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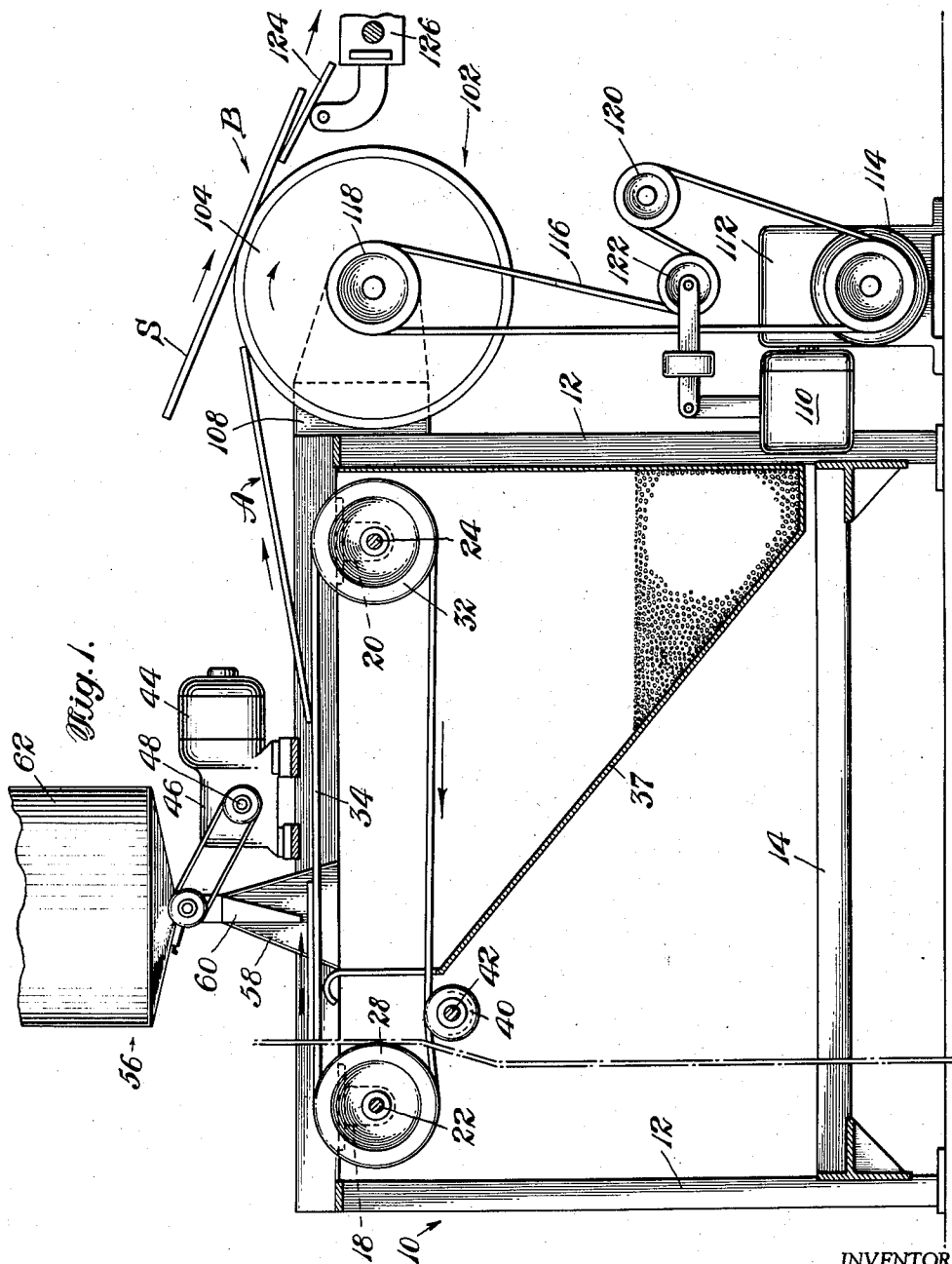
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SPHERE DISPENSING APPARATUS

Filed April 5, 1955

3 Sheets-Sheet 1



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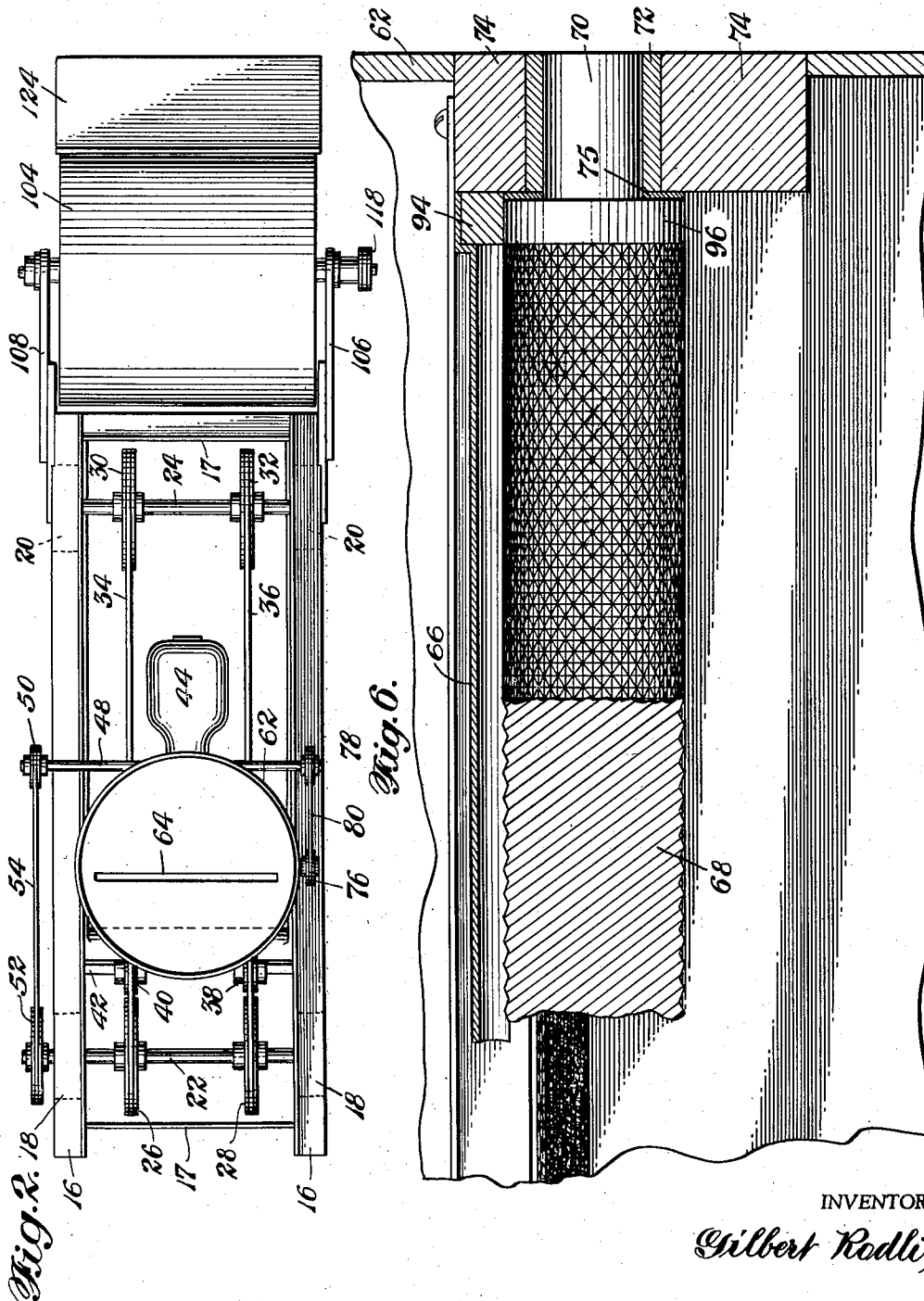
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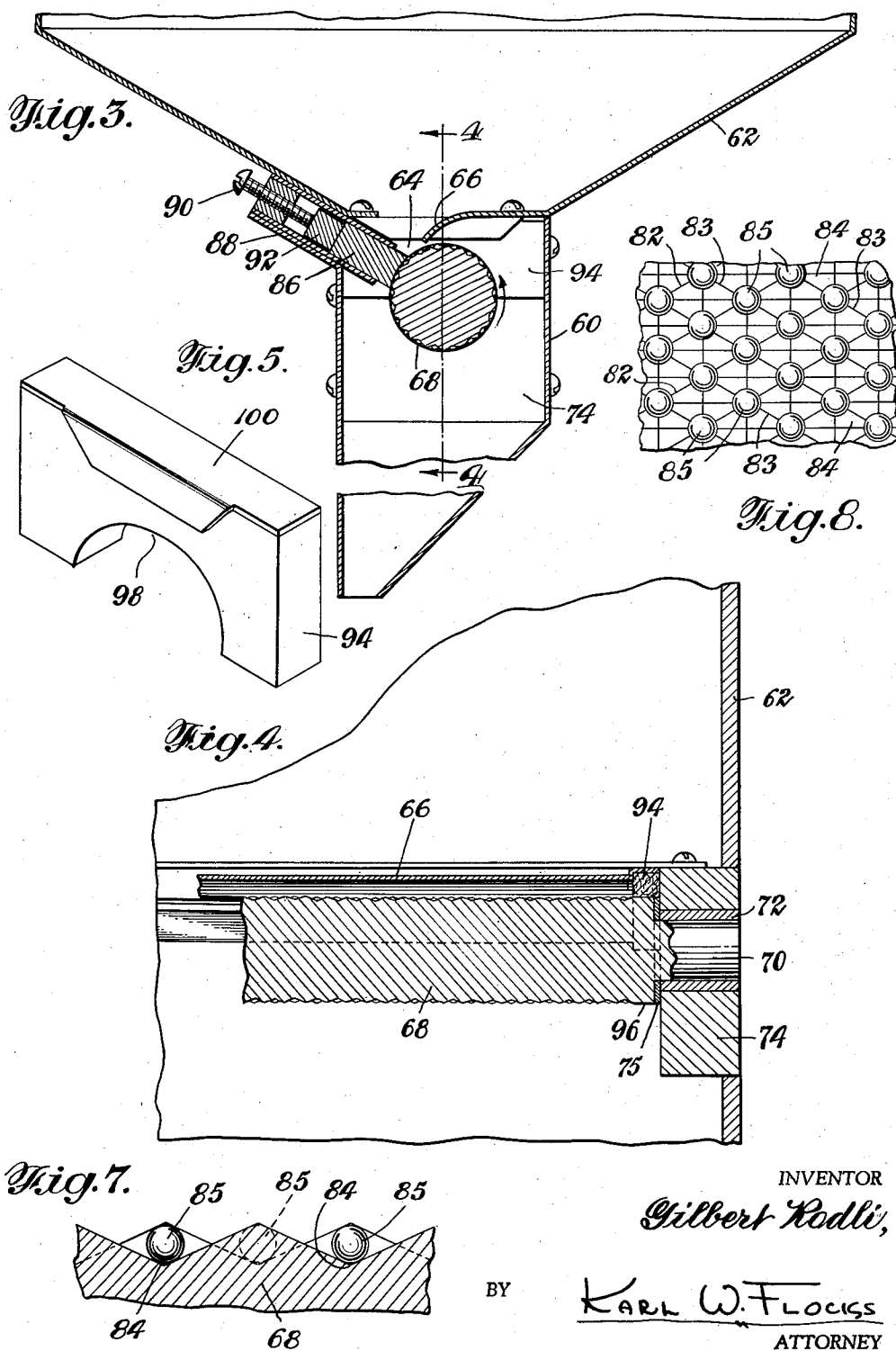
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SPHERE DISPENSING APPARATUS

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7 Claims. (Cl. 118—308)

The present invention relates to apparatus for applying reflecting elements to the surface of an article. More particularly, the present invention relates to apparatus for distributing small reflecting spheres over a coated surface of a sign or the like.

The development and improvement in the manufacture of micro-diameter glass spheres as a reflective media has led to the extensive use of the reflectorized sign on roads and highways. The common practice in the manufacture of reflectorized signs is to apply a paint-like binder to the sign message or area to be reflectorized. The micro-diameter glass spheres are then deposited in a layer on and in the wet or tacky surface to which they adhere. Prior to the instant invention, various methods have been utilized in applying the glass spheres to the wet binder. However, these heretofore known methods were either cumbersome and uneconomical from a production standpoint or the apparatus involved was too expensive to build, delicate in structure and too slow for production shops. Moreover, the heretofore known sphere distributing apparatus was unreliable, resulting in inconsistent disposition of spheres, thereby causing the finished sign to have high and low spots of brilliancy as well as varying angles of reflectivity.

It is generally recognized in the art that in order to produce a sign that will reflect light in the most efficient manner, a mono-layer of the small glass spheres must be dispensed on the sign surface. By distributing the spheres in mono-layers, the entire surface of the sign is uniformly coated and each sphere is evenly exposed. Thus, light from a common source is reflected in a uniform manner, and, accordingly, the sign reflective surface will not produce varying angles of reflectivity or accompanying shadows.

It is therefore an object of the present invention to provide apparatus for uniformly distributing glass spheres in a mono-layer over a coated surface of a sign or the like.

Another object of the present invention is to provide apparatus for depositing a mono-layer of glass spheres on the tacky surface of an object to be reflectorized, without streaking, distorting or blemishing the surface.

Still another object of the present invention is to provide glass sphere distributing apparatus wherein the sign is moved under a stationary sphere dispensing device, thereby resulting in an even distribution of spheres over the area of the sign to be reflectorized.

Still another object of the present invention is to provide glass sphere dispensing apparatus wherein a knurled rotor having a spiral shaped pattern is utilized for distributing the glass spheres in a mono-layer.

Still another object of the present invention is to provide a knurled rotor for distributing glass spheres wherein the spirals formed in the rotor are of a predetermined depth, thereby insuring the disposition of a mono-layer of the glass spheres on the surface to be coated.

Still another object of the present invention is to provide a sphere dispensing rotor which is formed with a plurality of sphere receiving cavities, the cavities being linearly

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aligned with respect to the longitudinal axis of the rotor, whereby the spheres contained in the cavities will be dispensed from the rotor in mono-layers.

Still another object of the present invention is to provide a knurled rotor for distributing glass spheres wherein a seal cooperates with spiral grooves formed in the rotor to effect a mono-layer distribution of the spheres on the surface to be coated.

Other objects and the nature and advantages of the instant invention will be apparent from the following description taken in conjunction with the accompanying drawings, wherein:

Fig. 1 is a side elevational view with parts shown in section of the sphere dispensing apparatus embodied in the present invention;

Fig. 2 is a top plan view of the sphere dispensing apparatus illustrated in Fig. 1;

Fig. 3 is a sectional view taken along the line 3—3 of Fig. 2;

Fig. 4 is a sectional view taken along the line 4—4 of Fig. 3;

Fig. 5 is a perspective view of the sealing device for sealing the ends of the rotor illustrated in Fig. 4;

Fig. 6 is an enlarged view of the apparatus shown in Fig. 4, the rotor being illustrated in elevation;

Fig. 7 is a portion of a section of the rotor showing the formation of the grooves formed in the rotor; and

Fig. 8 is an enlarged plan view of a portion of the rotor showing the glass spheres positioned in the rotor cavities, the cavities being formed by the intersections of the grooves formed in the surface of the rotor.

Referring to the drawings, and particularly Figs. 1 and 2, the sphere dispensing apparatus embodied in the present invention is illustrated and includes a frame which is generally indicated at 10. The frame 10 comprises four vertical legs 12 which are interconnected by spaced horizontal structural members, one of which is indicated at 14. The vertical legs 12 are interconnected at the uppermost end thereof by longitudinally extending top rails 16 and laterally extending rails 17, the rails 16 defining the upper frame structure for supporting the sphere dispensing apparatus. Suitably journaled for rotation in bearings 18 and 20, which are mounted on the top rails 16 in spaced relation are shafts 22 and 24, respectively. Secured to the shaft 22 for rotation therewith are spaced pulleys 26 and 28 while spaced pulleys 30 and 32 are secured to the shaft 24 for rotation therewith. The apparatus described herein is adapted to pass a sign which has been coated with a tacky material beneath a glass sphere dispensing hopper. For this purpose, rope conveyors 34, 36 are employed, the rope conveyors 34, 36 operatively engaging the pulleys 26, 30 and 28, 32, respectively and being adapted to be moved thereby. Idler pulleys 38 and 40 are secured to a shaft 42 which is journaled for rotation in suitably mounted bearings, the idler pulleys 38, 40 being adapted to compensate for sag that may occur in the rope conveyors 34 and 36.

Secured to the frame 10 between the top rails 16 and adjacent a pair of the vertical legs 12 is a receptacle 37. The receptacle 37 is formed with an inclined wall which extends downwardly to the bottom thereof and is adapted to direct excess glass spheres that are not retained on the surface of the article to be coated to the bottom of the receptacle, from where they may be reclaimed by some convenient means.

In order to drive the rope conveyors 34, 36 so that a sign or the like may be conveyed thereon to the sphere dispensing station, the shaft 22 is driven by an electric motor 44 that is conveniently mounted on a platform secured to the spaced top rails 16. The electric motor 44 is operatively connected to a speed reducing unit 46 from which a drive shaft 48 extends. The drive shaft 48

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is suitably journaled on the frame 10 and has mounted for rotation therewith a pulley 50. The pulley 50 is interconnected to a drive pulley 52 through a belt 54, the drive pulley 52 being secured to the outer end of the shaft 22 and adapted to cause rotation thereof in response to rotation of the drive shaft 48.

As shown particularly in Figs. 1 and 2, a device for dispensing the small glass spheres is mounted on the frame 10 and is indicated generally at 56. The sphere dispensing device 56 includes mounting brackets 58 which are secured to the spaced top rails 16, the mounting brackets 58 having a sphere dispensing hopper 60 secured therein. As illustrated in Fig. 3, the dispensing hopper 60 is connected directly to a sphere receiving hopper 62 which has a funnel-shaped configuration and is formed with a bottom opening 64. Referring now to Figs. 3, 4 and 6, the receiving hopper 62 is shown having secured thereto a curved deflector 66 that is positioned adjacent the bottom opening 64 and partially covers a rotor 68, the details of which will be described more completely hereinafter. The rotor 68 has reduced end portions 70, one of which is illustrated in Fig. 6, the end portion 70 being journaled in a bushing 72 that is mounted in a bearing block 74. A washer 75 is positioned between the block 74 and the end face of the rotor 68 and thereby prevents endwise movement of the rotor. The bearing block 74 is secured in the end brackets 58 and thus mounts the rotor 68 for rotation. As shown in Fig. 2, one end of the reduced end 70 of the rotor 68 extends through the associated bracket 58 and has a pulley 76 secured thereon. The pulley 76 is interconnected to a pulley 78 mounted on the drive shaft 48 by a belt 80 and it is seen that rotation of the rotor 68 is thus related to the movement of the rope conveyors. Accordingly, the amount of spheres fed from the dispensing hopper 60 by the rotor 68 can be controlled with respect to the movement of the rope conveyors thereby insuring an adequate and even distribution of the spheres on the article to be coated. In the operation of the device, the small glass spheres are deposited in the receiving hopper 62 where they fall by gravity through the opening 64. The spheres are then picked up by the rotor 68 and carried downwardly therewith from where they fall to the bottom of the sphere dispensing hopper 60, being directed outwardly onto the surface of the article to be coated through the opening in the bottom of the dispensing hopper.

Referring now to Figs. 6, 7 and 8, the rotor 68 is shown in detail and will be described with particular reference to the distribution of the glass spheres in a mono-layer on a road sign or similar article. The surface of the rotor 68 is machined to effect a knurled appearance, a series of helically extending grooves being formed therein. The helical grooves, shown more clearly in Figs. 6 and 8, extend in transverse directions and each groove traverses 180° of the rotor circumference. It is seen that one groove will intersect all of the oppositely extending grooves and these intersections define a plurality of sphere receiving interstices or cavities 84 that are V-shaped in configuration (Fig. 7). As shown in Figs. 6 and 7 the intersecting helical grooves are V-shaped when the rotor is seen in cross section and the side walls defined by the intersecting grooves are therefore inclined. The diameters of the glass spheres to be dispensed are formed in relatively small sizes and thus a single sphere indicated at 85 in Fig. 7 will be deposited in each cavity 84 formed in the rotor surface. Since each groove formed in the rotor intersects the oppositely extending grooves, lineal formations of the cavities 84 are formed in the rotor surface and thus a series of the spheres 85 are located in the cavities 84 will be aligned in straight line order with respect to the longitudinal axis of the rotor (see Fig. 8). As the rotor rotates, the spheres 85 located in the aligned cavities will drop therefrom uniformly and thereby effect a mono-layer sphere distribution. As the glass spheres fall through the opening 64 in the bottom of the hopper

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62, a seal must be provided on the rotor 68 or else the spheres will tend to prematurely drop off the rotor in clusters, thereby destroying the reflecting surface of the sign being coated. In order to effectively seal the rotor 68, a felt seal 86 is provided and is positioned in engaging relation with the surface of the rotor and located adjacent the discharge opening 64 in the hopper 62. The felt seal 86 is adjustably mounted in a housing 88 which is secured to the dispensing hopper 60. The seal 86 is adjusted by a plurality of bolts 90 which engage a stationary stiffening member 92, the stiffening member 92 positively engaging the felt seal 86. It is seen that as the rotor 68 rotates, a wiping action is effected by the felt seal 86 on the rotor surface and spheres not located in the cavities 84 in the rotor 68 will be prevented from dropping to the discharge end of the dispensing hopper 60. It is apparent that the glass spheres located in the rotor cavities will drop from the rotor in uniform layers, as the rotor rotates, thereby depositing a continuous mono-layer of the spheres on the surface of the article to be coated.

In order to prevent the small glass spheres from rolling off of the extreme ends of the rotor 68, end seals 94 are provided and are adapted to engage a smooth end surface 96 of the rotor as shown in Fig. 6. The end seals 94 are formed of a felt material and, as illustrated in Fig. 5, have a semi-cylindrical opening 98 formed therein which is adapted to be received by the smooth end surface 96 of the rotor. A keeper 100 is secured to the top surface of the seal 94 and maintains the seal under pressure, thereby adding rigidity and firmness to the seal. As illustrated in Fig. 6, the deflector 66 engages the keeper 100 and is adapted to secure the keeper in position.

Located at the discharge end of the rope conveyor is a sphere reclaiming device indicated generally at 102. The sphere reclaiming device 102 includes a large rubber covered roll 104 journaled in suitable bearings in top rail extensions 106, 108. The roll 104 is driven by a variable speed motor 110 at the same speed as the rope conveyors 34, 36. The motor 110 is operatively connected to a speed reducer 112 which has secured to the drive shaft thereof a drive wheel 114. A V-type belt 116 engages the drive wheel and drives a wheel 118 mounted on the shaft of the rubber covered roll 104. A fixed idler roll 120 and a floating idler roll 122 are suitably mounted in engagement with the belt 116 and are provided to take up the slack in the belt 116, as required. The floating idler roll 122 is adjusted to regulate the tension in the belt 116, as desired.

Adjustably mounted adjacent the roll 104 on a conveyor is an inclined plate 124, a portion of which is seen in Fig. 1. It is apparent that as a sign S approaches the discharge end of the rope conveyor 34, 36, it contacts the rubber covered roll 104, the uppermost portion of which is positioned higher than the rope conveyors 34, 36. As the sign S contacts the rubber covered roll 104, it is tilted upwardly to the inclined position A shown in Fig. 1. When the sign S moves to the inclined position A, excess spheres which have been deposited on the sign, but not on the binder or tacky surface, roll off the sign between the rope conveyors 34, 36 and into the sphere return receptacle 37 from where they are returned to the sphere receiving hopper 62 by some convenient means. Further movement of the roll 104 carries the sign upwardly until it passes the center of gravity thereof and tilts to the position shown at B in Fig. 1. The inclined plate 124 then guides the sign S thereover onto a conveyor 126 to a suitable discharge point.

The operation of the device is as follows:

A sign or similar article is coated with a paint binder and then placed face-up on the feed end of the rope conveyors 34, 36 which are being driven by the motor 44 at a predetermined speed. The glass spheres to be dispensed onto the surface of the sign are dumped into the funnel-shaped receiving hopper 62 and gravitate down-

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wardly therein toward the opening 64. The spheres pass through the opening 64 and contact the exposed surface of the rotor 68, being deflected thereon by the deflector 66. The cavities formed by the intersecting grooves in the knurled rotor 68 act as receiving chambers for the individual spheres, and thus the spheres are caused to be linearly aligned prior to the dispensing thereof. As the rotor 68 rotates, being driven by the motor 44, the spheres are carried therewith, excess spheres being wiped from the surface of the rotor by the felt seal 86 and thereby being prevented from dropping off the rotor prematurely or in clusters. It is seen that as the rotor continues to rotate, the spheres located in a single row of the rotor cavities will drop therefrom and through the dispensing hopper 58 and thus, as the sign continuously moves forward, a stream of the spheres will be distributed on the surface thereof in mono-layers. After the sign passes under the dispensing hopper 58 and has received the mono-layer of spheres on the surface thereof, it progresses to the discharge end of the rope conveyors 34, 36. At the discharge end of the rope conveyors, the sign strikes the roll 104 and is tilted, the excess spheres falling into the receptacle 37 for reclaiming. The sign is then carried forward by the roll 104 to the discharge conveyor 126.

It will be obvious to those skilled in the art that various changes may be made without departing from the spirit of the invention and, therefore, the invention is not limited to what is shown in the drawings and described in the specification, but only as indicated in the appended claims.

What is claimed is:

1. In apparatus for applying small spheres on an object, means for receiving said spheres, means secured to said receiving means for dispensing said spheres, said dispensing means including a rotor mounted therein, said rotor having a plurality of helically extending V-shaped grooves formed therein, said grooves intersecting to define a plurality of cavities for receiving said spheres, said cavities being formed with inclined walls and in straight line relation, the straight line formed being positioned parallel to the axis of said rotor, whereby said spheres are dispensed from said rotor in mono-layers.

2. In apparatus for applying small spheres on an object as set forth in claim 1, wherein sealing means engage the ends of said rotor, said sealing means sealing the ends of said rotor from said spheres during the dispensing operation.

3. In apparatus for applying small spheres on an object, means for conveying said object to a dispensing station, means located above said conveying means at said dispensing station for receiving said spheres, means communicating with said receiving means for dispensing said spheres on said object, said dispensing means including a dispensing rotor, said rotor having a plurality of

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V-shaped grooves formed therein, said V-shaped grooves intersecting to define a plurality of cavities having inclined walls for receiving said spheres, the depth of cut of said cavities being at least as large as the diameter of said spheres and a seal engaging the ends of said rotor for sealing said rotor ends from said spheres during the dispensing operation.

4. In apparatus for applying small spheres on an object as set forth in claim 3, wherein said sealing means comprises a felt block having a semi-cylindrical opening formed therein, said felt block receiving a keeper thereon for securing said block in sealing position.

5. In apparatus for applying small spheres on an object as set forth in claim 3, V-shaped grooves are helically formed in the surface of said rotor.

6. In apparatus for applying small spheres on an object as set forth in claim 3, wherein said cavities are formed in straight line relation, said straight lines being parallel with respect to the longitudinal axis of said rotor, said spheres thereby being dispensed from said rotor on said object in single file relation to define a mono-layer distribution of said spheres on said object.

7. In apparatus for applying spherical particles on an object, a hopper for receiving said particles having an opening formed in the bottom thereof, a dispensing hopper secured to said receiving hopper, a rotor rotatably mounted on said dispensing hopper and communicating with said opening in said receiving hopper, a first series of helically extending grooves formed in said rotor, a second series of helically extending grooves formed in said rotor, each of said grooves in said second series intersecting the grooves of said first series to define a plurality of particle receiving cavities, said grooves being V-shaped in configuration whereby the side walls thereof are inclined, the depth of cut of said grooves being constant throughout said rotor and at least as great as the diameter of said spheres, so that when said particles are located in said cavities the topmost edges of said cavities extend at least as high as the topmost edges of said particles.

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