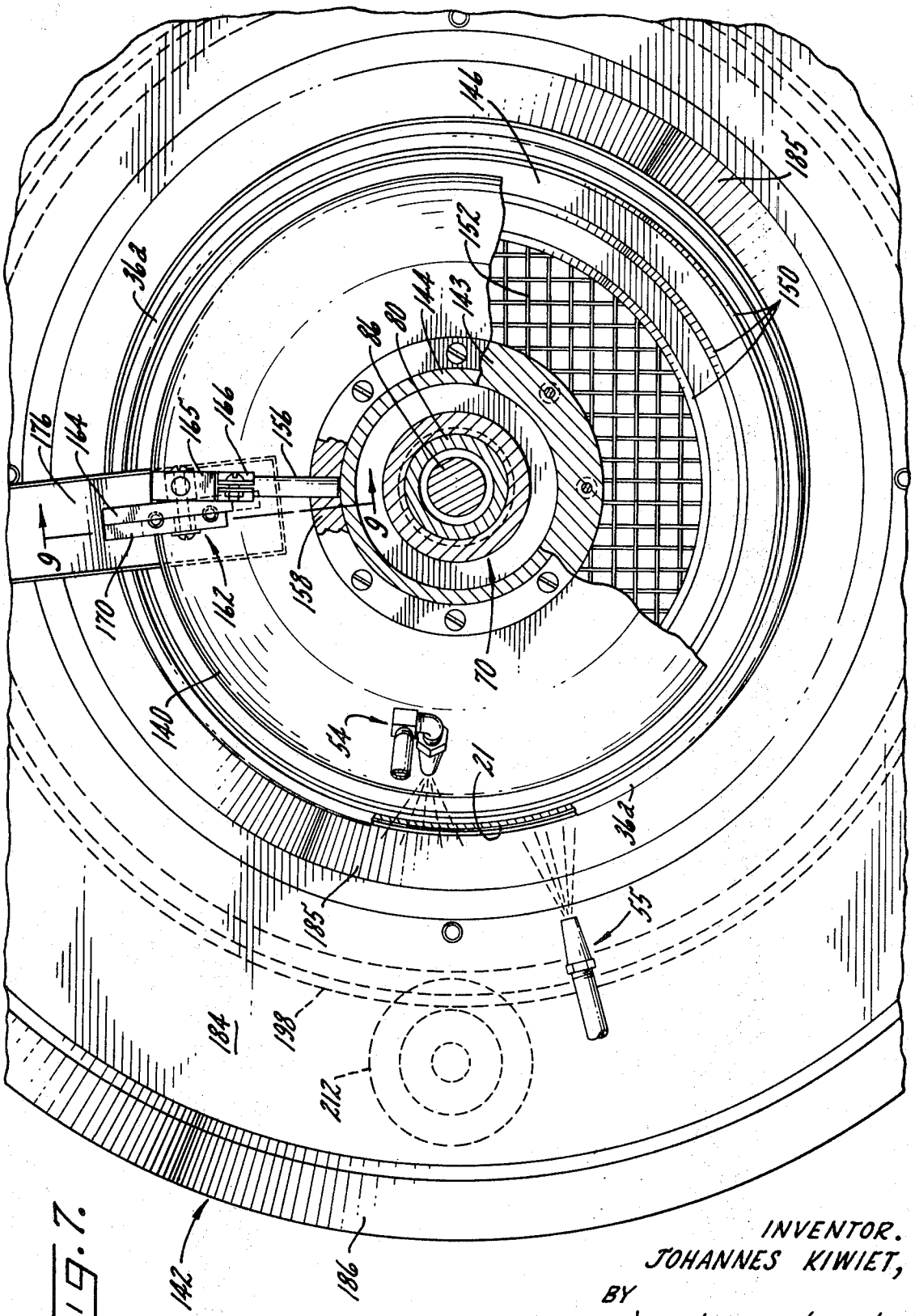

FIG. 7.

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Fig. 8.

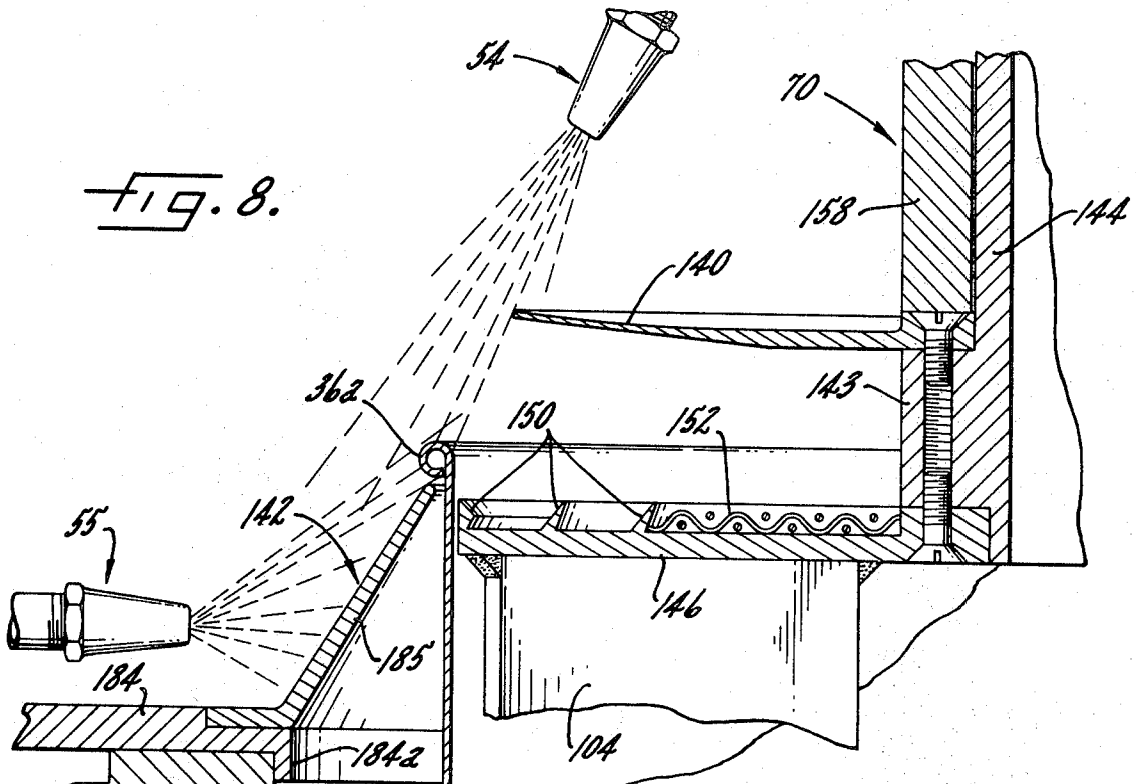
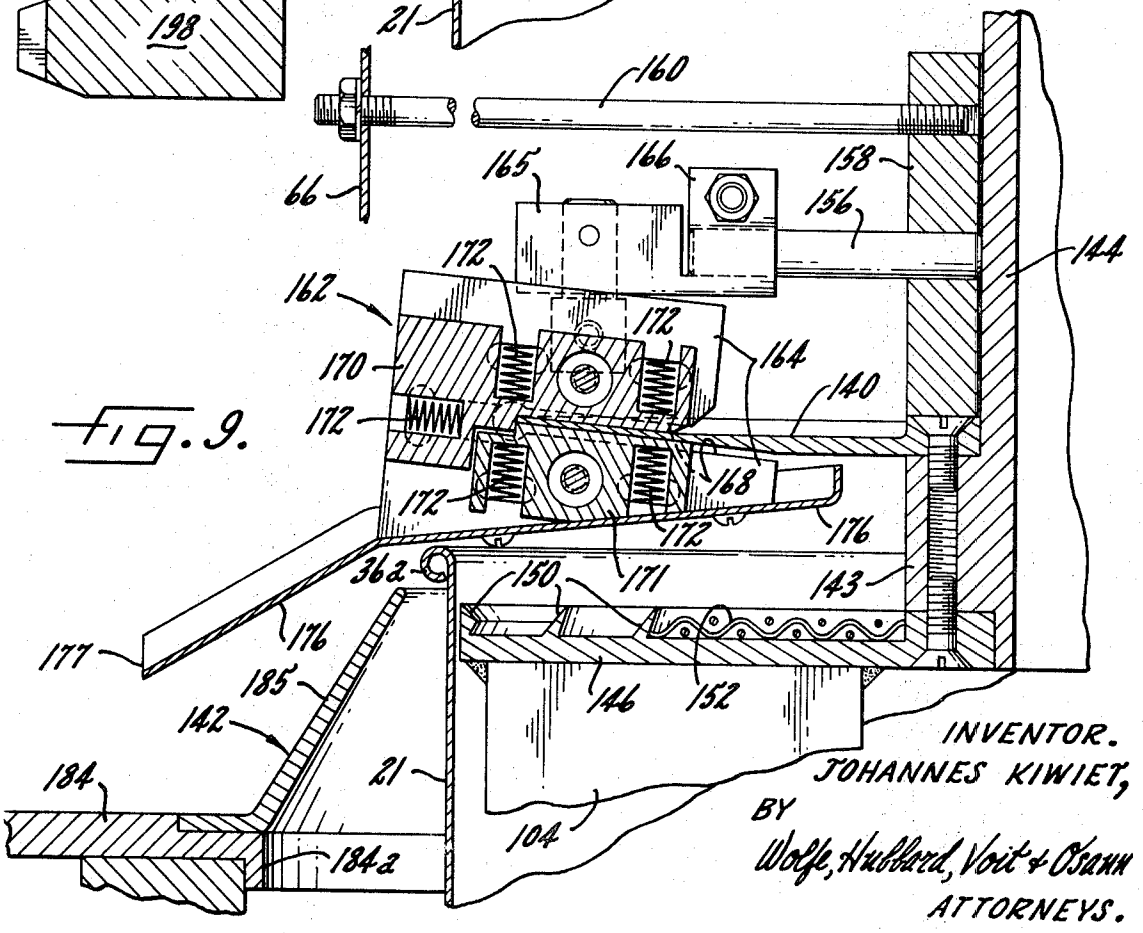


Fig. 9.



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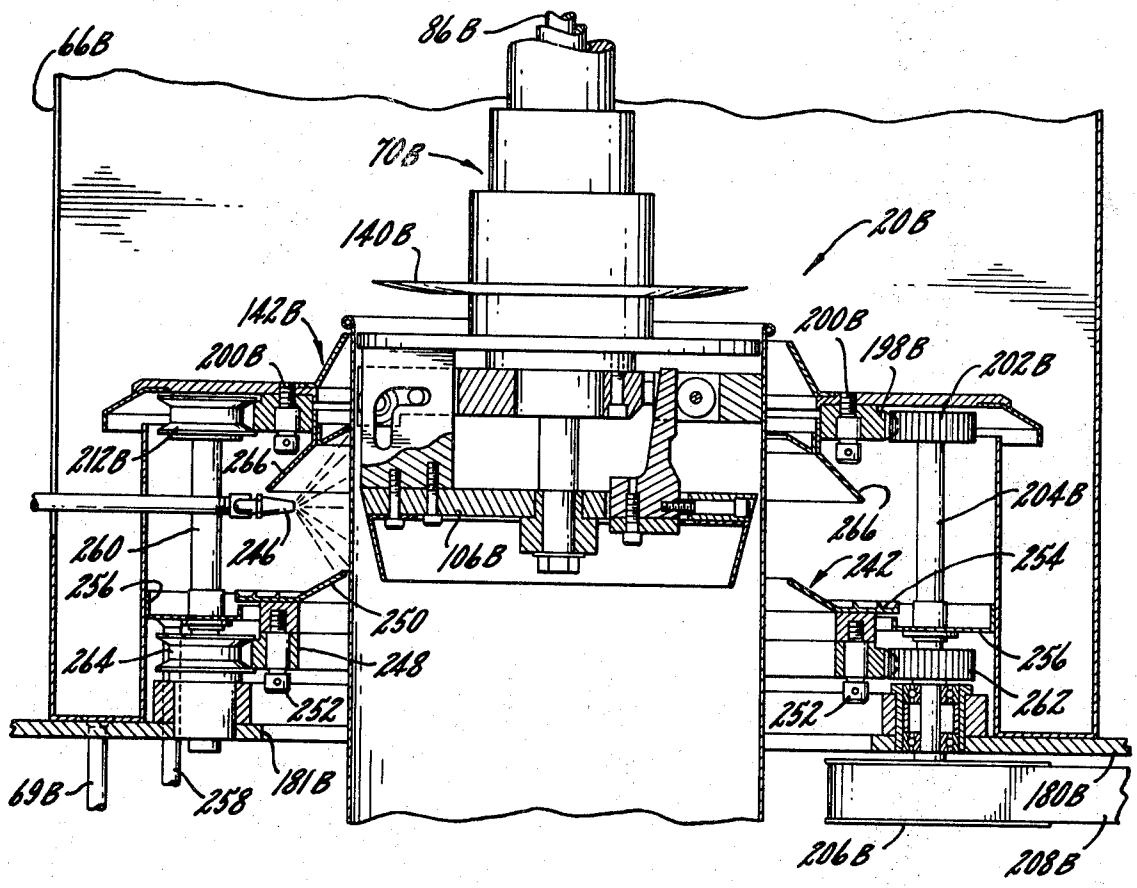

Fig. 10.

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SPRAY COATING APPARATUS

The present invention relates generally to spray coating apparatus, and more particularly, to an improved spray coating system for coating portions of external surfaces of workpieces such, merely by way of example, as a cylindrical shell which may comprise the sidewall of a container or the like. In its principal aspects, the invention is concerned with improved spray coating apparatus characterized by their ability to rapidly coat select portions of a workpiece surface with a material such as paint, lacquer, rust inhibitor, or other material in a liquid or semi-liquid state, yet wherein the coating is applied uniformly within sharp and well defined limits even where the surface being coated includes irregularities, contours, projections, curls, and the like.

In various industries, such, for example, as the container manufacturing industry, efforts have been made to apply uniform coatings to the surfaces of workpieces, *e.g.*, the cylindrical sidewall of a container, yet wherein the coating can be applied on a mass production basis. Interior and exterior surfaces of container sidewalls are conventionally coated separately, often utilizing different coating materials. Rapid handling of shells for coating is troublesome and difficult and some areas present even greater problems in coating such as, for example, about the curl formed on the upper edge of a container sidewall. Multi-material coating, striping and the like have also heretofore presented additional difficulties in handling and were not readily susceptible to rapid mass production operations. While there is disclosed and claimed in my copending application Ser. No. 492,682 filed October 4, 1965, and assigned to the assignee of the present invention, centrifugal spray coating methods and apparatus for uniformly coating the internal surface of a cylindrical shell, prior to the present invention, there has not been a completely satisfactory solution to the problem of applying coatings to select portions of the external surface of the workpiece within sharp and well defined limits.

Accordingly, it is a general aim of the present invention to provide an improved spray coating system characterized by its ability to rapidly apply a coating of spray material to select portions of the external surface of the workpiece to be coated. While not so limited in its application, the invention will find especially advantageous use in applying a uniform coating about a curl formed on an edge of a cylindrical shell, such, merely by way of example, as the cylindrical sidewall of a 55 gallon shipping drum of the type commonly made from sheet steel or other suitable material.

In accordance with another of the important aspects of the present invention, it is an object to provide improved apparatus for spray coating portions of the external surface of a cylindrical shell characterized by their versatility and which readily permit effective use thereof in multi-material coating, striping and the like, yet wherein the coatings are applied in rapid, continuous operations. In this connection, it is an object to provide a reliable external work surface coating system particularly suitable for mass production operations.

Yet another aspect of the present invention is to provide an improved spray coating apparatus for externally coating portions of external surfaces of cylindrical workpieces wherein the spray material may be applied within distinct, preselected, limits about the workpiece surface yet wherein no special preparation of workpiece is required and such coating can be applied to workpieces in a continuous manner. In this connection it is an object of the present invention to provide a spray coating apparatus of the foregoing type characterized by its ability to apply different materials or color coatings to portions of a workpiece surface simultaneously or in a successive manner.

Other objects and advantages of the invention will become apparent as the following description proceeds, taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a fragmentary, and partially diagrammatic, elevation view of an exemplary material spray system for applying coatings to external portions of a cylindrical shell, such system embodying the features of the present invention;

FIG. 2 is a top plan view of the exemplary spray coating apparatus shown in FIG. 1;

FIG. 3 is an enlarged fragmentary elevation view, partly in section, of a spray coating apparatus used in conjunction with the spray system of the present invention, here illustrating the device in readiness for receiving a cylindrical shell;

FIG. 4 is a fragmentary elevation view partly in section of a portion of the apparatus shown in FIG. 3, here depicting the shell held in position by the apparatus in readiness for the coating operation;

FIG. 5 is an enlarged fragmentary cross-sectional view taken substantially along the line 5–5 in FIG. 3, here depicting the rotatable clamping arrangement for holding the workpiece during the coating operation;

FIG. 6 is an enlarged, cross-sectional view taken substantially along the line 6–6 in FIG. 4;

FIG. 7 is an enlarged fragmentary cross-sectional view taken with a portion of the upper mask cut away for purposes of depicting the interior along the line 7–7 in FIG. 4;

FIG. 8 is an enlarged fragmentary section of the exemplary apparatus of FIG. 1, depicting the spraying of a curl on the upper edge of a cylindrical shell, and illustrating the upper and lower masks for limiting the application of the coating within desired limits;

FIG. 9 is an enlarged fragmentary view in section taken with a portion of the upper mask cut away for purposes of depicting the interior along the line 9–9 in FIG. 7, here illustrating the scraper arrangement for removing excess spray material from the upper mask; and

FIG. 10 is a fragmentary front end view, similar to FIG. 4, here depicting a slightly modified spray coating apparatus also embodying the features of the present invention.

While the invention is susceptible of various modifications and alternative forms, specific embodiments thereof have been shown by way of example in the drawings and will herein be described in detail. It should be understood, however, that it is not intended to limit the invention to the particular forms disclosed, but, on the contrary, the intention is to cover all modifications, equivalents and alternatives falling within the spirit and scope of the invention as expressed in the appended claims.

Referring now to the drawings, there is diagrammatically illustrated in FIG. 1 an exemplary spray coating system generally indicated at 20, which is particularly suitable for coating select portions of the external surface of cylindrical shells 21, 22 on a mass production basis and in accordance with the present invention. While the particular type of workpiece to be coated is not critical to the present invention, it will be appreciated as the ensuing description proceeds, that the exemplary spray coating system 20 shown in FIG. 1 will find particularly advantageous, but by no means exclusive, use in coating portions of the external surface of a cylindrical shell such as the sidewalls of conventional 55 gallon shipping containers which can be made of sheet metal or any other suitable natural or synthetic sheet material.

As here illustrated, cylindrical shells 21, 22 are fed to the spray coating station, generally indicated at 24 in seriatim order, by means of a conveyor belt 26 or the like. The particular means for driving the conveyor belt are not critical to the present invention, and may take any of a wide variety of conventional forms well known to those skilled in the art. It should suffice to say that the drive system for the conveyor belt is such that control means are provided for automatically moving the belt to transfer shells from work station to work station, and for intermittently stopping the belt as successive shells reach a work station so as to permit performance of an operational cycle. In the present instance, in order to insure that the shells 21, 22 are properly aligned with work station 24, for example, the belt is provided with a plurality of positioning lugs 28 which serve to accurately position the shells at predetermined points on the conveyor belt 26.

For the purpose of axially moving the cylindrical shell 21 into the illustrative spray coating station 24, there is provided a pair of oppositely facing C-shaped brackets 30 which are

respectively disposed on either side of the conveyor belt **26**. Each of the C-shaped brackets **30** includes a pair of upright posts **32** having annular flanges **34** formed adjacent the upper ends thereof, such flanges normally being disposed at the level of or slightly below the level of the upper surface of the belt **26**. The arrangement is such that when the belt **26** is stopped with a cylindrical shell accurately positioned beneath the coating station **24**, the lower peripheral edge **36** of the shell is disposed immediately above the two pairs of flanges **34**. As shown in FIG. **1**, the brackets **30** are coupled to a roller follower member **38** the latter raising and lowering shell **21** under the guidance of a disc cam **40**. The disc cam **40** is fixed to a generally horizontally extending drive shaft **42**, driven by motor **44** through roller chain and sprocket drive **46**.

The exemplary spray apparatus **20**, as shown in FIG. **1**, is supported above shells **21**, **22** carried by belt **26** on a generally rectangular framework **50** including spaced horizontally extending members **51** and spaced vertically extending columns **52**.

For the purpose of distributing liquid or semi-liquid spray material on the surface of the workpiece to be coated, the exemplary apparatus **20** includes spray nozzles **54**, **55** adjustably mounted respectively to horizontally extending support shafts **56**, **57** which are in turn connected to vertically extending support shafts **58**, **59** (FIG. **2**) through slide clamps **60**, **61**. The vertical support shafts **58**, **59** are connected to a slide clamp **64** fixed to a cross member **51**, outboard of the apparatus. The arrangement is such that the spray material, which is normally maintained in a supply reservoir (not shown) is delivered under pressure by means of one or more pumps (not shown), through spray nozzles **54**, **55**, the latter here being completely adjustably supported in the work station **24**.

In order to confine both air-borne particles of spray material emanating from the spray nozzles and drippings from excess spray material carried away from the apparatus, there is provided a rectangular enclosure **66** surrounding the work station. Exhaust vents **68** disposed at the top of the enclosure **66** are connected to a suitable exhaust fan and filter system (not shown) to remove the air-borne spray particles and fumes from within the enclosure. A drain **69** at the bottom of the enclosure **66** received drippings and settled particles of spray material which may be returned to the material source, or discarded, as desired.

In accordance with the present invention, provision is made for receiving the workpiece in the work station **24**, rotatably supporting the workpiece within the work station enclosure and rotating the workpiece at a preselected position relative to the path of spray material projected outwardly from the spray nozzles so as to apply a coating to a selected portion of the work surface. To this end, a powerhead, generally indicated at **70** (FIGS. **1** and **3**), extends vertically along the center of the work station **24** supported by a pair of cross members **72** of frame **50**.

As best shown by reference to FIG. **3**, the powerhead **70** includes a stationary outer sleeve **74** bolted to frame members **72** through collar members **76**. Disposed within the stationary sleeve **74** and supported with a suitable thrust bearing **78** is a rotatable sleeve member **80** which is rotatably driven by a belt and pulley arrangement **82** through motor drive mechanism **83** (FIG. **1**). Centrally supported within the rotatable sleeve **80** is an axially shiftable and rotatably supported shaft **86**.

In keeping with the invention, the powerhead **70** includes provision for positively clamping the workpiece for rotation with rotatable sleeve **80**. As best shown by reference to FIGS. **3**, **4**, and **5**, conjointly, a plurality of expanding shoes, generally indicated at **84**, extend radially outward from a spider member **86**, the latter being secured to a flanged hub member threadably connected to rotatable sleeve **80** as indicated at **90** (FIGS. **3** and **4**). As here shown, (FIG. **5**) the clamping shoes **84** are generally T-shaped and have a pair of spaced axially extending bores **88** which receive pins **89** extending radially outward from the spider member **86**.

For the purpose of normally urging the clamping shoes **84** radially inward towards their non-expanded position, compression springs **92** or the like surrounding the outer ends of pins **89** are carried in an enlarged cavity portion of bores **88** so that the springs are confined between a shoulder portion **94** on clamping shoes **84** and retaining members **96** secured to the ends of pins **89**. Thus, the springs **92** tend to normally bias the clamping shoes **84** radially inward and, when expanded, the clamping shoes are cammed radially outward against the biasing effect of the springs **92**.

For the purpose of properly positioning a shell **21** about the clamping shoes **84**, there are provided a plurality of stop fingers **98** (FIGS. **3** and **5**) pivotally mounted at the ends of arms **100** on spider member **86**. As viewed in FIG. **3**, the shell is raised until its upper peripheral edge engages abutment shoulders **100** on stop fingers **98**. For the purpose of retracting the stop fingers after the workpiece has been properly positioned, guide pins **101** projecting horizontally from the stop fingers ride in generally L-shaped camming slots **102** formed in plates **104**.

In carrying out the present invention, provision is made for camming the clamping shoes **84** radially outward and retracting the stop fingers **98** after the workpiece has been moved into a proper position with respect thereto. To accomplish this, a support plate **106** (FIGS. **3**, **4**, and **6**), mounted below spider member **84** and secured to central shaft **86** of powerhead **70** through suitable support member **107**, carries a plurality of upstanding camming members **108** which serve to define outwardly facing cam surfaces **109**. The camming members **108** extend through slots **110** provided in clamping shoes **84** and to facilitate relative movement between camming members **108** and clamping shoes **84** for camming the latter radially outward, rollers **112** mounted on the shoes **84** engage the outwardly facing cam surfaces **109** of camming members **108**. Suitable adjusting screws **116** (FIG. **6**) are provided to regulate the position of the camming members thereby enabling alignment of the expansion of each of the expanding shoes **84**.

Plate members **104** which include the guide slot **102** that receives guide pins **101** of stop fingers **98** are also secured to support plate **106**. Thus, when the support plate **106** together with the central shaft **86** is shifted downwardly, the cam surfaces **109** of members **108** and rollers **112** on clamping shoes **84** coact to cam the clamping shoes **84** radially outward and at the same time guide pins **101** of stop fingers **98** ride in slots **106** thereby retracting the stop fingers **98** radially inward, as shown in FIG. **4**.

Secured to the underside of support plate **106** is a generally frustoconical shaped guide plate **113**, the generally inwardly tapering sidewalls of which help to guide the shell **21** over the clamping portion of the powerhead **70**.

In order to rotatably drive the support plate **106** and its associated central shaft **86** together with spider **86** and rotatable sleeve **80**, there is provided a vertically oriented drive pin **120** secured to support plate **106** and passing through a suitable opening provided in spider **86**. The drive pin **120** also insures that camming members **108** are not torque transmitting members.

In keeping with the invention, provision is made for lowering the support plate **106** thereby expanding the clamping shoes and retracting the stop fingers **98** synchronized with the elevating of the workpiece into work station **24**, as previously described.

In the exemplary form of the invention, the upper end of the central shaft **86** is threadably received in an annular carrier member **124** (as best shown in FIG. **3**). The carrier member **124** is provided with an annular recess **125** which receives a pair of rollers **126** secured to spaced arms **127** of a yoke member **128**. The opposite end of the yoke member **128** includes a roller follower **130** which rides on a disc cam **132**, the latter being fixed to a horizontally extending shaft **134** supported at the top of the apparatus (FIGS. **1** and **2**).

In order to drive shaft **134**, there is provided, as best viewed in FIG. **1**, a generally vertically extending shaft **136** which interconnects the workpiece lifting drive shaft **42** to shaft **134** through bevel gear couplings **137**, **138**.

In accordance with another of the important aspects of the present invention, provision is made for restricting the amount of surface sprayed so that only a preselected portion of the workpiece is coated within well defined limits. In order to achieve this result, as best shown by reference to FIGS. **1**, **3**, **4**, and **8**, conjointly, upper and lower masks **140**, **142**, respectively, are provided to permit spray material from nozzles **54**, **55** to be applied to the surface of the workpiece between the masks and prevent application of spray material to other portions of the workpiece.

The upper mask **140** which is of generally dish-shaped construction surrounds the powerhead **70** and an arrangement is made so that the upper mask **140** is rotatably driven and axially shifted together with support plate **106**.

Referring to FIGS. **3**, **4**, and **8**, conjointly, the upper mask **140** is secured to the top of an annular flange **143** formed on sleeve member **144** surrounding powerhead **70**, while an annular guard member **146** is secured to the lower end of flange **143**. Camming plates **104** are secured to the underside of guard member **146** by welding or the like so that guard member **146**, sleeve **144** and the upper mask **140** are all positively connected to the support member **106** through camming plates **104**.

For the purpose of shielding the internal surface of the workpiece and the lower members of the powerhead from accumulated overflow and dripping of spray material, particularly from the upper mask **140**, the guard member **146** is provided with upstanding annular projections or baffles **150** which serve to confine the excess spray material on the top surface of the guard member. A screen **152** carried on the top surface of the guard member provides additional aid in confining excess accumulated material on the top surface of the guard member.

In order to prevent a large build-up of spray material on the upper mask a scraper arrangement is provided (best illustrated in FIG. **9**) which is adjustably supported on a pin **156** protruding from collar **158** surrounding sleeve member **144**. The collar is stationarily secured to the enclosure **66** through anchor bolt **160**. The scraper, generally indicated at **162**, comprises a generally U-shaped support plate **164** pivotally mounted to a support bracket **165**, the latter including a clamp **166** which receives pin **156** of collar **158**. The slotted portion **168** of support plate **164** receives an outward end portion of the mask **140** and upper and lower scraper members **170**, **171**, respectively, mounted on the support plate **164** are spring biased against the upper, lower, and end surfaces of the mask **140** by springs **172**.

In order to direct spray material removed from the mask scraper **162** there is provided a trough-like drip tray **176** bolted to the underside of support plate **164** and having a downwardly inclined portion **177** which allows the material to flow away from the work area.

In accordance with yet another of the important features of the present invention, provision is made for shifting the lower mask from its initial concentrically disposed surrounding relationship with respect to the workpiece, when receiving the same, to a position in relatively close proximity to the workpiece external surface in the vicinity of the spray nozzles so that a well defined limit of spray coverage can be accomplished. To this end, referring to FIGS. **1**, **3**, and **4**, conjointly, the lower mask **142** is carried by a horizontally shiftable slide member **180**, the latter being slideably mounted to frame **50**. A relatively large diameter opening **181** is provided in the slide member **180** to allow the workpiece to pass into the work station **24**, surrounded by enclosure **66**, which is secured to slide member **180**.

As best shown by reference to FIGS. **3** and **4**, it will be observed that the mask **142** includes a main support ring **184** having a generally frustoconical-shaped, upstanding sleeve **185** about its inner peripheral edge **184***a* and a generally frustoconical-shaped depending sleeve member **186** about its outer peripheral edge **184***b*. The mask **142** is concentrically supported with respect to the opening in slide member **180** so that a cylindrical workpiece, brought into the workstation passes through both the opening **181** of slide member **180** and the central opening **187** of mask **142** to position the workpiece about the powerhead **70**.

In order to shift the lower mask **142** from its initial concentrically disposed position with respect to the workpiece, as shown in FIG. **3**, to a position wherein the upper peripheral edge of sleeve member **185** is in relatively close proximity to the workpiece external surface in the vicinity of the spray nozzle, as shown in FIG. **4**, provision is made for moving the slide member **180** coupled with the workpiece elevating and powerhead descent and expansion apparatus. To this end, referring to FIGS. **1** and **2**, a horizontally extending link **190** journaled at one end to slide member **180** is coupled to vertically extending link **192** through toggle linkage **193**. The upper end of link **192** is connected to a cantilever **194**. Secured to the cantilever **194** is a follower member **195** which engages a cam disc **196**, the latter being secured to drive shaft **134**.

Cam discs **40**, **132**, and **196** are profiled and so arranged that rotation of their respective drive shafts **42**, **134**, in sequence, raises the workpiece into work station **24**, lowers powerhead **70** to clamp the workpiece thereto and shifts the slide member **180** carrying the lower mask **142** to the right, as viewed in FIG. **1**. Continued rotation of shaft **42** reverses the sequence of operation, first shifting the slide member **180** and mask **142** to a centered position with respect to the workpiece, raising the powerhead to release the clamping members and lowering of the workpiece back on to the conveyor **26**.

In accordance with yet another aspect of the present invention, provision is made for rotating the mast **142** with respect to the workpiece and at a sufficient angular velocity to centrifugally carry accumulated spray material away from the inner peripheral edge of the mask. To accomplish this, referring to FIGS. **1**, **3**, and **4**, conjointly, main support ring **184** of mask **142** is bolted or otherwise secured to a circular rack member **198** through removable bolts **200** or the like.

For the purpose of driving the circular rack **198**, there is provided a pinion **202** fixed to shaft **204** which is rotatably journaled in slide member **180**. A pulley **206** fixed to the lower end of shaft **204** beneath slide member **180** receives a belt **208** rotatably driven by pulley **209** of mask drive motor **210**, the latter being mounted on slide member **180**. In order to support the mask **142** for rotation with respect to the slide member **180** and the workpiece, a plurality of spool members **212** are rotatably journaled to slide member **180** and located about the periphery of circular rack **198** to supportingly receive the same, yet permitting relative rotation between the circular rack and the spools.

In the preferred form of the invention, the mask **142** is shifted so that a gap of approximately ⅛ inch is maintained between the workpiece and the inner peripheral edge of the mask in the vicinity of the spray nozzles to insure proper separation between the area to which the coating is being applied and the remaining surface area of the workpiece. Also, advantageous results are obtained when the mask **142** is rotated at approximately 100 r.p.m., to centrifugally carry excess spray material away from the inner peripheral edge of the mask. While those skilled in the art will appreciate that the present invention is not limited to any particular gap dimension or speed of mask rotation, they are presented, merely by way of example, and may vary, dependent upon the spray material utilized, the configuration of the workpiece being coated and the type of spray nozzles used.

Having in mind the foregoing structural details, a brief description of a typical spray coating operation will serve to facilitate an understanding of the present invention. To this end, reference is first made to FIG. **1** wherein the apparatus is shown with shell **21** positioned along belt **26** beneath the spray device **20**. At the start of the cycle, shell **21** is raised off of the

conveyor belt and moved upwardly until the upper peripheral edge **36***a* of the shell engages stop fingers **98** on powerhead **70**, as illustrated in phantom in FIG. **1**. After the shell has been brought into position in work station **24**, the powerhead is lowered to urge the clamping shoes **84** radially outward thereby clamping the shell to the powerhead for rotation therewith and bringing mask **140** into position above the central opening of the shell. After this occurs, the mask **142** is shifted to the right (FIGS. **4**, **7**, and **8**) thereby assuming the position wherein the inner peripheral edge of the mask **142** is in close proximity to the shell adjacent the left hand edge of the latter as viewed in FIGS. **4**, **7**, and **8** to define a lower limit of spray coverage. When the mask **142** is in position, both the powerhead supporting the shell and the mask **142** are rotated through their respective drive motors **83**, **210** and subsequently spray material is delivered to nozzles **54**, **55** for distribution onto the surface of the shell between the limits defined by masks **140**, **142** (FIG. **8**).

In the illustrative embodiment shown in FIG. **8**, the apparatus has been shown as used for application of a coating to a curl formed at the upper peripheral edge of the shell **21**. Consequently, the arrangement is such that material emanating from spray nozzle **54**, to the extent that it is not blocked by mask **140**, covers approximately the upper half of the curl while material emanating from spray nozzle **55** covers the lower portion of the curl.

After the shell portion being covered has been completely rotated past the spray nozzles, a preselected number of times, the latter are de-activated and rotation of both the powerhead **70** and the mask **142** is ceased. The mask **142** is then shifted back to its concentrically disposed position about the shell (FIG. **3**) and the powerhead is raised, thereby retracting the clamping shoes to their inward position to release the shell. The shell **21** is then returned to the conveyor belt and the cycle repeats itself for shell **22** and each subsequent shell positioned along the conveyor belt.

Turning now to FIG. **10**, there is shown a slightly modified spray coating apparatus **20B** which is quite similar in construction and operation to that shown in FIG. **1**. However, in the exemplary apparatus shown in FIG. **10**, the construction is such that multi-color coating or striping can be accomplished with a different material or color coating also being uniformly applied within sharp and well-defined limits on the exterior surface of the shell. In this instance, the apparatus includes a powerhead **70B**, masks **140B**, **142B**, slide member **180B** and enclosure **66B**, all similar to those shown in FIG. **1**.

In carrying out this form of the invention, provision is made for applying a band of differing material or different colored material intermediate the upper and lower peripheral edges of shells in a rapid and continuous manner. To this end, a second rotatable and transversely shiftable mask **242** is carried by slide member **180B** in an axially spaced relation with respect to mask **142B**. For the purpose of distributing spray material on the surface of the workpiece intermediate the masks a spray nozzle **246** is provided projecting horizontally into the enclosure **66B** between the masks **142B**, **242**.

In the present exemplary form of the invention, the mask **242** includes a circular rack member **248** and an annular material guard member **250** removably secured to the rack by bolts **252**. The guard member **250** which may be of unitary construction, includes a generally horizontally extending portion **250A** and a generally upstanding frustoconical shaped portion **250B**, the latter portion being in surrounding relationship to a shell supported on the powerhead **70B**.

In order to confine material drippings and excess material moving outwardly along the surface of mask **242** due to centrifugal action, there are provided a plurality of projections or baffles **254** on the top surface of the horizontal portion **250A**.

For the purpose of receiving any material overflow from the top surface of the mask horizontal portion **250A**, an annular trough **256** surrounds the outer peripheral edge of the guard member **250** and is located slightly below the guard member so that material flowing over the extreme outer baffle member **254** will fall into the trough **256**. A suitable drain **258** is provided in the trough which may, if desired, be connected to the source of material for reuse thereof.

In order to support the mask **250** on slide member **180B** and to rotate the mask **250** in a manner substantially similar to that used in conjunction with mask **142B**, shaft **204B** which carries pinion **202B** for driving mask **142B** and shafts **260** which carry support spools **212B** are extended in length and also carry, respectively, a drive pinion **262** and spools **264** for driving and supporting rack **248** of mask **242**. Pinion shaft **204B** is rotatably journaled in slide member **180B** with the lower end portion of the shaft extending below the slide member connected to pulley **206B** driven by belt **208B** in a manner similar to that described with respect to FIG. **1**.

For the purpose of defining an upper limit of spray coverage from nozzle **246** and to prevent spray material from being applied to the undersurface portions of the mask **142B**, there is provided an annular shield **266** secured to the rack **198B** of mask **142B**.

It will, of course, be understood to those skilled in the art that certain of the features and advantages of the present form of the invention may be utilized in a more simplified arrangement for coating a portion of the cylindrical shell surface. Where such usage is desired, and, for example, a curl is not to be coated, but the band or stripe is to be applied, then mask **140B** and the upper portion of mask **142B** could be omitted and the apparatus may merely be provided with at least mask **250** and shield portion **266** of mask **142B**, without departing from the present invention. In addition, a plurality of pairs of masks could be carried on slide member **180B** with spray nozzles located between respective pairs of masks for applying alternate bands of different color material or the like and the masks can be adjustably mounted to vary the spacing therebetween to enable the application of coatings having varied widths to the shell surface.

It will be apparent from the foregoing that there has herein been disclosed and described in detail novel spray coating systems employing apparatus which, although characterized by their simplicity and reliability, serve to insure rapid and continuous application of a coating to select portions of a workpiece within well defined limits. Not only does the novel arrangement of a powerhead and rotating masks contribute to such coating ability, but, moreover, there has herein been disclosed novel apparatus for applying spray particles to portions of a workpiece surface whereby the coating is applied uniformly within sharp and well defined limits even where the surface being coated includes irregularities, contours, projections and the like, yet wherein such coating can be applied in a continuous, mass production manner.

I claim:

1. Apparatus for externally coating a select surface portion of a cylindrical shell, comprising, in combination, a frame, means defining a work station carried by said frame, at least one material spray nozzle disposed in said work station, a powerhead adapted to support said shell for rotation in the work station adjacent said nozzle, means including a mask concentric with and surrounding the shell for defining a limit to said surface portion to be coated, means for shifting said mask transversely with respect to the surface so that the inner peripheral edge of the mask in the vicinity of the nozzle is in close proximity to the surface and means for rotating said mask while applying spray material to said surface portion from the nozzle.

2. Apparatus as claimed in claim **1** including a second mask concentric with the shell for defining another limit to said surface portion to be coated, and said second mask and said other mask being spaced from one another on opposite sides of unblocked spray material projected to said surface portion.

3. Apparatus as claimed in claim **2** wherein said second mask is connected to said powerhead for rotation therewith and said second spray limit is adjacent an end peripheral edge of said shell.

4. Apparatus as claimed in claim 2 wherein said second mask surrounds the shell and includes means for coupling said second mask to said other mask for simultaneously shifting both of said masks transversely with respect to the shell surface and for rotating said masks while applying material to said surface portion from the nozzle.

5. Apparatus as claimed in claim 1 wherein said powerhead includes a plurality of radially expanding clamping shoes and means for camming said shoes radially outward to engage the internal surface of said shell so that said shell is positively clamped to the powerhead for rotation therewith.

6. Apparatus as claimed in claim 5 wherein said powerhead includes a rotatable outer member and an axially shiftable, rotatable inner member, means for axially shifting said rotatable inner member toward said shell, and means associated with said axially shiftable member for actuating said clamping shoe camming means when the member is shifted towards said shell.

7. Apparatus as claimed in claim 5 wherein said powerhead includes a plurality of stop fingers pivotally mounted about the periphery of said powerhead for engagement with a shell to position said shell about the powerhead and means for retracting said stop fingers when said shoes are cammed radially outward to clamp said shell to the powerhead.

8. Apparatus for externally coating a select surface portion of a cylindrical shell, comprising, in combination, a frame, means defining a work station carried by said frame, at least one material spray nozzle disposed in said work station, means for supporting said shell for rotation in the work station adjacent said nozzle, means including a mask surrounding the shell for defining an axial limit to said surface portion to be coated, means for rotating said mask and means for relatively shifting said mask transversely with respect to the surface so that the inner peripheral edge of the mask in the vicinity of the nozzle is in close proximity to the surface.

9. Apparatus as claimed in claim 8 including a second mask surrounding the shell for defining another limit to said surface portion to be coated, said masks being spaced from one another on opposite sides of unblocked material projected to said surface portion.

10. Apparatus as claimed in claim 9 wherein said second mask is connected to said supporting means and said second spray limit is adjacent the peripheral edge of said shell.

11. A spray coating system for externally coating select surface portions of cylindrical shells, comprising, in combination, conveying means for transferring said shells to a preselected position along said conveyor in seriatim order, a frame, means defining a work station carried by said frame, at least one material spray nozzle disposed in said work station, a powerhead adapted to support a shell for rotation in the work station adjacent said nozzle, means for axially moving a shell from said position into and out of said work station, means including a mask concentric with and surrounding a shell supported by said powerhead for defining a limit to said surface portion to be coated, means for shifting said mask transversely with respect to the surface so that the inner peripheral edge of the mask in the vicinity of the nozzle is in close proximity to the surface, means for rotating said mask while applying spray material to said surface portion from the nozzle, and means for controlling said apparatus in continuing cycles for each subsequent shell along said conveyor means.