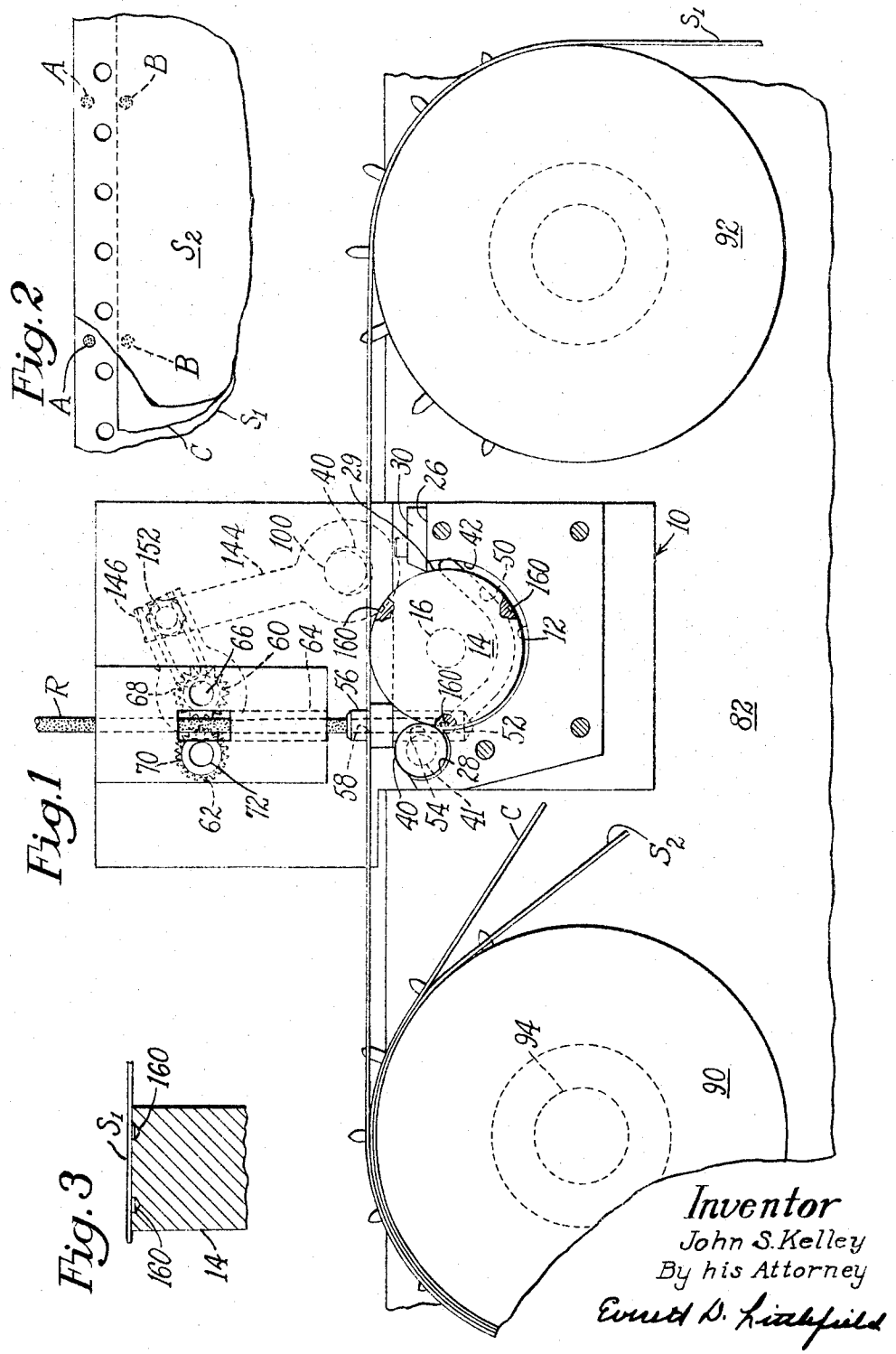
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ADHESIVE APPLYING APPARATUS

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ADHESIVE APPLYING APPARATUS

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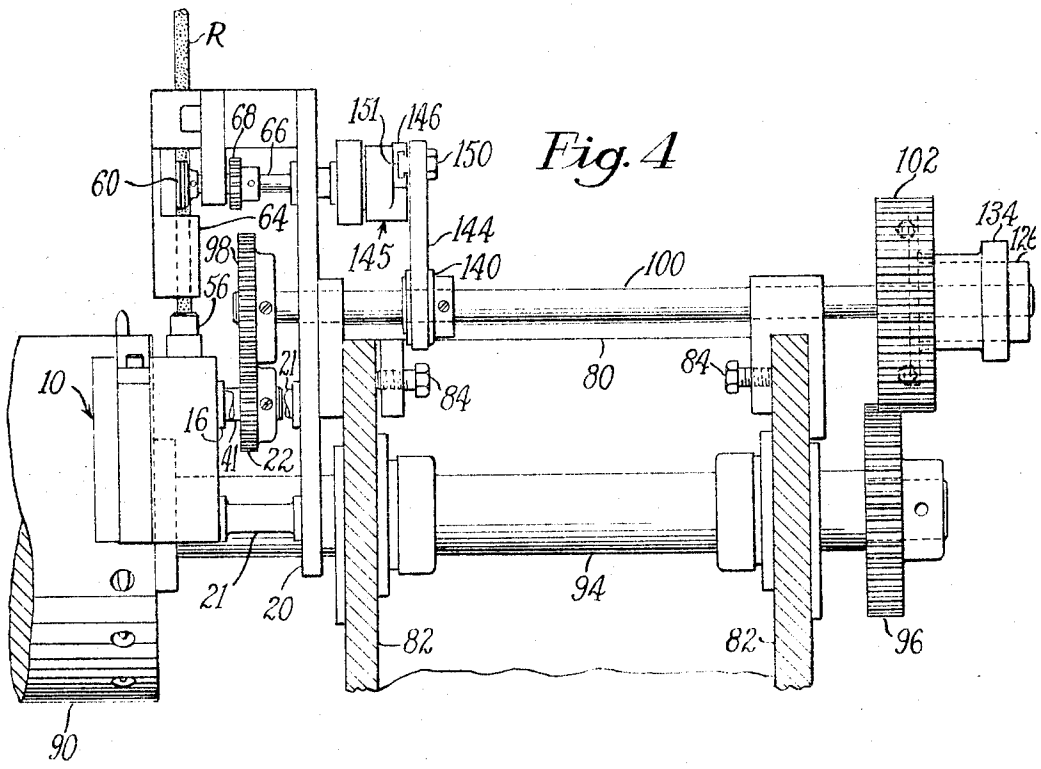


Fig. 4

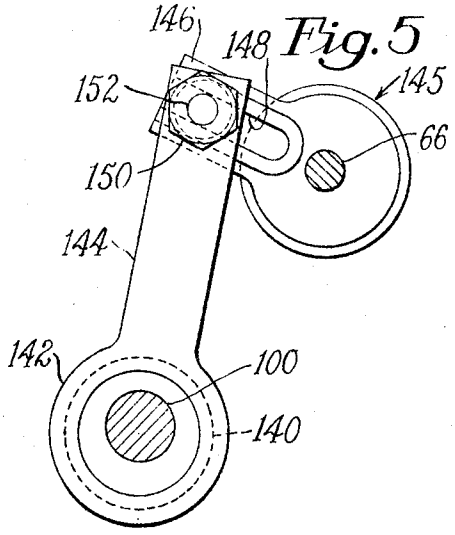


Fig. 5

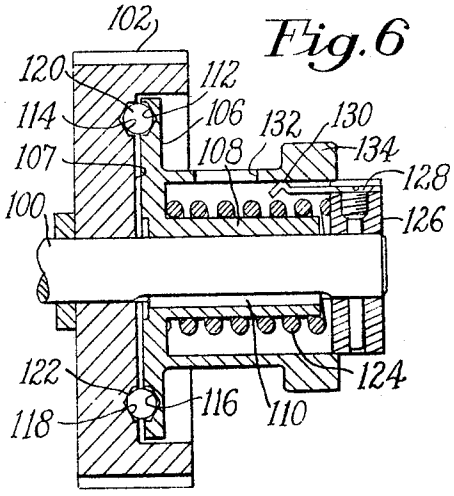


Fig. 6

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Fig. 7

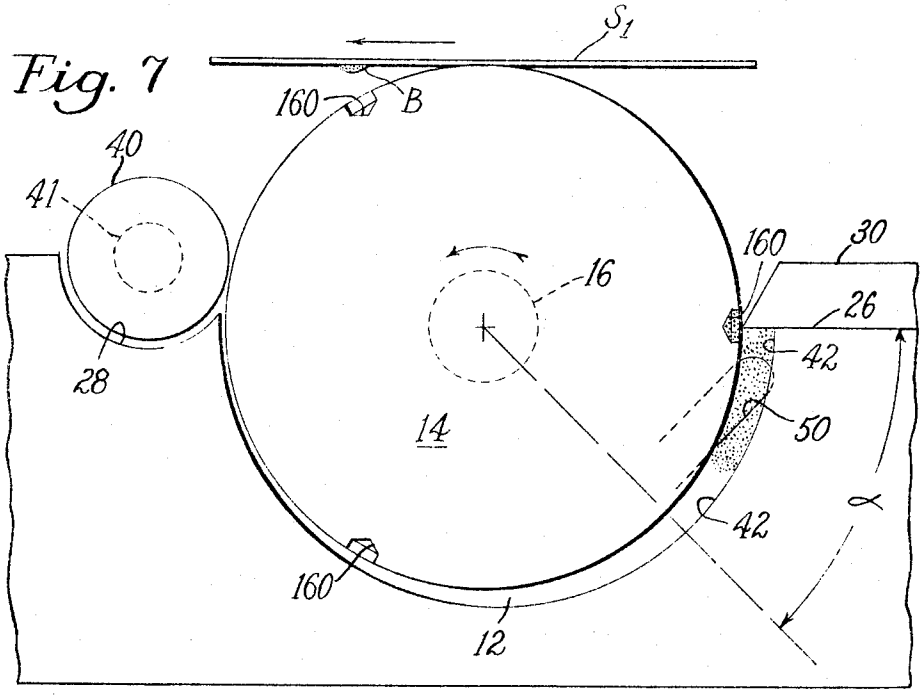


Fig. 8

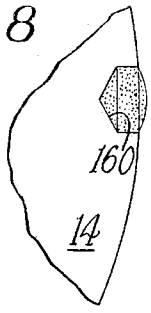
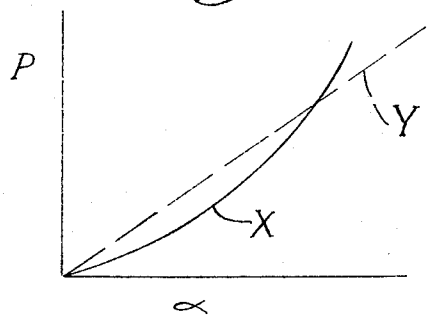


Fig. 9



United States Patent Office 3,272,177 Patented Sept. 13, 1966

3,272,177

ADHESIVE APPLYING APPARATUS

John S. Kelley, Wenham, Mass., assignor to United Shoe Machinery Corporation, Flemington, N.J., a corporation of New Jersey

Filed Nov. 12, 1963, Ser. No. 322,829
4 Claims. (Cl. 118—202)

This invention relates to apparatus for use in applying adhesive and particularly to a novel and improved apparatus of the type in which adhesive is transferred to a work piece from recesses in the peripheral surface of an applicator wheel.

It is a common and well-known procedure to apply adhesive to a work piece, or a series of work pieces, fed along by some sort of a conveyor, in the form of spaced apart dots or spots by means of an applicator wheel of the so-called intaglio type having on its peripheral surface a series of circumferential spaced recesses. These recesses are filled with adhesive by bringing liquid adhesive into contact with the periphery of the applicator wheel, for example, by immersing a part of the wheel in the liquid adhesive or by holding a body of the liquid adhesive against a portion of the periphery of the wheel under pressure, and then removing the excess liquid adhesive from the peripheral surface of the wheel by means of a suitable metering bar.

The patent to Kelley No. 2,787,241 discloses a wheel type adhesive applicator in which the applicator wheel may be provided, if desired, with circumferentially spaced recesses and a suitable metering bar substituted for the conventional rotary doctor roll, when it is desired to use this apparatus for applying molten thermoplastic adhesive as spaced dots or spots. As is explained in the aforementioned patent, in this prior apparatus some means must be provided to control the rate of flow of molten adhesive into a supply recess, located adjacent to the periphery of the applicator wheel, thus to accommodate changes in the rate at which adhesive is being transferred to the work piece, or the work pieces, from the periphery of the applicator wheel. It is an object of this invention to provide an apparatus of this same general type which is not only of a more simple and less expensive construction but also is entirely dependable and satisfactory in operation.

With the foregoing object in view, and in accordance with features of this invention, in the herein illustrated apparatus which comprises a so-called intaglio applicator wheel having a cylindrical operating surface provided with a plurality of adhesive receiving recesses and mounted for rotation in a generally circularly shaped chamber in a heated casing, there are provided a metering member having a sharp or knife edge arranged with its edge substantially in contact with the peripheral surface of the applicator wheel at one end of the circular recess and means for supplying molten adhesive to the recess under pressure. More particularly, the aforementioned chamber is so disposed eccentrically with respect to the axis of rotation of the applicator wheel that the space between the periphery of the wheel and the circular wall of the chamber gradually increases from a minimum radial dimension, at the point where the wheel enters the recess, to a maximum radial dimension adjacent to the metering bar and the means for supplying adhesive to the recesses under pressure comprises suitable passageways formed in the casing and providing an inlet, opening to the outside of the casing, and an outlet opening into the chamber adjacent to the metering bar together with a pair of driven feed wheels for feeding the leading end of a solid rod of adhesive through the inlet and into the passageways where it is melted and delivered through the outlet into the recess at a rate just slightly in excess of

the rate at which molten adhesive would be transferred to a work piece from the wheel with its recesses filled substantially level with the peripheral surface of the wheel. Preferably, and as herein illustrated, the applicator wheel and the rod feed wheels are driven directly from a parent machine which includes means for feeding work, such as a continuous web or sheet of material, past the applicator wheel for the application of spaced dots of adhesive thereto and means are provided for starting and stopping the applicator wheel and the rod feed wheels simultaneously and for varying the speed of the feed wheels relatively to the speed of the applicator wheel.

With this simple and improved arrangement, it has been found, inasmuch as the intaglio recesses can be overfilled by adhesive flowing under the knife edge of the metering bar a considerable variation of the rate at which molten adhesive is fed into the chamber adjacent to the periphery of the applicator wheel can be tolerated without danger of overflowing and the amount of adhesive transferred from the intaglio recesses in the wheel to the work piece or the quantity of adhesive per dot or spot can be varied through a considerable range merely by increasing or decreasing the speed of rotation of the feed wheels while maintaining the same speed of rotation of the applicator wheel. Also, changes in the rate of input of molten adhesive which may occur even with a constant feed wheel speed, due to variations in the volume per unit length of the adhesive rod and/or irregularities in the action of the feed wheels, are readily accommodated without the need of any separate rod feed control mechanism.

The above and other objectives and features of this invention will appear in the following detailed description of the embodiment illustrated in the accompanying drawings and will be pointed out in the claims.

In the drawings,

FIG. 1 is a view in side elevation of a portion of a parent machine having associated therewith an adhesive applying apparatus embodying the features of this invention;

FIG. 2 is a plan view of a portion of a sheet of material to which adhesive has been applied;

FIG. 3 is a view in vertical section of a part of an applying wheel associated with the adhesive applying apparatus;

FIG. 4 is a view in end elevation of the adhesive apparatus and also showing part of the parent machine with certain parts in vertical section;

FIG. 5 is a view in side elevation of a part of a feeding mechanism associated with the adhesive applying apparatus;

FIG. 6 is a view in side elevation of a part of the mechanism for driving the adhesive applying apparatus with certain parts shown in vertical section;

FIG. 7 is a view at an enlarged scale and in side elevation of a portion of the adhesive applying apparatus;

FIG. 8 is a detail view at an enlarged scale of a part of the adhesive applying wheel; and

FIG. 9 is a chart.

Referring to these drawings, an adhesive applying apparatus embodying the features of this invention is shown as associated with a machine for applying spaced groups of dots or spots of adhesive A, B to the marginal portion of a first sheet of paper S_1 to secure this sheet adhesively to the marginal portions of a second sheet of paper S_2 and an interleaved sheet of carbon paper C, see FIG. 1. This adhesive applying apparatus includes an applicator having a casing indicated generally by the reference character **10** and which is shaped to provide a circular chamber **12** adapted to receive a portion of an applying wheel **14**. This applying wheel is carried on a shaft **16** which is journaled in and extends outwardly beyond a wall of the

casing which is mounted on a supporting plate **20** by means of studs **21**, **21**, FIG. 4. The shaft **16** carries a gear, not shown, which meshes with a second gear **22**.

The width of the chamber **12** is substantially the same as the thickness of the wheel **14** and this chamber is eccentrically disposed relatively to the axis of the wheel and is extended radially to supply a flat supporting surface **26** and an arcuate clearance surface **28**. Adjustably mounted on the surface **26** by means including a clamp screw **29** is a metering bar **30**, the screw passing through a slot in the metering bar. A stringer roll **40** is rotatably mounted in the casing **10** on a shaft **41** and cooperates with the surface of the wheel as it re-enters the casing. The above-mentioned gear **22** is carried by the shaft **41**. Because of the eccentric disposition of the chamber **12** with respect to the axis of the applying wheel **14**, the space between the periphery of the wheel and the outer wall of this recess gradually increases in its radial dimension from a point adjacent to the stringer roll to a point adjacent to the metering bar thus to provide a supply chamber **42** for molten adhesive adjacent to the metering bar and for another purpose which will be explained below.

For feeding molten adhesive into the supply chamber **42**, the casing is provided with passageways having an inlet opening outside of the casing and an outlet opening into the supply chamber **42**. These passageways include a generally arcuately shaped recess **50**, cut in one side wall of the casing **10**, one end of which extends somewhat beyond the periphery of the applying wheel **14** to form an outlet opening into the supply chamber. The other end of the recess **50** overlaps a short transverse bore **52**, FIG. 1, which opens into another bore **54** extending upwardly through the top of the casing **12**. Threaded into the bore **54** is an inlet bushing **56** the bore **58** of which provides an inlet opening to the outside of the casing.

Mounted on the supporting plate **20**, above the applicator, is mechanism for feeding the leading end of a solid rod of adhesive R into the inlet bushing **56**. This mechanism comprises a pair of feed wheels **60**, **62** and a guide tube **64**. The feed wheel **60** is carried on a shaft **66** which also carries a gear **68** which is in mesh with a gear **70**. The gear **70** and the feed wheel **62** are carried by a second shaft **72**. The shaft **66** is journaled in and extends through the supporting plate **20**, FIG. 4, which is associated with an auxiliary frame construction indicated generally by the reference character **80** and which is held in place on two spaced apart frame members **82** of the machine on which the adhesive applying apparatus is mounted, by means of clamp screws **84**, **84**.

The parent machine includes the pair of drums **90**, **92** which are driven in synchronism by means of mechanism, not shown, but which includes a shaft **94** associated with the drum **90**, FIG. 4, journaled in the frame members **82**, **82**. This shaft carries at the end opposite to the drum a gear **96** which is in mesh with another gear, not shown, to form part of the aforementioned drive mechanism of the parent machine. The gear **22**, mentioned above as associated with the stringer roll shaft **41**, and meshing with a gear on the applying wheel shaft **16**, also meshes with a gear **98**. This gear is mounted on one end of a shaft **100** which is journaled in the auxiliary frame **80** and which carries at its other end a gear **102** which meshes with the aforementioned gear **96**.

As shown in FIG. 6, the gear **102** is loose on the shaft **100** but is drivingly connected thereto by means of an overload release clutch comprising a disc-like flange **106** formed integrally with a hub portion **108** which is slidably mounted on the shaft **100** and connected thereto by means of a key **110**. The side face of the flange **106** and an oppositely facing radial surface **107** on the gear **102** are formed with two sets of complementary semi-spherical recesses **112**, **114** and **116**, **118** and received in these recesses are balls **120**, **122**. These balls are retained in recesses **112**, **116** by a slight peening over of the marginal portions of these recesses after the bolts are installed. A compression spring **124** interposed between an inner portion of the flange **106** and a collar **126**, secured to the outer end of the shaft **100** by means of a setscrew **128**, normally holds the parts in the positions in which they are shown in FIG. 6, thus connecting the shaft **100** to the gear **102**. However, when the torque load on the gear **102** reaches a predetemined maximum value, the plate **106** will be forced to the right by the camming action of the balls **120**, **122** on their respective semi-spherical recesses until a spring latch **130** engages one end of a slot **132** in an outer hub portion **134**, and by a camming action further moves flange **106** to a point at which the space between the flange and the surface **107** is slightly greater than the depth of the spherical recesses, thereby releasing the gear from the shaft **100**. When the torque load has been reduced to a lower and safe value, the connection between the gear **102** and the shaft **100** may be re-established by manually pushing the hub portion **134** to the left, thus camming the latch **130** downwardly and restoring the parts to the positions shown in FIG. 6. It will be observed that the balls **120**, **122** together with their cooperating recesses are disposed at different radial differences from the axis of the shaft **100**. Accordingly, when the gear **102** is connected to the shaft **100** it will always assume the same angular position thereon. It will also be noted that, in the absence of an excess torque load, the gear **102** may be disconnected from the shaft **100** by pulling the hub portion **108** to the right until the latch **130** engages in the slot **132**.

Referring to FIG. 4 the shaft **100** carries an eccentric **140** on which there is mounted an eccentric strap **142** and a connecting rod **144**, FIG. 5. Mounted on the shaft **66** is a one way clutch mechanism of conventional design and indicated generally by the reference character **145**. Associated with this one way clutch mechanism is a radial arm **146** which is provided with a T-slot **148** in which there is adjustably mounted, by means of a clamp nut **150**, a block **151** carrying a stud **152**. The upper end of the connecting rod **144** is journaled on the stud **152** and, with this arrangement, the feed wheels are rotated through a small angle during each revolution of the shaft **100** and the solid rod of adhesive R is advanced a corresponding amount. By loosening the clamp nut **150** and changing the radial position of the stud **152**, the rate at which the solid rod of adhesive is fed into the bore **58** of the inlet bushing **56** may be increased or decreased, as desired.

For applying adhesives to the sheet S_1 in the form of groups of spaced dots A and B, the applying wheel **14** has its peripheral surface formed with three sets of axially spaced recesses **160**, **160**, each recess being shaped substantially as is shown in FIGS. 3, 7 and 8. When the parent machine is in operation, the sheet S_1 passes over the applying wheel **14** at a predetermined linear speed and as each set of axially spaced recesses passes by in contact with the sheet, a predetermined portion of the molten adhesive in these recesses will be transferred to the sheet, see FIG. 7, thereby producing a set of dots A and B.

Inasmuch as the molten adhesive enters the supply chamber **42**, in the immediate vicinity of the metering bar **30**, the recesses **160**, **160** on the wheel **14** will be filled with adhesive as the wheel rotates and the amount of molten adhesive thus picked up by each recess will vary in accordance with the pressure of the adhesive in the supply chamber **42** in the immediate vicinity of the metering bar **30**. In other words, when the pressure of the molten adhesive in the supply chamber **42** is relatively low, each recess **160** will be filled to a level substantially corresponding to the peripheral surface of the wheel, excess adhesive being removed by the action of the metering bar **30** the operating edge of which is substantially in contact with the periphery of the wheel **14**. However, as the

pressure of the adhesive in the vicinity of the metering bar increases, each recess picks up a little more adhesive until, with a relatively high pressure of the adhesive in the vicinity of the metering bar, each recess will be substantially overfilled, as illustrated in FIG. 8. Under these conditions, each dot A and B will contain a larger volume of adhesive and the rate of transfer of adhesive from the supply chamber **42** to the sheet S_1 will correspondingly increase.

On the other hand, the pressure of the adhesive in the vicinity of the metering bar **30** depends on several variables including the viscosity of the adhesive, speed of the wheel **14** and the degree to which the supply chamber **42** is filled back from the metering bar **30**. In the latter connection, it will be understood that because of the viscosity of the molten adhesive and the direction of rotation of the applying wheel **14**, the supply chamber **42** will gradually fill back from the metering bar in the direction indicated by the angle "α" and against the direction of rotation of the wheel. FIG. 9 illustrates two curves X and Y resulting from a plotting of the pressure of the adhesive P, adjacent to the metering bar **30**, against the angle "α" of filling of the chamber **42**. Curve X represents the pressure conditions which will exist when the chamber **12** is eccentrically disposed with respect to the axis of the wheel **14** so that the supply chamber decreases in radial dimension as it extends backwardly from the bar **30**, while the curve Y represents conditions existing when the recess is concentric with the axis of the wheel **14** and the supply chamber is of uniform radial dimension.

With the novel arrangement which has been described, it is possible to select a rate of feed of the rod R by suitable adjustment of the radial position of the stud **152**, FIG. 5, such that the rate of feed of molten adhesive into the supply chamber **42** is just slightly in excess of the rate at which molten adhesive is removed from the chamber **42** and applied to the sheet S_1 when the recesses **160, 160** are filled substantially level with the peripheral surface of the wheel. Now, as the chamber **42** begins to fill back in the direction of the angle "α," the pressure of the molten adhesive adjacent to the metering bar also increases so that the recesses **160, 160** become slightly overfilled and more adhesive is transferred to the sheet S_1 in the form of larger dots A and B. Soon a balanced condition will be reached and the rate of feed of the rod will exactly correspond to the rate of transfer of adhesive. Thus, a self-regulating system is provided without the need for a more complicated or expensive rod feed control mechanism. Moreover, within reasonable limits, it is possible to increase the rate of transfer of molten adhesive above the aforementioned minimum rate and thus to increase the quantity of adhesive in each adhesive dot A and B by suitable adjustment of the radial position of the stud **152** to increase the rate of feed of the rod.

It will be observed that the automatic regulating action just referred to is considerably enhanced by the herein illustrated embodiment wherein the recess **12** is eccentrically disposed with respect to the axis of the wheel **14** and to be more effective, the eccentricity could increase faster, thus to provide a more abrupt pressure rise. This is because pressure of the adhesive does not increase at first at quite as rapid a rate (see curve X) as would be the case with the recess **12** concentric with the axis of the wheel (see curve Y). In other words, during the initial overfeeding of the rod R, pressure of the adhesive and hence the rate of transfer of adhesive increases rather slowly. This assures an adequate supply of molten adhesive in the reservoir before balance is reached. However, the curve X soon becomes steeper as the overfilling continues and the compensating action of the overfill of the recesses **160, 160** soon accomplishes the desired balanced condition.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. Apparatus for applying adhesive to work pieces comprising an intaglio applicator wheel having a cylindrical operating surface and provided with circumferentially disposed recesses, a heated casing formed to provide a chamber having a circular shaped wall and oppositely facing side walls, means mounting the applicator wheel for rotation in the casing between said side walls and with its peripheral surface adjacent to said circular shaped wall of the chamber, a metering bar having an operating edge mounted on the casing between said circular shaped wall and said cylindrical operating surface with said operating edge substantially in contact with the peripheral surface of the applicator wheel at the leaving end of said chamber, means for driving the wheel in a direction such that its operating surface moves along the circular shaped wall of the chamber toward said metering bar, and means for supplying molten adhesive to said chamber in a location closely adjacent to said metering bar under pressure and at a minimum rate just slightly in excess of the rate in which molten adhesive would be transferred to a work piece from the applicator wheel with the recesses therein filled substantially level with the peripheral surface of the wheel, and means for increasing the rate at which molten adhesive is supplied to the chamber above said minimum rate to cause molten adhesive to accumulate in the chamber reversely from the metering bar against rotation of the wheel and pressure of the molten adhesive adjacent to the metering bar to increase, whereby the recesses in said wheel are overfilled with adhesive, under the increased pressure, and the rate of transfer of adhesive to a work piece is correspondingly increased.

2. Apparatus according to claim **1** wherein the wheel is disposed eccentrically with respect to said chamber so that its peripheral surface is closer to the circular wall at the entering side of the chamber than at the leaving side thereof adjacent to said metering bar so that the rate at which pressure of the molten adhesive increases becomes greater as the chamber fills back from the metering bar reversely against the rotation of the wheel.

3. Apparatus for applying adhesive to work pieces comprising an intaglio applicator wheel having a cylindrical operating surface and provided with circumferentially disposed recesses, a heated casing formed to provide a chamber having a circular shaped wall, and oppositely facing side walls, means mounting the applicator wheel for rotation in the casing between said side walls and with its peripheral surface adjacent to said circular shaped wall of the chamber, a metering bar having an operating edge mounted on the casing between said circular shaped wall and said cylindrical operating surface with said operating edge substantially in contact with the peripheral surface of the applicator wheel at the leaving end of said chamber, means for driving the wheel in a direction such that its operating surface moves along the circular shaped wall of the chamber toward said metering bar, and means for supplying molten adhesive to said chamber under pressure in a location closely adjacent to said metering bar at a minimum rate just slightly in excess of the rate in which molten adhesive would be transferred to a work piece from the applicator wheel with the recess therein filled substantially level with the peripheral surface of the wheel, said means comprising passageways formed in the heated casing providing an inlet opening to the outside of the casing and an outlet opening into the chamber, a pair of feed wheels for feeding the leading end of a solid rod of adhesive into the inlet end and through said passageways where it is melted and delivered from the outlet into said chamber under pressure, means driven from the means for driving the applicator wheel for driving said feed wheels, and means for varying the speed of said feed wheels relatively to the speed of the applicator wheel to

increase the rate at which molten adhesive is supplied to the chamber above said minimum rate to cause molten adhesive to accumulate in the chamber reversely from the metering bar against the rotation of the wheel, and pressure of the molten adhesive adjacent to the metering bar to increase, whereby the recesses in said wheel are overfilled with adhesive, under the increased pressure, and the rate of transfer of adhesive to a work piece is correspondingly increased.

4. Apparatus according to claim 3 wherein the wheel is disposed eccentrically with respect to said chamber so that its peripheral surface is closer to the circular wall at the entering side of the chamber than at the leaving side thereof adjacent to said metering bar so that the rate at which pressure of the molten adhesive increases becomes greater as the chamber fills back from the metering bar reversely against the rotation of the wheel.

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CHARLES A. WILLMUTH, *Primary Examiner.*

LEON G. MACHLIN, *Assistant Examiner.*