

**May 27, 1952**

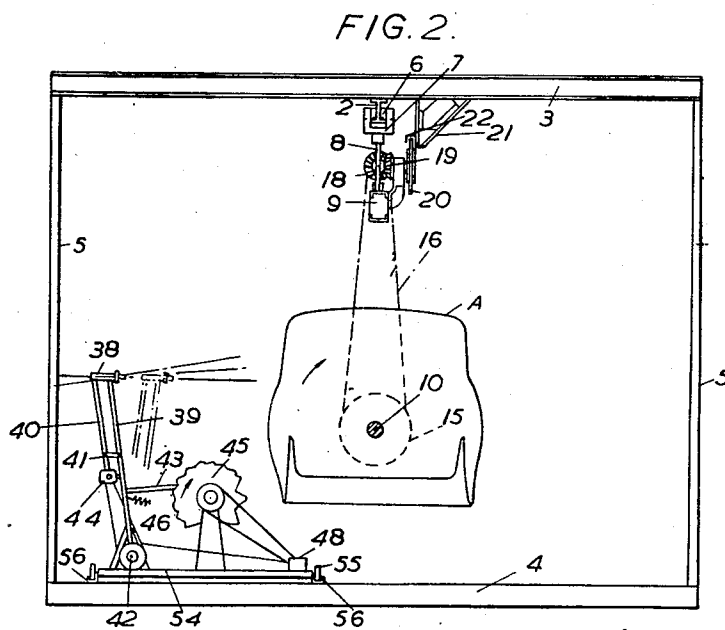
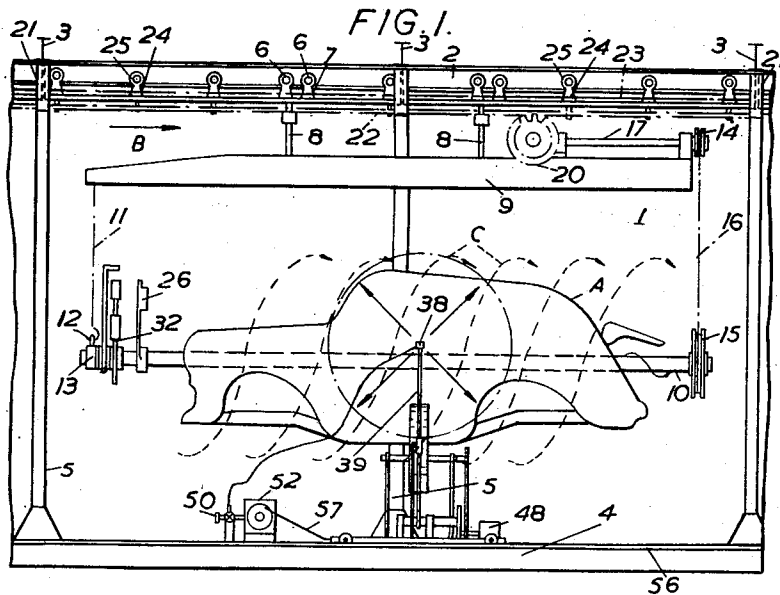
A. P. FOWLER

**2,598,246**

# APPARATUS FOR PAINTING MOTORCAR BODIES

Filed Nov. 4, 1949

5 Sheets-Sheet 1



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May 27, 1952

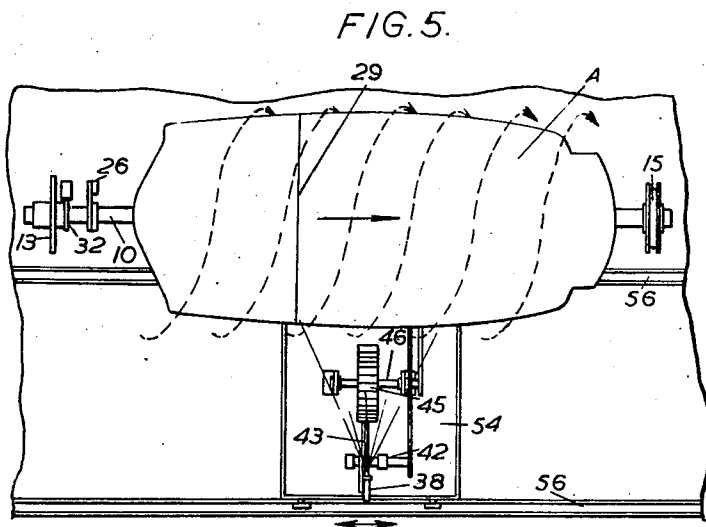
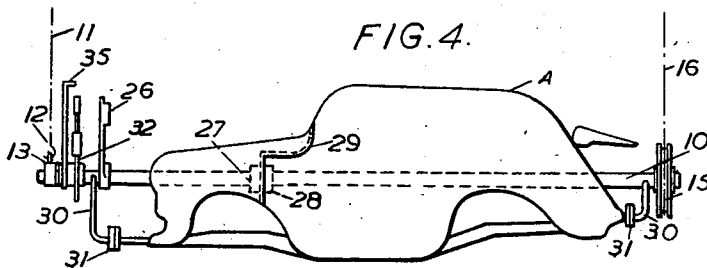
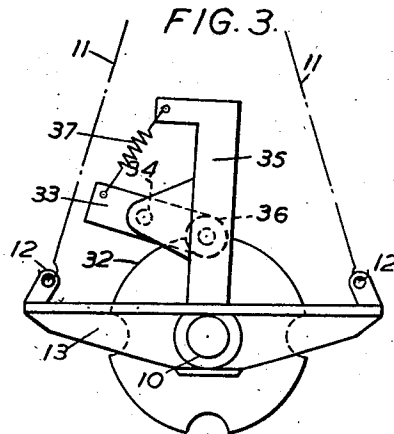
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APPARATUS FOR PAINTING MOTORCAR BODIES

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5 Sheets-Sheet 2



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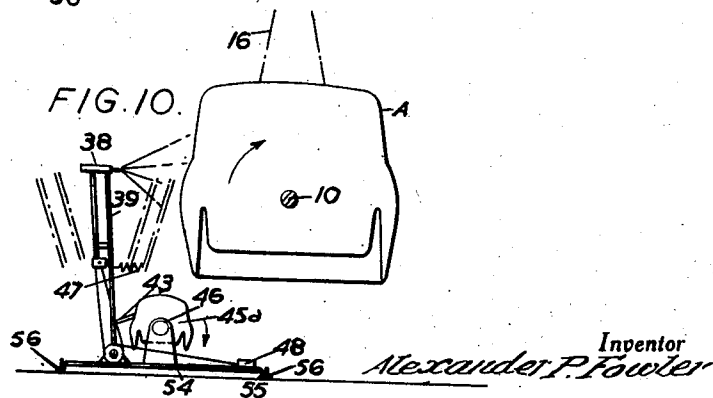
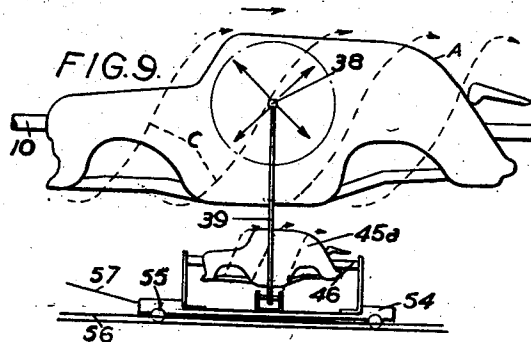
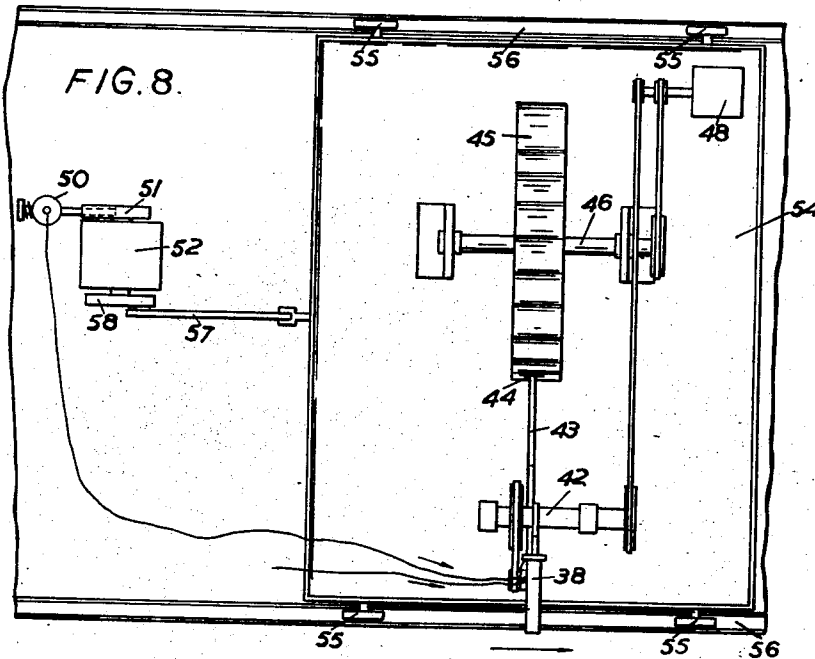
May 27, 1952

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APPARATUS FOR PAINTING MOTORCAR BODIES

2,598,246

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5 Sheets-Sheet 4



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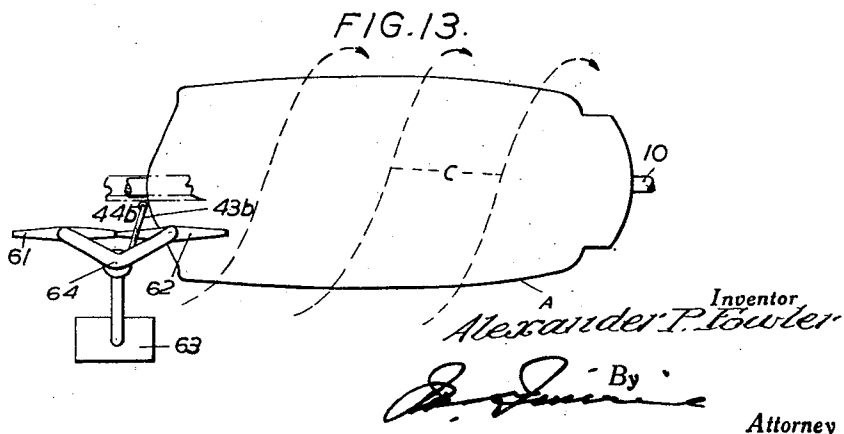
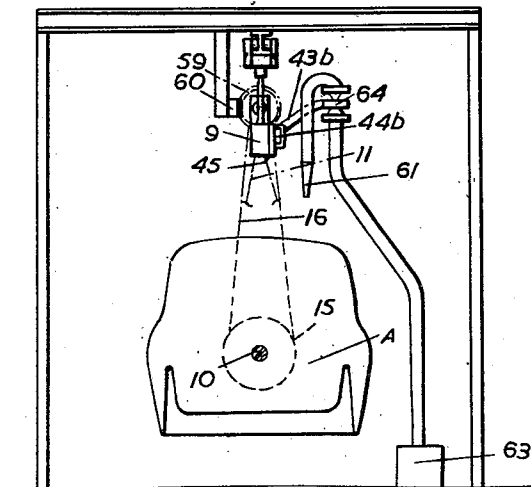
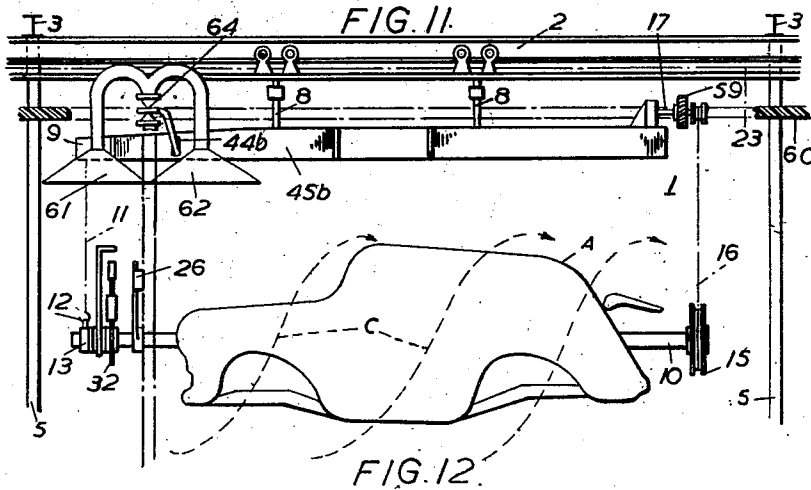
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APPARATUS FOR PAINTING MOTORCAR BODIES

Filed Nov. 4, 1949

5 Sheets-Sheet 5



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## UNITED STATES PATENT OFFICE

2,598,246

## APPARATUS FOR PAINTING MOTORCAR BODIES

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12 Claims. (Cl. 118—321)

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This invention relates to apparatus for painting motor car bodies, and has for its main object to achieve automatically the painting of motor car bodies when being produced on a quantity production basis.

Apparatus according to the present invention is so constructed that paint can be applied to motor car bodies by progressively applying the paint in a helical band on the body surface by moving the body in a longitudinal direction past a paint projecting zone and simultaneously rotating the body about a longitudinal axis intersecting the body, the distance of the area of contact of paint at any part of the helical band from the projecting zone being maintained constant and the volume of paint being projected from the zone during a painting operation being related to the speed of the respective area of contact while passing the said zone.

Preferably the rate of paint flow from the projecting zone is modified in accordance with the varying radii in the helical band along which the paint is projected. The paint may either be projected as a compact stream so that it is flowed on to the body, or projected in particle form, i. e. as a spray.

Preferably, when the paint is flowed on to the body it is projected so as to fall on to the upper part of the body, and where paint is projected as a spray it is preferred that the projecting zone is disposed about the level of the longitudinal axis about which the body is rotated and to one side thereof so that as the body is rotated it moves in an upward direction away from the zone.

A booth for painting motor car bodies in accordance with a preferred embodiment of the present invention may be characterised by the combination with means for passing a body lengthwise through the booth, said body being supported to rotate about a longitudinal axis intersecting the body, and means for causing simultaneous rotation of the body about the said axis, of paint projecting means disposed to apply paint to the body as it passes the projecting means, said projecting means being mounted for axial displacement to and from the body whereby the distance between the projecting means and the body part opposite thereto is maintained substantially constant, the movement of the projecting means being synchronised with the respective linear and angular speeds of the contact area of the body by a rotating cam comprising an actuating contour corresponding to the varying radii in the helical band of contact of paint

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leaving the projecting means, and a valve controlling the volume of paint coming from the projecting means operated from a rotating cam having an actuating contour, corresponding to the varying radii of the body portion to be coated, and an obturating contour corresponding to the body parts not required to be coated, whereby the flow of paint is regulated to obtain an even coating and arrested when the areas not required to be coated become disposed opposite to the paint projecting means.

In order that the invention may be more clearly understood preferred embodiments thereof will now be described by way of example with reference to the accompanying diagrammatic drawings in which,

Figure 1 is a part elevation of a spray booth, Figure 2 is an end view looking from the right of Figure 1,

Figure 3 is a fragmentary view, to an enlarged scale, of the spindle locking mechanism shown in Figure 1,

Figure 4 shows one method of securing a vehicle body to the supporting spindle,

Figure 5 is a plan of a vehicle body on the spindle and the paint sprayer,

Figure 6 is an elevation to an enlarged scale of the paint sprayer shown in Figure 1,

Figure 7 is an end view looking from the right of Figure 6,

Figure 8 is a plan of Figure 6,

Figure 9 is a part elevation of apparatus according to the invention and employing as an actuating cam a small replica of the vehicle body to be painted,

Figure 10 is an end view looking from the right of Figure 9,

Figure 11 is a part elevation of a booth for flowing paint on to car bodies passaged there-through,

Figure 12 is an end view looking from the left of Figure 11, and

Figure 13 is a plan of a part of the booth shown in Figure 11.

In the drawings like references designate the same or similar parts.

The spray booth 1 comprises an overhead rail 2 of I-section running lengthwise through the booth and supported on rafters 3 which form part of the spray booth of which the floor is indicated at 4. Stanchions for the rafters are indicated at 5, the walls (not shown) of the booth being fixed to the stanchions.

Pairs of wheels 6 run on the bottom flange and to each side of the web of the rail 2. The wheels

6 are mounted in co-axial pairs, two such pairs being carried on each of two stirrups 7 which are also each provided with a depending part 8 hingedly connected at the bottom to a beam 9 which is thus slung by the appropriate group of stirrups from the respective wheels 6 under the rail 2. The beam is slightly longer than a vehicle body, indicated by A, which is to be sprayed in the booth, and from each end of the beam flexible means depend and are connected to a horizontal shaft 10 on which a car body A is threaded so that the shaft intersects the dash, the body A being rigidly connected to the shaft 10 to prevent relative rotation therebetween.

As viewed in Figure 1, the left hand end of the beam supports a pair of chains 11, each having a hook 12 at the bottom which engages a bracket 13 on the shaft 10, the bracket 13 including a bearing in which the shaft can rotate. At the other end of the beam 9 is mounted a toothed wheel 14 and at the similar end of the shaft 10 is keyed a toothed wheel 15, a chain 16 passing over both wheels. Thus chains 11 and 16 flexibly suspend the shaft 10 from the beam 9.

The toothed wheel 14 is keyed on a shaft 17, on which is a bevel 18 which gears with a bevel 19, Figure 2, and to the latter is connected a pinion 20; the bevels 18, 19 and the pinion 20 being mounted in bearings carried by the beam 9.

From the rafters 3 depend brackets 21, to which is secured a rack 22, this rack being intermittent and disposed to be engaged by the pinion 20 at predetermined locations in the spraying stage, so that as the wheels and beam are passaged along the rail the shaft 10 is moved lengthwise of the rail and is rotated.

The passaging of the body is effected in the direction of the arrow B, Figure 1, by a towing chain indicated at 23, Figure 1, which at suitable intervals carries forked elements 24 which carry wheels 25 disposed to run on the rail 2 for giving support at sufficient intervals to the chain, the chain being connected to the elements 24. The shaft 10 may be provided with an adjustable counter balance 26, Figures 1 and 3, for the body A.

The body A may be secured to the shaft 10, as shown in Figure 4, by making the shaft in two parts each having a flange 27, 28 which flanges are suitably bolted together by the dash bulkhead 29 of the body A, and brackets 30 emanating from the shaft 10 are bolted to the bumper strong points 31 of the body; thereby the body is secured to the shaft so that rotation of the latter is rigidly imparted to the body.

The shaft 10 may be provided with a ratchet device to prevent unintentional reverse rotation of the body A during its passage through the booth. This device comprises a notched plate 32, Figures 1 and 3, fixed to the shaft 10, and a ratchet arm 33 pivoted at 34 on an arm 35 emanating from the bracket 13. The operating end of the arm 33 carries a roller 36 held towards the plate 32 by a spring 37 so that when the roller engages a notch in the plate 32 and the shaft 10 is locked to the bracket and the chains 11 prevent rotation of the bracket. The notches are spaced apart so that the body can be rotated to a limited extent as is usual, and locked against rotation when the shaft is under the mechanical control of the rack 22 and pinion 20.

To one side of the path of the motor car body A and at a suitable height in relation thereto, preferably at about the level of the axis of rotation, is arranged the spray forming device which

may consist of a group of spray guns or of a single spray gun 38 as indicated in the drawings, the gun or guns being carried on a pair of arms 39, 40 arranged to oscillate in a vertical plane normal to the axis of rotation of the car body. The upper ends of the arms 39, 40 are connected to the spray gun 38 and a link 41 also connects the arms.

The lower end of the arm 39 is pivoted at 42 and a support 43 extends from the arm and carries a follower 44 to engage the contour of a cam 45 mounted for rotation with a spindle 46 the axis of which is parallel to the axis of the shaft 10 carrying the car body A. A spring 47 maintains the follower 44 in contact with the cam 45.

The spindle 46 is rotated by a motor 48 so that the angular speed of the cam 45 corresponds to the angular speed of the motor car body being painted and the contour of the cam is arranged with respect thereto so that the gun 38 is maintained at a substantially constant distance from the area of contact of the paint projected from the gun to that part of the motor body opposite to the gun.

The oscillating arm 39 may be mounted near the floor of the booth and the actuating cam 45 also supported from the floor, or both may be supported on a low carriage as described below, so that the oscillating arm 39 is given maximum length and, therefore, maximum axial adjustment for the spray for a minimum variation in the radii of the contour of the cam.

The gun 38 is hingedly connected to the arm 39 and is self controlled by a cam 49 supported by the arm 39, the cam 49 being rotated by the motor 48. By engaging the arm 40 the cam 49 maintains the axis of the gun as a normal to the car body during rotation of the latter in spite of the varying curvatures of the body presented to the gun.

From the foregoing it will be understood that as the car body is passaged past the spray gun, the area of contact of paint with the body traces a helical band C, Fig. 1, about the body from end to end thereof, and that the gun is maintained at a constant distance from the area of contact during the painting operation in spite of the varying radii of the body parts in the said helical band.

As regards the volume of paint projected from the gun 38 at any particular time, this is controlled so as to be related to the speed of the respective areas of contact while passing the paint projecting zone. To this end the flow of paint from the gun is controlled by a valve 50, of any suitable known construction, such for example as a needle valve, the valve being actuated by a cam 51 rotated in synchronism with the motor car body A by an electric motor 52. The actuating contour of the cam 51 corresponds to the varying radii in the helical band, and includes an obturating contour 53, Figure 6, for cutting off the flow of paint to the gun, for example, when the under surfaces of the motor car body are presented thereto.

In order to simulate the hand operation of a spray gun the pivot 42 of the arm 39 is mounted on a carriage 54 which is supported on wheels 55 to run on the floor of the booth or on rails or on guide tracks 56 disposed therein. The carriage 54 is given a reciprocating movement through a link 57 connected therewith and with a crank disc 58 on the motor shaft, and the tracks 56 guide the carriage for movement in a direction parallel to the axis of rotation of the motor car body A. The actuating cam 45 and the motor 48

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are also, as shown in the drawings, mounted on the carriage 54.

In an alternative construction the carriage 54 may be dispensed with and the arm 39 pivoted near to the floor of the booth. To simulate the hand operation of a spray gun in such circumstances the arm may include a universal joint and the link 57 connect the arm with the crank disc 58 so as to oscillate the arm 39 in a vertical plane parallel with the axis of the motor car body A simultaneously with the oscillation in a plane at right angles to the motor car body axis derived from the actuating cam 45.

The construction diagrammatically illustrated in Figures 9 and 10 is similar to that described above but instead of a cam 45 being employed a small replica 45a of the motor car body to be painted is mounted on the spindle 46 for rotation therewith. The cam 45a is supported on a reciprocable carriage 54 similar to that described above, and is so operated that when the body A and the replica are moving in the same direction their linear speeds are proportional to their relative sizes. The return movement of the carriage is a quick one so that when one body A has been completely painted under control of the replica the latter is returned to its starting position in readiness to control the painting of the next body passing the painting position. Control of the volume of paint is similar to that previously described.

Where it is desired to coat the motor car body by flowing the paint on, it may not be necessary, according to the disposition of the nozzles with regard to the body, to arrange for adjustment of the nozzles to and from the body. Figures 11 to 13 diagrammatically show a booth for flowing paint on to a car body. In this arrangement the car body is suspended from a beam 9 as described above but rotation of the shaft 10 is effected by a toothed wheel 59 on the shaft 17, the toothed wheel engaging a rack 60 as the beam 9 is passed through the booth by the towing chain 23.

The paint is flowed from two nozzles 61, 62 mounted in fixed positions above the path of the car body and fed from a source of supply 63 through a valve 64 which regulates the volume of paint flowing from the nozzles according to the speed of the body part on which the paint is to be flowed. The valve may be of any suitable known form such as a needle valve and is controlled by a cam 45b secured to the side of the beam 9. The contour of the cam is engageable by a follower 44b on a support 43b connected with the valve and is such that according to the contour of the cam the support regulates the valve in accordance with the surface speed of the body part presented to the nozzles for painting. The cam 45b is so shaped that when parts which it is desired not to paint are presented to the nozzles the flow of paint is obtured by the valve 64.

A motor car body being painted according to the invention may be a body with or without wings or bonnet or such a body with an integral chassis (i. e. a body), sometimes known as a unitary or combined body and chassis, or such a body without a chassis.

By the present invention motor car bodies may be delivered in succession into the booth and there automatically painted in a quantity production system of painting the bodies.

I claim:

1. Apparatus for treating a body having irregular non-symmetrical surfaces, comprising a movably supported device for projecting a treating

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liquid, a conveyor movable past said device and including a mount adapted to support the body substantially longitudinally of conveyor movement, said mount being rotatable about an axis that is substantially longitudinal of conveyor movement, means for rotating said mount as it is advanced by the conveyor to rotate the body as it is carried longitudinally past said device, and mechanism actuated in synchronism with the linear and axial speeds of the contact area of the body, and means operated by said mechanism and operatively connected with said device for moving said device toward and from said conveyor to maintain substantially constant spacing between said device and the body surface and accommodate variations both longitudinally and circumferentially of the body.

2. In apparatus for coating motor car bodies with paint, a rotatable body carrying mount, a conveyor system, support means carried by said conveyor system and rotatably supporting said mount for continuous axial movement thereby past a paint projecting position, means to rotate said mount about its axis, paint projecting means mounted adjacent the path of said mount, valve means to control the volume of paint flowing to the paint projecting means, a cam having an actuating contour to control said valve means, and means for actuating said cam in synchronism with said mount to operate said valve means to deliver a volume of paint to the paint projecting means according to the varying radii of a body rotated by said mount.

3. Apparatus as defined in claim 2, wherein said cam also has an actuating contour to effect obturation of the flow of paint when there is presented to the paint dispensing means a portion of a body to which paint is not to be applied.

4. In apparatus for coating motor car bodies with paint, a rotatable body carrying mount, a paint projecting station, a conveyor system extending past said station, support means carried by said conveyor system and rotatively supporting said mount for continuous axial movement past said paint projecting station, means to rotate said body mount about its axis as it is moved axially, paint projecting means at said paint projecting station and mounted for displacement towards and away from the path of said spindle, a cam and means for actuating said cam in synchronism with the linear and angular speeds of the contact area of a body to which paint is to be applied, said cam being operatively connected with the paint projecting means to effect said displacement thereof so that the distance between the projecting means and a body on the spindle is maintained substantially constant.

5. In apparatus for coating motor car bodies with paint, a rotatable body carrying spindle, an elevated conveyor system, suspension means by which said spindle is suspended from the conveyor system for continuous axial movement thereby past a paint projecting position, means to rotate said spindle about its axis, a spray gun disposed generally radially of said spindle, means movably supporting said gun for displacement towards and away from the path of said spindle, a cam operatively connected with said spray gun and means for actuating said cam in synchronism with the linear and angular speeds of the contact area of a body to which paint is to be applied to effect said displacement of the spray gun so that the distance between the spray gun and a body on the spindle is maintained substantially constant.



6. In apparatus for coating motor car bodies with paint, a rotatable body carriage, a conveyor system, support means on said conveyor system and rotatably supporting said carriage for continuous axial movement thereby past a paint projecting position, means to rotate said carriage about its axis, a stanchion mounted at the paint projecting position for movement toward and from said conveyor system and carriage, means yieldingly pressing said stanchion toward said conveyor system, a spray gun disposed to project paint at about the level of the horizontal axis of said carriage and mounted on said stanchion for displacement towards and away from the path of said carriage, a cam operatively connected with said spray gun and means for actuating said cam in synchronism with the linear and angular speeds of the contact area of a body to which paint is to be applied to effect movement of said stanchion and displacement of the spray gun so that the distance between the spray gun and a body on the carriage is maintained substantially constant.

7. In apparatus for coating motor car bodies with paint, a rotatable body carriage, a conveyor system, support means carried by said conveyor system and rotatably supporting said carriage for continuous axial movement thereby past a paint projecting position, means to rotate said carriage about its axis, a spray gun mounted for displacement towards and away from the path of said carriage, a cam rotatable in synchronism with the linear and angular speeds of the contact area of a body to which paint is to be applied to effect said displacement of the spray gun so that the distance between the projecting means and a body on the spindle is maintained substantially constant, valve means to control the volume of paint flowing to the spray gun, a cam having an actuating contour to control said valve means, and means for actuating said cam in synchronism with said mount to operate said valve means to deliver a volume of paint to the spray gun according to the varying radii of a body rotated by said carriage and to effect obturation of the flow of paint when there is presented to the spray gun a portion of a body to which paint is not to be applied.

8. In apparatus for coating motor car bodies with paint, a rotatable body carrying spindle, a conveyor system, support means carried by said conveyor system, and rotatably supporting said spindle for continuous axial movement thereby past a paint projecting position, means to rotate said spindle about its axis, a spray gun mounted for displacement towards and away from the path of said spindle and for oscillation in a path parallel to the axis of said spindle, a cam operatively connected with said spray gun, means for actuating said cam in synchronism with the linear and angular speeds of the contact area of a body to which paint is to be applied to effect said displacement of the spray gun so that the distance between the gun and a body on the spindle is maintained substantially constant, means for oscillating said spray gun, and means for actuating said oscillating means in timed relation with the movements of the spindle to effect said oscillation of the gun to simulate hand operation of the gun.

9. In apparatus for coating motor car bodies with paint, a rotatable body carriage, a conveyor system, support means by which said carriage is supported from the conveyor system for continuous axial movement thereby past a paint project-

ing position, means to rotate said carriage about its axis, a pair of interconnected arms spaced apart in a direction normal to the axis of said carriage for displacement towards and away from the path of the carriage and arranged for lengthwise movement relative one to the other, a spray gun supported by adjacent ends of said arms for movement therewith, a first cam co-operating with a first one of said arms, means for rotating said first cam in synchronism with the linear and angular speeds of the contact area of a body to which paint is to be applied to effect said displacement of the links so that the distance between the spray gun and a body on the carriage is maintained substantially constant, a second cam rotatably supported by the first said arm, and means for rotating said second cam in synchronism with said first cam for co-operating with the second of said arms to vary the lengthwise disposition of the two arms and thereby maintain the axis of the gun substantially normal to a body on said spindle.

10. In apparatus for coating motor car bodies with paint, a rotatable body carriage, a conveyor system, support means by which said carriage is supported from the conveyor system for continuous axial movement thereby past a paint projecting position, means to rotate said carriage about its axis, a pair of interconnected arms spaced apart in a direction normal to the axis of said spindle for displacement towards and away from the path of the spindle and arranged for lengthwise movement relative one to the other, a spray gun supported by adjacent ends of said arms for movement therewith, a first cam co-operating with a first one of said arms, means for rotating said first cam in synchronism with the linear and angular speeds of the contact area of a body to which paint is to be applied to effect said displacement of the links so that the distance between the spray gun and a body on the carriage is maintained substantially constant, a second cam supported for rotation by said first arm, and means for rotating said second cam in synchronism with said first cam to co-operate with the second of said arms to vary the lengthwise disposition of the two arms and thereby maintain the axis of the gun substantially normal to a body on said spindle, valve means to control the volume of paint flowing to the spray gun, a third cam having an actuating contour to control said valve means, and means for rotating said third cam to actuate said valve means to deliver a volume of paint to the gun according to the varying radii of a body rotated by said spindle and to effect obturation of the flow of paint when there is presented to the gun a portion of a body to which paint is not to be applied.

11. In apparatus for coating motor car bodies with paint, a rotatable body carrying spindle, a conveyor system, support means by which said spindle is supported from the conveyor system for continuous axial movement thereby past a paint projecting position, means to rotate said spindle about its axis, a pair of arms spaced apart in a direction normal to the axis of said spindle for displacement towards and away from the path of the spindle and arranged for lengthwise movement relative one to the other, a spray gun supported by adjacent ends of said arms for movement therewith, a link connecting said arms between the ends thereof, an oscillatable carriage for said arms, guide means to guide said carriage for oscillation in a path parallel with the axis of said spindle, means for oscillating said carriage

along said guide means, means for operating said oscillating means in timed relation with the movements of said spindle to effect oscillation of the carriage to simulate hand operation of the gun, a first cam co-operating with a first one of said arms, means for rotating said first cam in synchronism with the linear and angular speeds of the contact area of a body to which paint is to be applied to effect said displacement of the links so that the distance between the spray gun and a body on the spindle is maintained substantially constant, a second cam supported for rotation by said first arm, and means for rotating said second cam in synchronism with said first cam to co-operate with the second of said arms to vary the lengthwise disposition of the two arms and thereby maintain the axis of the gun substantially normal to a body on said spindle.

12. In apparatus for coating motor car bodies with paint, a rotatable body carrying spindle, an elevated conveyor system, suspension means by which said spindle is suspended from the conveyor system for continuous axial movement thereby past a paint projecting position, means to rotate said spindle about its axis, a pair of arms spaced apart in a direction normal to the axis of said spindle for displacement towards and away from the path of the spindle and arranged for lengthwise movement relative one to the other, a spray gun supported by adjacent ends of said arms for movement therewith and at a position such that it is disposed to project paint at about the level of the horizontal axis of said spindle, a link connecting said arms between the ends thereof, an oscillatable carriage for said arms, guide means to guide said carriage for oscillation in a path parallel with the axis of said spindle, a crank pin operable in timed relation with the movements of said spindle, a link connecting the crank pin to the carriage to effect oscillation of the carriage to simulate hand operation of the gun, a first cam co-operating with a first one of said arms,

means for rotating said first cam in synchronism with the linear and angular speeds of the contact area of a body to which paint is to be applied to effect said displacement of the links so that the distance between the spray gun and a body on the spindle is maintained substantially constant, a second rotatable cam journaled on said first arm, means for rotating said second cam in synchronism with said first cam and co-operating with the second of said arms to vary the lengthwise disposition of the two arms and thereby maintain the axis of the gun substantially normal to a body on said spindle, valve means to control the volume of paint flowing to the spray gun, and a third cam having an actuating contour to control said valve means to deliver a volume of paint to the gun according to the varying radii of a body rotated by said spindle and to effect obturation of the flow of paint when there is presented to the gun a portion of a body to which paint is not to be applied.

ALEXANDER PROUD FOWLER.

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