Aug. 21, 1962 J. G. YAHNKE ET AL 3,050,416

METHOD OF PREVENTING OFFSET ON A FRESHLY PRINTED SHEET

Filed May 27, 1957 2 Sheets-Sheet 1

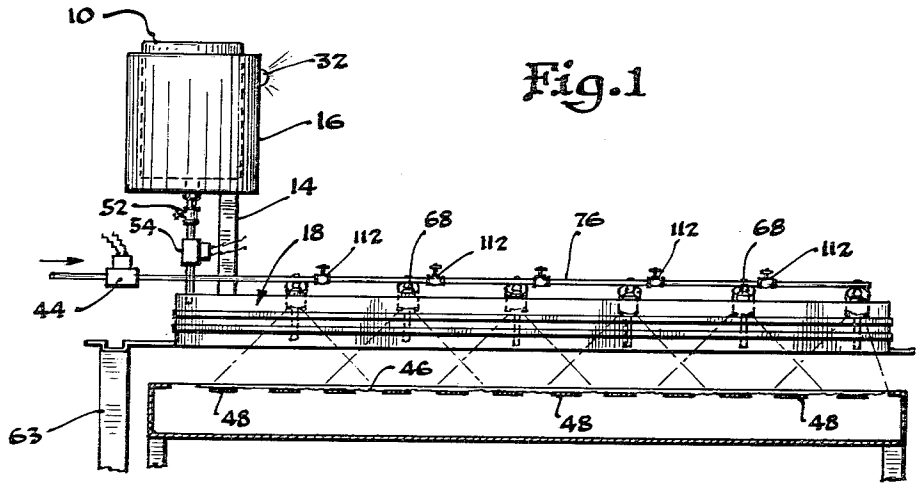

Fig. 1

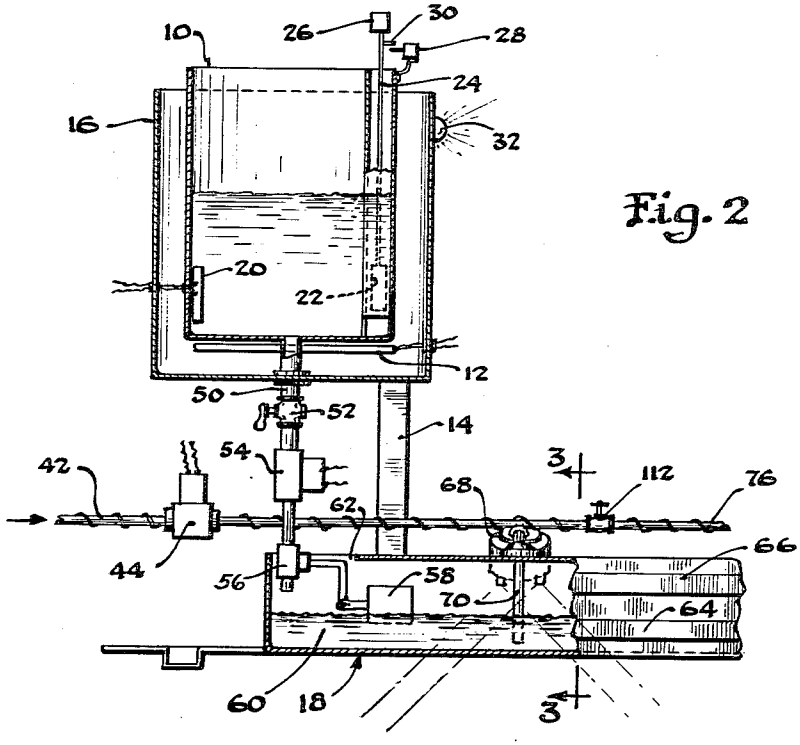

Fig. 2

METHOD OF PREVENTING OFFSET ON A FRESHLY PRINTED SHEET

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Fig. 3

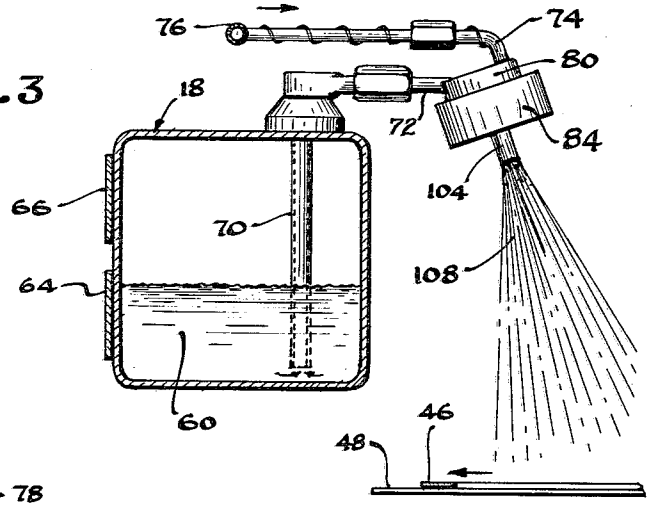


Fig. 4

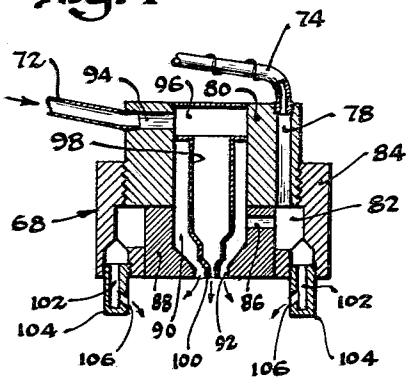


Fig. 5

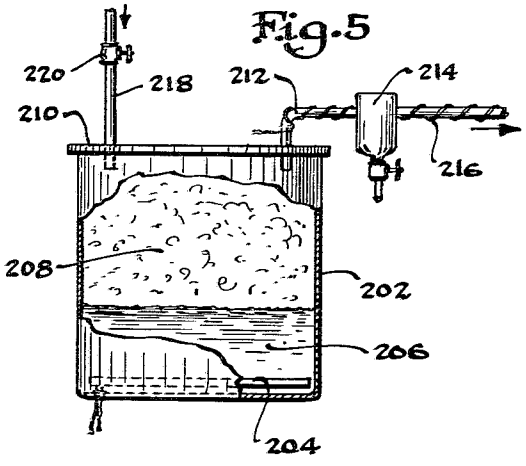
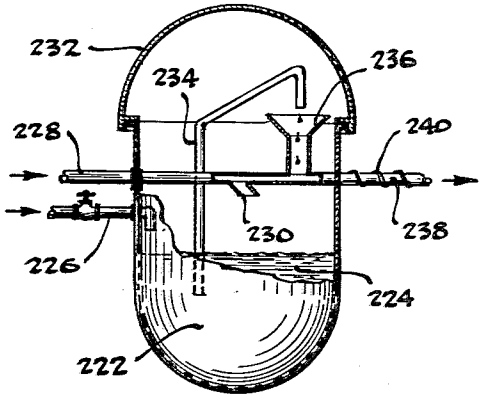


Fig. 6



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3,050,416
METHOD OF PREVENTING OFFSET ON A FRESHLY PRINTED SHEET

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3 Claims. (Cl. 117—104)

This invention relates to an improved method for spraying molten liquids and more particularly to the prevention of offset by the use of said method.

In the high speed printing of paper board and carton stock the problem of offset has always been a considerable limitation on the speed of printing and the size of loads. Dry powders have been dusted on the printed sheet to prevent offset but these are inefficient and create dust problems. Recently wax has been sprayed and is an improvement but there is still room for further improvement.

It is a principal object of this invention to provide a wax spray that is not subject to present day disadvantages.

A further object is to provide an improved method for preventing offset by an application of a siphon spraying technique.

These and other objects and advantages of the invention will become apparent upon a reading of the following detailed description of the invention taken in conjunction with the accompanying drawings in which:

FIGURE 1 is an elevational view of one embodiment of a spray device according to the invention;

FIGURE 2 is a view partly in vertical section and partly in elevation of the supply and control elements of a device according to the invention;

FIGURE 3 is a sectional view taken along the lines 3—3 of FIG. 2;

FIGURE 4 is a cross-sectional view through one embodiment of a spray head according to the invention;

FIGURE 5 is a cross-sectional view through one embodiment of a steam generator according to the invention, and

FIGURE 6 is a cross-sectional view through another embodiment of the invention showing a vaporizing device.

In the accomplishment of the foregoing objects and in accordance with the practice of this invention there is now provided a device for spraying molten waxes which comprises a heated supply tank for said waxes, an elongated, heated container for hot wax positioned adjacent an object to be sprayed, means connecting said tank with said container, siphon spray means mounted adjacent said container and adapted to withdraw wax therefrom in response to the passage of compressed moisture bearing gas through said means, and means for starting and stopping the flow of said compressed gas, preferably by remote control actuated by the passage of an object to be sprayed past a reference point.

The means connecting the tank with the container is preferably adapted to maintain a constant level of liquid in the container, as by a float controlled valve. The container is open to the atmosphere and may have one or a plurality of siphon spray heads extending therein and being supplied therefrom.

There is also provided a method for spraying a hot liquid wax which comprises heating a supply of wax such as molten paraffin wax, passing said liquid into an elongated container positioned adjacent an object to be sprayed, siphoning liquid wax from said container into a spray nozzle by passing compressed moisture bearing

gas past the end of said nozzle, mixing the gas and liquid wax after emission from the nozzle, and directing said mixture onto an object to be sprayed.

Further in accomplishment of the foregoing objects and in accordance with the invention there is now provided a method of siphon spraying of molten wax which comprises siphoning a stream of molten wax from a supply and simultaneously dispersing the stream into small particles by means of moisture bearing compressed gas.

By "moisture bearing compressed gas" is meant compressed air which is carrying more moisture than is normally present in air at atmospheric pressure and normal humidity. The amount of moisture in the "moisture bearing compressed gas" is preferably somewhere near the saturation point of the air under given conditions of temperature and pressure. It is also intended that this term shall include compressed steam which is considered in the broad sense to be a gas and is moisture bearing in the gaseous phase.

An important bonus feature of this invention is that the dispersion of wax in steam or moist compressed air not only is highly effective in preventing offset by physically separating one sheet from another, but the water in the steam or moist compressed air actually causes the ink to dry faster before it can blot on the overlying sheet. This is especially noticeable when the ink is one which is set by water, such as inks sold under the tradenames Aquaset, Vaposet, Hidry, Moistureset and the like. It is also true of varnish inks and oil inks. While the reason is not fully understood it is the tentative theory that the condensing steam and water vapor cause rapid cooling of the surface of the ink upon contact therewith and cause the ink to set harder and faster. The thin film of water that condenses on the surface of the ink interferes with the affinity of the ink for the sheet on top of it.

Another bonus obtained through the use of steam or moist compressed air is that the moisture thus released to the air around the press stops the formation of static electricity in dangerous amounts. Static electricity around the press and on the printing stock has been one of the most troublesome problems in printing.

Of course a major advantage of using steam is that it keeps the apparatus free of solidifying deposits of wax and prevents clogging, plugging and the resulting stoppage of the flow of wax through the machine, as usually the temperature of the steam will equal or exceed the melting point of the wax that is being sprayed. Naturally the steam may be superheated and a certain amount of superheating is encouraged by wrapping all of the steam pipes with electrical heating wires or strips. Also one may spray higher melting waxes using high temperature steam.

In one embodiment of the invention for instance steam at 10 pounds per square inch gauge pressure is employed. It has a temperature of about 240° F. which easily maintains waxes up to 240° melting point in molten condition. If the pressure is increased to 20 pounds p.s.i.g. the temperature of the steam will be about 259° F., and so forth with 100 pound p.s.i.g. steam having a temperature of about 338° F. It will be recognized that the temperature of the molten wax will be maintained safely above its melting point. It is not, however, necessary to keep the wax far above its melting point when using steam because the steam prevents clogging due to cooling of the wax as it passes through the spray head. This enables one to operate the steam process effectively at lower wax temperatures than in the compressed air process. Lower wax temperature is more economical, safer and minimizes oxidation and discoloration of the wax.

Considering the drawings in greater detail the device illustrated in FIGS. 1 and 2 consists of a heating and sup-

ply tank 10 which is heated by the electrical element 12 or other suitable, readily controllable source of heat. The tank is contained within a shell 16 which in turn is mounted on the support member 14 above the hollow supply bar 18. A thermostatic control 20 is positioned within the tank 10 and is connected to the heating element 12 to maintain the contents of the tank at a predetermined temperature. A float 22 is provided within said tank and is connected by a rod 24 to a signal element 26. A switch 28 is adapted to be closed by a finger 30 attached to the rod 24 and to energize an indicating light 32 mounted on the shell 16 or at any suitable remote location.

The moisture bearing compressed gas (steam) originates in a boiler or vaporizer (see FIGS. 5 and 6) and passes through the pipe 42 to the solenoid operated valve 44 which is adapted to be opened and closed in response to an electrical stimulus from a remote location. In the present case the stimulus is provided by the actuation of an electrical switch (not shown) by the passage of a sheet of material to be printed past a determined location. For instance a sheet of paper or cardboard 46 (FIG. 1) carried on a web or conveyor 48 can be used to trip a biased lever (not shown) and actuate the switch, signalling through the solenoid to the valve 44 and opening said valve to pass gas to the sprayers. When the sheet 46 has passed the reference point the lever returns to initial position, shutting off the supply of gas to the sprayers as will be explained in more detail later. As another embodiment of the idea one may employ an electronic "eye" and beam of light which is interrupted by the passage of a sheet through the beam, and the interruption being used by conventional methods to actuate the solenoid valve 44.

A supply of heated liquid such as molten paraffin wax is prepared in the tank 10 and passes through the pipe 50 and the manually operated valve 52 to the solenoid operated valve 54 which is so connected to the operating switch (not shown) of the printing press that said valve will be open when the press is running but will close when the press stops. This is a safety feature to prevent accidental overflow of wax from the supply bar 18 onto the press frame and mechanism.

The molten wax passes from the solenoid valve 54 to a discharge valve 56 (FIG. 2) which is controlled by a lever system originating in the float 58. The float rides on the surface of the liquid 60 in the supply bar 18 and as the liquid is used up the float opens the valve 56 and allows more liquid to enter from the tank 10. In preferred practice the bar 18 is substantially square and is maintained about half-full of liquid during operation. In one embodiment the bar 18 is about 2 inches square and about 1 inch of molten paraffin is maintained during operation. An opening 62 is provided in one end of said bar 18 to admit the float 58 and the discharge valve 56, and to vent the bar so that the sprayers may function properly. The bar is supported as at 63.

Strip heating elements 64 and 66 are attached to a side of the bar 18, preferably to the side opposite the spray nozzles although other locations may be suitable also. One of the elements, usually the lower, 64 is connected in parallel with the heater 12 of the tank 10 so that the bar 18 will operate at substantially the same temperature as the tank. The other of the elements, usually the upper, 66 is connected to a timing device and is used principally as a heating-up or preheating aid. For example, the timer may be set to turn on the element 66 about 30 minutes before the press and spray unit are expected to be in operation.

Coming now to the spraying element itself there is illustrated in FIGS. 1, 2 and 3, a spray head 68 (or several of them) which is mounted on the bar 18, and a conduit 70 extends from said head to a point beneath the surface of the liquid 60. The head 68 has service lines 72 for liquid and 74 for compressed moisture bearing gas, and the latter is connected to a service main 76 which communicates with the solenoid valve 44.

FIG. 4 shows the structure of the spray head 68 in cross-sectional detail. Compressed gas is conveyed to the head 68 through the line 74 and passes through a conduit 78 in the upper portion 80 of the head. The conduit 78 communicates with a chamber 82 formed between the lower ring 84 of the head and the upper portion 80. A small hole 86 is provided in the inner element 88 (or a plurality of holes may be provided if desired) and connects the chamber 82 with an inner air chamber 90. Compressed gas leaves the chamber 90 by the small circular opening 92 in the element 88.

Molten wax or other hot liquid is sucked up through the conduit 70 from the liquid supply in the bar 18 (FIG. 3). Said wax passes through the pipe 72 to the spray head 68 and enters the head through the opening 94. A chamber 96 is formed by the restrictive unit 98 which graduates stepwise from larger to smaller size at the discharge end. The gas rushing past the nozzle opening 100 creates a vacuum which draws molten wax from said nozzle and sprays it outwardly from the head 68.

Compressed moisture bearing gas also passes from the chamber 82 into the openings 102 in the center of the protruding elements 104. Gas escapes from said element through a single angled opening 106 in each and the stream of gas so emitted passes through the cone of gas and wax issuing from the center of the head and spreads said cone to a wide but rather thin spray pattern. In FIG. 3 for instance the spray pattern 108 is shown depositing wax on the paper 46 being carried through said pattern by the conveyor 48.

In an operation of the device one charges the material to be heated, such as paraffin wax, or a mixture of paraffin and synthetic waxes, into the tank 10. Wax is put into the tank 10 in the form of flakes, blocks or chips. Current is applied to the heating element 12 to melt the wax and current is simultaneously applied to the heating element 64 on the bar 18 to preheat the bar 64 and the spray nozzle assembly. If the device is being put back into operation after sitting overnight with wax in it, a timer may be preset to supply current to the preheat element 66 on the bar 18.

When the wax in the system is molten and at proper operating temperature (between about 110° F. and 400° F.) the press is started and printing of sheets is begun. When the first sheet passes a predetermined reference point it actuates a lever or cuts a beam of light thereby energizing a switch (not shown) which closes the circuit and energizes the solenoid valve 44 to admit compressed moisture bearing gas from a source to the gas system of the device. Compressed gas passes through the pipe 76 to the individual spray head 68 which, incidentally, can be closed off by means of the valves 112 (FIGS. 1 and 2) so that one or any desired number of spray heads can be operated at will.

As compressed gas passes through the spray head 68 it creates a vacuum on the wax discharge nozzle 100 and draws wax from the supply in the bar 18 to the nozzle. Here the wax is atomized into tiny globules which solidify in the air before striking the sheet of paper 46. The tiny wax pellets adhere to the printed sheet and successfully prevent offset of the partially dried printing ink and stricking of the sheets to one another. The wax pellets provide a desirable feel and gloss to the sheet and cause the sheets to slide over one another with ease. In addition the coating of wax particles prevents rubbing off of ink after it has dried.

When molten wax is withdrawn from the bar 18 the supply will be continually replenished by the action of the float activated valve 56 which allows wax to drain from the tank 10. When the supply in the tank becomes low the float gauge turns on the indicator light and warns the operator to put more wax in the tank.

When the end of the printed sheet which may, of

course, be quite small or may range in size up to a large roll of paper or the like, passes the predetermined reference point the lever (biased) or the electric beam will energize the solenoid valve **44** to close and stop the flow of compressed gas to the spray heads. The heads will stop spraying instantaneously thereby providing one of the significant advantages of this apparatus. That is, the spray is stopped instantaneously with no over-spraying beyond the paper sheet and no dripping. This occurs because the wax is being drawn up to the spray nozzle **100** by vacuum and the instant the vacuum is broken the weight of the column of wax in the pipe **70** tends to pull the wax back from the nozzle into the bar **18**.

As previously indicated the molten wax issuing from the nozzle **100** solidifies quickly in the air and strikes the sheet in the form of tiny globules, adhering to the sheet.

While the device illustrated in the accompanying drawings is shown operating over the paper sheet it will be apparent that the device may be so mounted that the spray heads spray the wax onto the bottom of a sheet passing over them, or onto a sheet passing alongside or in front of the device.

The use of steam or moisture bearing compressed air is a great advance over older methods. First, it prevents clogging by solidifying wax. Secondly, it makes feasible the use of higher melting waxes. Thirdly, it speeds up the setting of printing inks and particularly the setting of vapor-setting type inks.

In FIG. 5 one form of steam generator is shown. It consists of a vessel **202** in the bottom of which is a heating element **204** (electrical). Water **206** is heated to boiling and steam **208** forms in the upper part of the vessel **202**. A flanged lid **210** seals the vessel and contains the steam which discharges through the line **212**, and through the trap **214** to the solenoid valve **44** in the device illustrated in FIGS. 1 and 2. The steam is kept from condensing by heating the discharge line **212** by means of an electric heating strip **216** or wire wound around the line. The stream may also be superheated by said heating strip **216** and the temperature and pressure of the steam may be substantially raised for more effective operation. Water is added through the line **218** and controlled by the valve **220**, which may be more elaborately arranged with a float actuator to provide continuous or automatic admission of water.

A device for adding moisture to compressed air is shown in FIG. 6. A cup **222** is adapted to contain water **224** which may be added through the pipe **226**. Compressed air enters through the line **228** and a portion of it is bled off through the opening **230** into the chamber formed by the cup **222** and the dome **232** which may be of transparent plastic or glass. Since the chamber is sealed and the air is under pressure, force is exerted on the surface of the water **224** which tends to force some of the water up the tube **234** where it discharges dropwise or in a small stream into the receiver **236**. From the receiver the water falls into the main stream of air passing through the line **228** where it is atomized and carried to the solenoid valve **44** on the device shown in FIGS. 1 and 2. The moisture bearing compressed air may be prevented from condensing by heating the discharge pipe **238** by means of the wound strip heater or wire **240**. In order to increase the moisture bearing capacity of the compressed air entering the line **228** it may be desirable to preheat the air by suitable means (not shown). By using a large amount of electrical energy or equivalent source of heat at the discharge line **238** one may cause some or all of the entrained water to flash into steam, and thereby to raise the water vapor pressure in the moisture bearing compressed air to optimum levels.

The device illustrated in FIG. 6 may also be used to add a light oil to the spray system, or an emulsion of oil and water. Oil is useful in adding lubrication in the case where the spray system is being used to lubricate metal or plastic sheets for deep draw stamping. For this purpose one may also add oil to the molten wax prior to spraying.

The solenoid valve **44** is shown herein as providing positive control over the supply of air admitted to the spray heads. In another embodiment (not shown) it has been found desirable to have a by-pass around the valve **44** that is adjusted to bleed a small amount of air or steam into the gas supply line and to the spray heads to keep them clear and clean.

The amount of wax deposited on the sheet can be varied at will simply by increasing or decreasing the gas pressure on the system. Increasing the gas pressure causes a greater volume of gas to pass through the nozzle, thereby drawing or siphoning a larger amount of wax. Decreasing the gas pressure of course has the opposite effect.

Among the materials which can be spray coated according to this invention are paper, cardboard, carton stock, plastic sheeting, pressed hardboard, metal sheets or metal-to-plastic bonded and laminated sheets. The use in lubricating metal sheets such as aluminum sheets for deep-draw forming is especially interesting but it should be understood that other non-ferrous metals, as well as ferrous metals may also be very effectively lubricated for severe forming operations such as deep-drawing. In some cases it may be desirable to spray-coat both sides of a sheet before forming or stamping.

It will be apparent from the foregoing description of the invention that there is now provided a type of wax spray device which has features of design, control and operation not heretofore known to the art.

In the foregoing description the term "wax" is intended to cover a particular class of materials and is not limited to paraffin wax.

In addition to molten paraffin wax it is possible in the practice of this invention to spray other molten materials such as the molten vegetable waxes (carnauba), beeswax, the normally solid synthetic waxes of the polyethyleneglycol type and other synthetic waxy substances such as the material sold under the trade name "Polymekon" wax. Another important class of materials useful in this invention are the synthetic plastics which are molten (liquid) at higher temperatures somewhat above room temperature, but are solids at room temperature. Polyethylene, nylon and a large variety of other synthetic plastics have the desired characteristics and are useful either alone, in admixture with each other, or admixed with any of the natural or synthetic waxes.

The synthetic plastics have the advantage of being compatible with printing inks and be printed over quite well.

Others may practice this invention in any of the numerous ways which will be suggested to one skilled in the art upon reading this description. All such practice of the invention is intended to be covered hereby provided it falls within the scope of the appended claims.

We claim:

1. In the method of preventing offset on a freshly printed sheet, the steps of melting a wax, introducing water into a flowing stream of compressed air to increase the water vapor pressure thereof, siphoning said molten wax into a wax conduit by means of said stream of substantially moisture saturated moisture bearing compressed air discharging past the open end of said wax conduit, mixing said air and said molten wax outside of said conduit upon discharge therefrom and simultaneously dispersing said wax into small particles by the action of said air, and depositing said particles on said sheet.

2. The method of claim 1 wherein the moisture bearing compressed gas is steam.

3. The method of preventing ink offset which comprises simultaneously setting the ink and applying a protective layer of wax particles thereover by spraying a stream of molten wax and simultaneously dispersing said stream into small particles by means of compressed steam.

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