

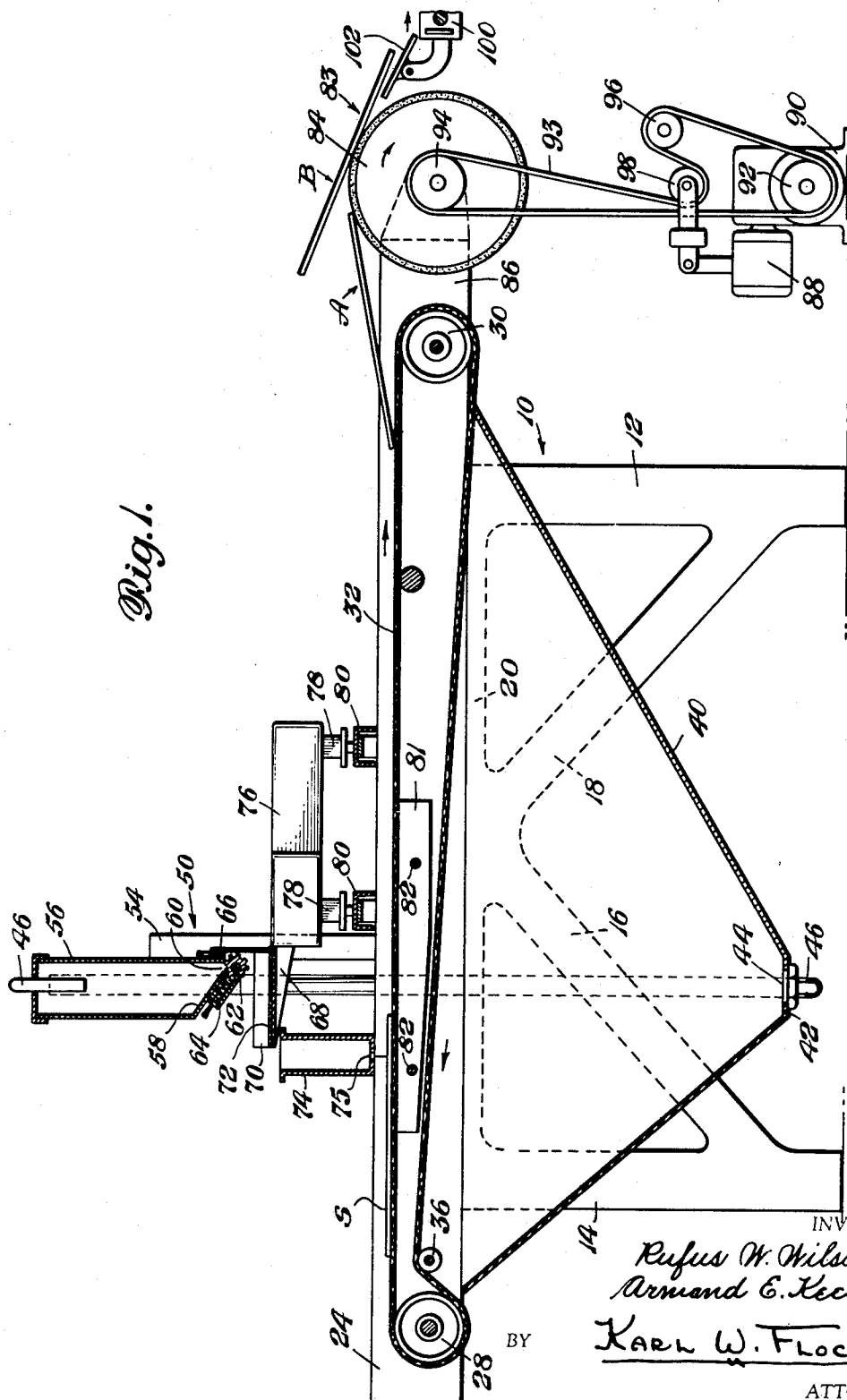
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SPHERE DISPENSING APPARATUS

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2 Sheets-Sheet 1



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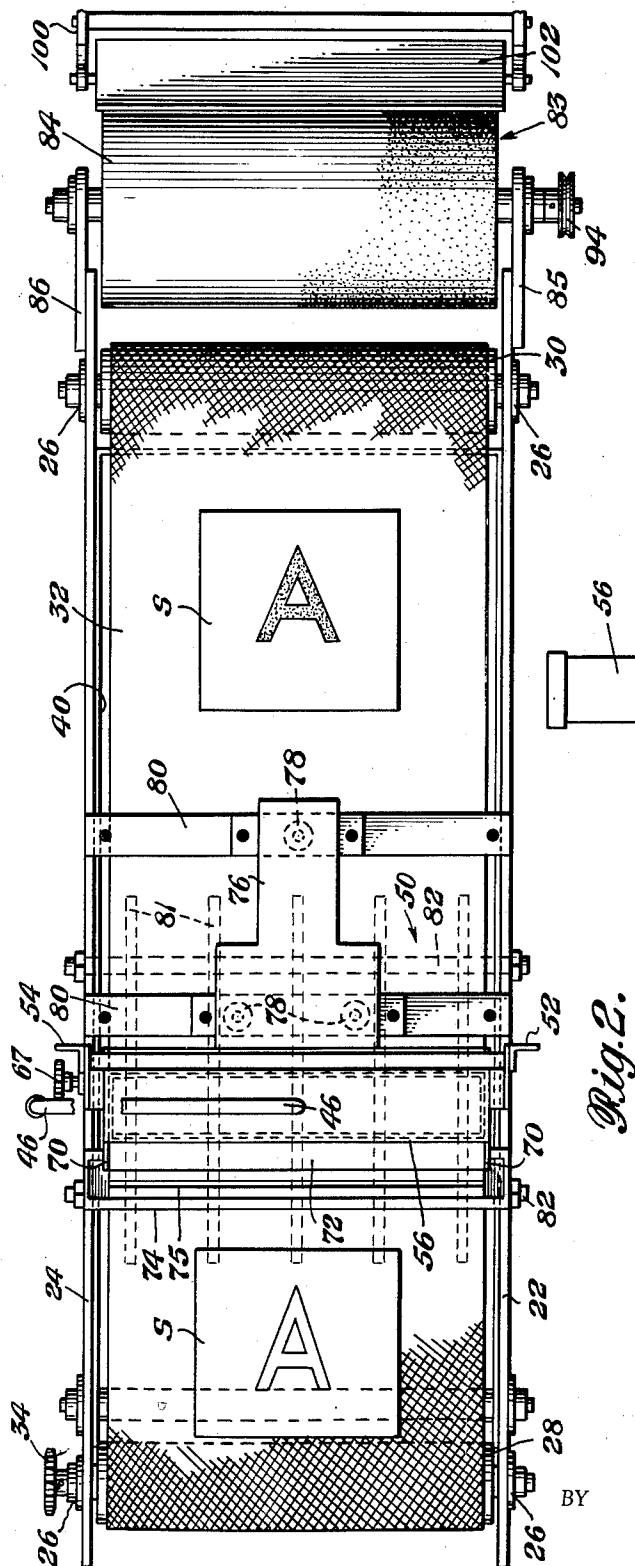


Fig. 2.

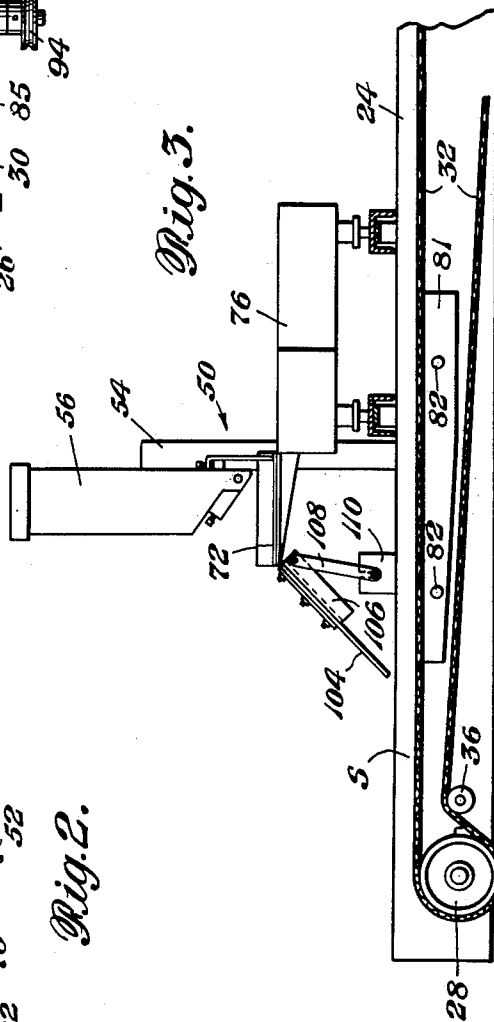


Fig. 3.

INVENTORS
Rufus W. Wilson and
Armand E. Keeley
BY
KARL W. FLOCKS
ATTORNEY

1

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SPHERE DISPENSING APPARATUS

Rufus W. Wilson and Armand E. Keeley, Huntingdon, Pa., assignors to Wald Industries Inc., Huntingdon, Pa., a corporation of Pennsylvania

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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 monolayer 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 an object of the present invention to provide apparatus for uniformly distributing glass spheres 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 apparatus for vibrating the glass spheres into a sphere dispensing hopper from where they are distributed in a mono-layer over the surface of the sign.

Still another object of the present invention is to regulate the amount of spheres applied to the signs, thereby preventing an accumulation of spheres on the sign surface.

Still another object of the present invention is to provide simple and automatic means for reclaiming excess spheres and returning them for further use.

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 vertical sectional view of the apparatus in accordance with the present invention;

Fig. 2 is a plan view of the apparatus shown in Fig. 1, and

Fig. 3 is a partial vertical sectional view of the invention showing a modification of the sphere dispensing device.

Referring to the drawings, and particularly Figs. 1

2

and 2, the apparatus embodied in the present invention is shown comprising a frame which is generally indicated at 10. The frame 10 includes the vertical legs 12, 14 which have formed integrally therewith angularly disposed supporting members 16, 18. The legs 12, 14 and supporting members 16, 18 extend into an integral portion 20 which forms the top of the frame 10. Referring to Fig. 2, a pair of side rails 22, 24 are shown secured to the sides of the top portion 20 and extend beyond both ends thereof. Suitably journaled for rotation in bearings 26, which are secured to the side rails 22, 24, are a pair of rolls 28, 30. The rolls 28, 30 are positioned at opposite ends of the frame 10 and drive a woven wire endless conveyor belt 32 which is suitably attached thereto. The roll 28 supplies the driving power for the belt 32 and is driven by a sprocket drive gear 34 which is operatively connected to a suitable source of electrical power. An adjustable idler roll 36 is journaled in suitable bearings in the side rails 22, 24 and engages the belt 32, thereby compensating for sag that may occur therein.

Secured to the frame 10 between the side rails 22, 24 and directly below the conveyor belt 32 is a sphere return hopper 40. The sphere return hopper 40 is formed with inclined walls which extend downwardly to a bottom portion 42. The bottom portion 42 is provided with an opening 44 which has a tube 46 securely connected thereto, the purpose of which will hereinafter be described.

Referring again to Figs. 1 and 2, a sphere dispensing device is shown generally indicated at 50 and includes vertical support brackets 52 and 54 which are secured to the frame 10. Attached to the support brackets 52, 54 is a sphere receptacle 56 which has an opening in the top thereof to receive the tube 46 therethrough. The tube 46 extends downwardly from the sphere receptacle 56, as shown in dotted lines in Fig. 1, to the sphere return hopper 40 where it communicates with the opening 44 formed therein. Spheres that fall into the return hopper 40 roll through the opening 44 into the tube 46 connected thereto. A controlled supply of air pressure (not shown) is then introduced into the tube 46 to move the spheres up through the tube and into the sphere receptacle 56. The receptacle 56 has a lower inclined wall 58 which directs the spheres introduced into the receptacle to an opening 60 formed in the bottom thereof. Mounted in suitable bearings which are secured to the support brackets 52, 54 is a rotor 62 which is formed with a series of grooves on the outer periphery thereof. The rotor 62 is positioned adjacent the opening 60 in the receptacle 56 and is adapted to meter the spheres through the opening 60 in regulated quantities. Felt seal adjusting units 64 and 66 are mounted in engagement with the rotor 62 and are provided to effectively seal the rotor 62 around the opening 60. Referring to Fig. 2, the rotor 62 is shown extending beyond the support bracket 54 to receive a sprocket gear 67. The sprocket gear is operatively connected to the drive gear of the motor which supplies the power to actuate sprocket gear 34. The rotor 62 is thereby rotated at a speed which is synchronized with the speed of travel of the conveyor belt 32. Accordingly, the amount of spheres fed from the hopper 56 by the rotor 62 can be controlled so that an excess of spheres will not be accumulated during the sphere dispensing operation.

Also secured to the support brackets 52, 54 is a platen apron 68 which has mounted thereon a frame 70. Rigidly clamped in the frame 70 is a polished plate glass platen 72 which, as shown in Fig. 1, is positioned directly under the rotor 62 and receives the spheres fed thereby from the receptacle 56. Secured to the side rails 22, 24 and disposed under the open side of the platen 72 is a sphere dispensing hopper 74. The hopper 74 is formed with an open top and is thereby adapted to receive the spheres

3

therein from the platen 72. An opening 75 is formed in the bottom of the hopper 74 and is provided for dispensing the spheres from the hopper 74 during the sphere dispensing operation.

In order to regulate the amount of spheres dropped into the hopper 74 from the platen 72, a vibro motor unit 76 is provided and is mounted for operation in engagement with the platen 72. As shown in Fig. 1, the vibro motor unit 76 is mounted on motor insulator cups 78 which are, in turn, received by motor mount bars 80. The mount bars 80 have an inverted U-shaped configuration, the inner side of the U engaging the motor supports 80, 82. The motor supports 80, 82 are secured to the side rails 22, 24 and are bolted to the mount bars 80 by suitable means. Electrically connected to the vibro motor unit 76 is a rheostat (not shown) energized by the motor which drives the sprocket gear 34 and sprocket gear 67. The vibro motor, when energized, will vibrate, being cushioned by the insulator cups 78 and the pulsations of the vibro motor 76 are controlled as desired by regulating the rheostat. Since the platen 72 operatively engages the vibro motor 76, operation of the vibro motor will cause the platen to be vibrated therewith and any spheres deposited on the platen 72 will be vibrated therefrom into the dispensing hopper 74. The frame 70 extends above the platen 72 along the sides thereof and prevents the spheres from being vibrated off the platen sides, thereby assuring that a regulated amount of spheres will be deposited into the dispensing hopper 74. Since the vibro motor 76, belt 32 and rotor 62 are driven by a common source of power, it is apparent that the speed of the conveyor belt 32, the rate of delivery of the spheres from the receptacle 56 and the pulsations of the vibro motor can be synchronously controlled to regulate the amount of spheres dispensed from the dispensing hopper 74.

Prior to the sphere dispensing operation, a sign S to be reflectorized is treated or coated with a binder, which generally consists of a wet tacky material having predetermined specifications. The binder is applied to the sign S before the sign is placed on the feed end of the dispensing apparatus and will cover the message area to be reflectorized in a sufficient amount to retain the spheres deposited therein. The spheres to be applied to the binder are graded as to the diameter and weight, thereby assuring the same characteristics for all the spheres. The sign S is placed face-up on the belt 32 and passes under the dispensing hopper 74 at which point the spheres are dispensed through the opening 75 and deposited in the binder on the surface of the sign S. As the spheres are applied to the binder, it is essential that the sign be positioned perfectly flat, thereby assuring that the spheres will come to rest immediately after they are dropped on the sign surface. Consequently, a series of grids 81 supported by grid tie bars 82 are mounted under the belt 32 at the point where the spheres are applied to the sign. The tie bars 82 are secured in the side rails 22, 24 and provide with the grids 81 an even supporting structure for the belt 32. If the grids 81 were not provided, it is apparent that the weight of the wire conveyor belt 32 would produce enough sag in the belt to cause the sign to be uneven as the spheres are applied thereon. Since the weight and diameter of each sphere is approximately the same, each sphere sinks into the binder the same depth, thereby providing an even bed of spheres, each sphere having an equal amount of binder around the base thereof. The excess spheres which bounce off the sign and the spheres which do not strike the sign fall through the woven wire conveyor belt 32 into the sphere return hopper from where they are returned to the sphere receptacle 56.

Located at the discharge end of the conveyor belt 32 is a sphere reclaiming device indicated generally at 83. The sphere reclaiming device 83 includes a large rubber covered roll 84 journaled in suitable bearings in side rail extensions 85, 86. The roll 82 is driven by a variable speed motor 88 at the same speed as the belt 32. The

4

motor 88 is operatively connected to a speed reducer 90 which has secured to the drive shaft thereof a drive wheel 92. A V-type belt 93 engages the drive wheel and drives a wheel 94 mounted on the shaft of the rubber covered roll 84. A fixed idler roll 96 and a floating idler roll 98 are suitably mounted in engagement with the belt 93 and are provided to take up the slack in the belt 93, as required. The floating idler roll 98 is adjusted to regulate the tension in the belt 93, as desired.

Adjustably mounted adjacent the roll 84 on a conveyor is an inclined plate 102, a portion of which is seen in Fig. 1. It is apparent that as the sign S approaches the discharge end of the conveyor belt 32, it contacts the rubber covered roll 84, the uppermost portion of which is positioned higher than the conveyor belt 32. As the sign S contacts the rubber covered roll 84, 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 through the woven wire conveyor belt 32 and into the sphere return hopper 40 from where they are returned to the sphere receptacle 56 by the tube 46. Further movement of the roll 84 carries the sign upwardly until it passes the center of gravity and tilts to the position shown at B in Fig. 1. The inclined plate 102 then guides the sign S thereover onto the conveyor 100 to a suitable discharge point.

The operation of the device is as follows:

A sign S is coated with a binder and is placed face-up on the feed end of the conveyor belt 32, which is traveling at a predetermined speed. The rotor 62 and vibro motor 76 are actuated and are regulated to operate at a speed that is synchronized with the speed of the moving belt. The graded glass spheres to be dispensed onto the surface of the sign are initially dumped into the return hopper 40 from where they are moved through the tube 46 by a suitable supply of compressed air to the sphere receptacle 56. The rotor 62 is operated to deposit the spheres on the platen 72 at a predetermined rate from where they are vibrated into the dispensing hopper 74 by the vibro motor 76 which is pulsed in synchronism with the rotation of the rotor 62. As the platen 72 is vibrated by the vibro motor 76, the spheres deposited thereon are caused to be vibrated into the dispensing hopper 74 from where they are dispensed in a mono-layer through the opening 75 onto the tacky or wet surface of the approaching sign S. The spheres, which do not strike the sign S, fall through the woven wire conveyor belt 32 to the sphere return hopper from where they are returned to the receptacle 56. After the sign S passes under the dispensing hopper 74 and has received the mono-layer of spheres on the surface thereof, it progresses to the discharge end of the conveyor belt 32. At the discharge end of the belt 32, the sign S strikes the roll 84 and is tilted thereby to reclaim the excess spheres deposited on the sign. The excess spheres fall into the return hopper 40 and the sign is carried forward by the roll 84 to the discharge conveyor 100.

Referring now to Fig. 3, a modification of the dispensing device 50 is illustrated therein and includes an inclined glass plate 104. The plate 104 is suitably secured to a side clamping member 106 which is pivoted on a lever 108. The lever 108 is pivoted on a bracket 110 which is firmly attached to the side rails 22, 24. It is apparent that the glass plate 104 can be tilted to any angle desired by moving the lever 108 on its pivot point, which is secured to the bracket 110. In operation, the vibro motor 76 vibrates the platen 72 to drop the spheres from the platen onto the glass plate 104 over which they roll onto a sign S being carried by the woven wire conveyor belt 32.

It is apparent from the above description, that the sphere dispensing apparatus disclosed herein applies a mono-layer of spheres onto the surface of a sign without

5

streaking, distorting or otherwise blemishing the sign surface. Moreover, the amount of spheres applied to the surface of the sign is regulated by synchronously controlling the speed of the conveyor belt carrying the sign, the amount of spheres distributed to the vibrating platen and the rate of pulsation of the vibro motor. The excess spheres deposited on the signs are effectively and efficiently returned to the sphere receptacle automatically and the finished sign is guided to a discharge conveyor for convenient removal thereof.

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 a continuously moving object, means for conveying said object to a dispensing station, means for dispensing said spheres on said object at said dispensing station, said dispensing means having a laterally extending opening formed therein for allowing said spheres to be dispensed on said object in a mono-layer, means for storing said spheres prior to the dispensing thereof, means for distributing said spheres from said storing means at a predetermined rate, said distributing means and said conveying means being synchronously driven to control the amount of spheres dispensed on said object, means for receiving said spheres from said storing means prior to the dispensing of said spheres on said object, and means for vibrating said receiving means, thereby causing said spheres to be transferred from said receiving means into said dispensing means, whereby said dispensing means dispenses said spheres in a mono-layer onto said object at said dispensing station.

2. In apparatus for applying small spheres on an object as set forth in claim 1, wherein said distributing means comprises a rotor which meters the flow of spheres to said receiving means, the amount of spheres metered to said receiving means being proportional to the speed of said conveying means.

3. In apparatus for applying small spheres on an object, means for conveying said object to a dispensing station, means for dispensing said spheres on said object at said dispensing station, means for storing said spheres prior to the dispensing thereof, means for distributing said spheres from said storing means at a predetermined rate, means for receiving said spheres from said distributing means, said distributing means comprising a rotor for metering the flow of spheres from said storing means to said receiving means in predetermined quantities, means for transferring said spheres from said receiving means to said dispensing means at said dispensing station whereby said spheres are dispensed onto said object, and means for reclaiming the spheres not deposited on said object, said reclaiming means including a roll located at the discharge end of said conveying means, the upper portion of said roll being disposed above the level of said conveying means thereby being adapted to tilt said object as it moves from said conveying means over said roll to cause the unused spheres to roll from said object for reclaiming.

4. In apparatus for applying small spheres on an object as set forth in claim 3, wherein said dispensing means includes a hopper having an opening in the lowermost end thereof, said opening being adapted to deposit a mono-layer of spheres on said object as it is conveyed thereunder.

5. In apparatus for applying small spheres on an object, means for conveying said object to a dispensing station, means for dispensing said spheres on said object at said dispensing station, means for storing said spheres prior

6

to the dispensing thereof, means for distributing said spheres from said storing means at a predetermined rate, means for receiving said spheres from said distributing means, said distributing means comprising a rotor for metering the flow of spheres from said storing means to said receiving means in predetermined quantities, means for transferring said spheres from said receiving means to said dispensing means at said dispensing station whereby said spheres are dispensed onto said object, and means for reclaiming the spheres not deposited on said object, said reclaiming means including a roll located at the discharge end of said conveying means, the upper portion of said roll being disposed above the level of said conveying means thereby being adapted to tilt said object as it moves from said conveying means over said roll to cause the unused spheres to roll from said object for reclaiming, said rotor and said conveying means being synchronously driven to control the amount of spheres dispensed on said object.

6. In apparatus for applying small reflecting glass spheres to a roadway sign or the like, means for conveying said sign to a dispensing station, means for dispensing said spheres on said sign at said dispensing station, said dispensing means including an inclined plate for allowing said spheres to be dispensed on said sign in a mono-layer, means for storing said spheres prior to the dispensing thereof, means for distributing said spheres from said storing means at a predetermined rate, means for receiving said spheres from said storing means prior to the dispensing of said spheres on said sign, and means for transferring said spheres from said receiving means onto said inclined plate, whereby said inclined plate dispenses said spheres in a mono-layer onto said sign at said dispensing station.

7. In apparatus for applying small glass spheres on an object, means for conveying said object to a dispensing station, means for dispensing said spheres on said object at said dispensing station, said dispensing means being provided with limited exit means for said spheres whereby said spheres are dispensed onto said object in a mono-layer, means for storing said spheres prior to the dispensing thereof, means for distributing said spheres from said storing means at a predetermined rate, means for receiving said spheres, said distributing means comprising a rotor for metering the flow of said spheres to said receiving means in predetermined quantities, means for vibrating said receiving means thereby causing said spheres to be transferred from said receiving means into said dispensing means whereupon said dispensing means dispenses said spheres through said limited exit means in a mono-layer onto said object, said conveying means and said rotor being synchronously driven to control the amount of spheres dispensed on said object, and sphere reclaiming means for reclaiming the spheres which do not adhere to said object during the dispensing operation, said sphere reclaiming means including a separately driven roll located at the discharge end of said conveying means, the topmost portion of said roll being located above the level of said conveying means, whereby said roll is adapted to tilt said object as it leaves said conveying means to roll off the unused sphere from said object.

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