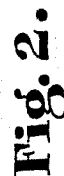


Aug. 2, 1966 **W. G. POYNTER** **3,263,606**
MULTICOLOR PERFECTING PRESS HAVING AN OFFSET BLANKET WITH
ELECTROMAGNETIC SUPPORT MEANS

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2 Sheets-Sheet 1



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2 Sheets-Sheet 2

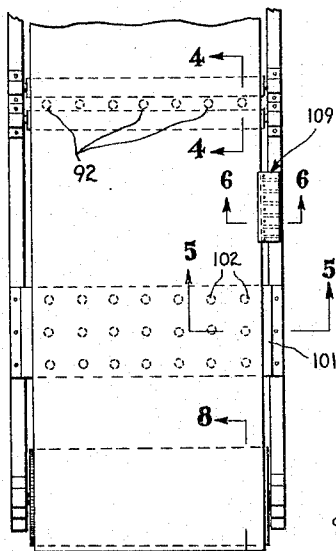


Fig. 3.

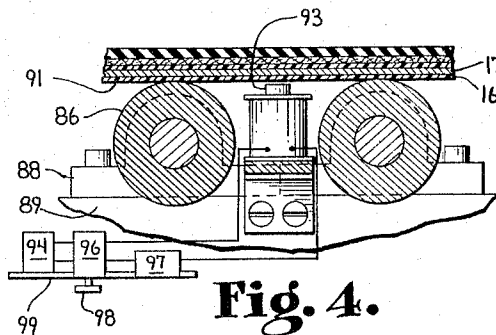


Fig. 4.

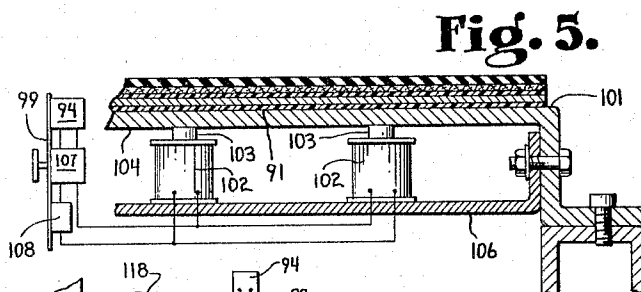


Fig. 5.

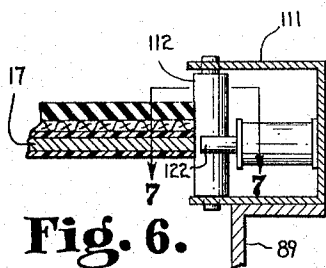


Fig. 6.

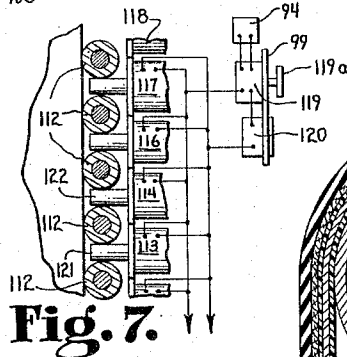


Fig. 7.

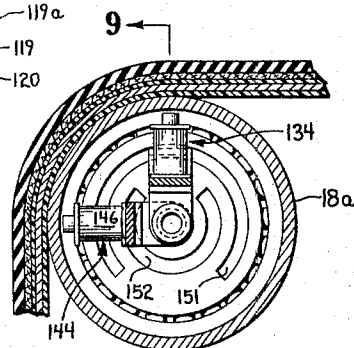


Fig. 8.

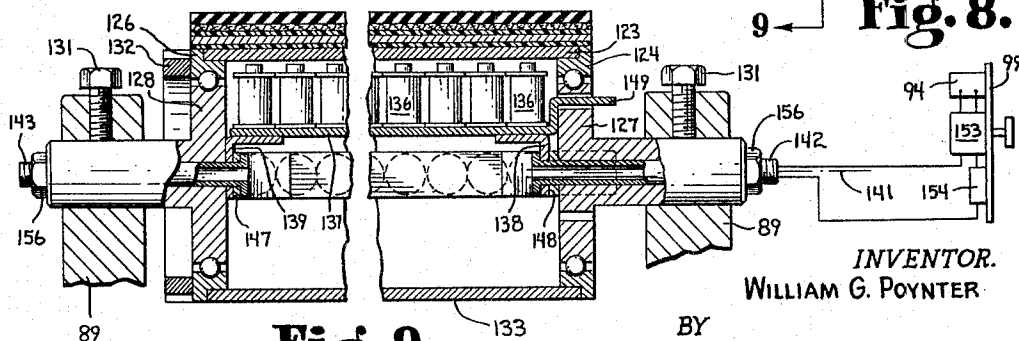


Fig. 9.

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3,263,606

MULTICOLOR PERFECTING PRESS HAVING AN OFFSET BLANKET WITH ELECTROMAGNETIC SUPPORT MEANS

William G. Poynter, 1868 Norfolk, Speedway City, Ind.

Filed May 27, 1964, Ser. No. 370,649

4 Claims. (Cl. 101-179)

This invention relates generally to the printing arts and more particularly to a web fed or sheet fed offset press which conveys the ink to the paper or other printable base material.

Offset printers and pressmen have many problems. Among these are the following: substantial make-ready times; excessive material waste on start-ups, before sellable prints are obtained; equipment damage due to paper breakage; speed limitations; limitations on range of paper stocks and smearing and drying problems attendant thereto; register difficulty; and variation in print quality during a run. These and other difficulties and problems result in breakdowns, production limitations, excessive space requirements and costs.

It is, therefore, a general object of the present invention to provide an improved printing apparatus and method.

A further object is to provide means whereby positive register and high quality multiple color prints can be obtained throughout a run.

A further object is to provide means useful with a wide range of paper stocks from the lightest weight papers to the heaviest cardboards or boxboards including types not now generally used in offset printing because of problems such as application of moisture, lifting of fibers and coatings; and to provide means useful also with other types of print bases ranging from plastics to textiles to foils to metals to enameled boxboard without smearing or drying problems.

A further object is to provide means for achieving the foregoing objects and relatively immune to breakdowns, and capable of obtaining long plate life.

A further object is to provide means conserving material, easy to make ready, and capable of high production rates.

Other objects, advantages, and features, will become apparent as the description proceeds.

Described briefly, a typical embodiment of the present invention employs an endless ink conveyor belt as the offset printing blanket. Ink impressions are transferred to the proper locations on the belt at various points along the upper course of the belt. The transfer of the ink to the belt is accomplished by a plurality of endless belt printing plates.

The plate belts and blanket belt are synchronized to guarantee constant and accurate registry. The paper or material to be printed passes in a path from a supply means to a depository and is contacted at one point by the blanket which, together with the paper, is sandwiched between a printing roller and a support roller. The path of the paper is quite direct by comparison with conventional multi-color printing presses and all colors of a picture are printed on the paper simultaneously.

Ink temperature control means are provided both for the plates and for the blanket to assure stability, and cleaning means are provided for the blanket to guarantee consistency. Suitable drying means are provided for the inks after printing.

The full nature of the invention will be understood from the accompanying drawings and the following description and claims.

FIG. 1 is a diagram of the apparatus according to a typical embodiment of the present invention.

FIG. 2 is an enlarged fragmentary section through the

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blanket belt showing a typical interior construction which can be employed.

FIG. 3 is a fragmentary top plan view of the blanket belt of FIG. 1.

FIG. 4 is a section therethrough taken along the line 4-4 in FIG. 3 and viewed in the direction of the arrows and illustrating one of the magnetic control units for holding the blanket flat against horizontal rollers.

FIG. 5 is a fragmentary cross section taken along the line 5-5 in FIG. 3 and viewed in the direction of the arrows and showing details of a magnetic platen unit to prevent slapping of the belt.

FIG. 6 is a section taken along the line 6-6 in FIG. 3 and viewed in the direction of the arrows and illustrating a side guiding unit.

FIG. 7 is a fragmentary section taken along the line 7-7 in FIG. 6 and viewed in the direction of the arrows.

FIG. 8 is a fragmentary cross section through a drive roller 18a illustrating an embodiment alternate to that shown in FIG. 1.

FIG. 9 is a cross section therethrough taken along the line 9-9 in FIG. 8 and viewed in the direction of the arrows.

Referring now to the drawings in detail, an offset printing blanket is provided in the form of an endless belt 11. United States Letters Patent 1,989,375, granted to George R. Meyercord, shows a belt used as an offset printing blanket. Various belt constructions can be used in the practice of the present invention, but one example is shown in FIG. 2 wherein the upper layer 12 is of a rubber-like or rubber material essentially the same as that used in the conventional blankets for offset printing. A fiber reinforcing cord 13 is provided beneath the outer layer. The next layer is a plastic material 14, as is the inner or bottom layer 16. A ferromagnetic cord layer 17 is sandwiched between the layers 14 and 16 for a purpose which will become apparent as the description proceeds. It should be understood at this point, that these layers need not be discrete layers and may be interwoven to provide the necessary strength and homogeneity so that the blanket, while being flexible, will not stretch. The blanket travels between the pulleys or rollers 18 and 19, the latter of which may have an adjustable tensioner 21 thereon to adjust the tension in the blanket belt. Either or both of the rollers 18 and 19 may be driven, but if only one is driven it is preferable that the roller 18 be the driven roller. It thereby serves to drive the belt, but separate belt drive means could be used if desired.

Further according to the present invention, four plate belts 22, 23, 24 and 26 are provided. These are essentially identical in overall construction and the description of one will suffice for all.

Referring now to the plate belt 22, it may be of any material on which a transferable image can be produced by indiscriminate application of a material thereto. It may be much like the typical offset printing plate on which inked images are produced by indiscriminate application of ink thereto by inking rollers. But according to one embodiment of this invention, the plate is of the endless construction. In fact, it could be a series of offset printing plates adhesively or otherwise attached to a suitable backing material, the principal requirements being that the belt be flexible but not stretchable. This belt is carried between the rollers 27 and 28, either of which may be the driving roller, although it is preferable that roller 27 be the driving roller. If desired, the belt can be driven otherwise than by either of these rollers.

A series of dampening rollers 29 is provided in conventional manner and function to dampen the plate belt in the manner similar to the damping of a conventional offset printing plate. A series of inking rollers 31 is also provided and these contact the outer surface of the plate

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belt 22 to perform the inking function. An important feature of this invention is the fact that the ink reservoir 32 and the inking rollers themselves are heated so that the ink is applied in a comparatively hot state to the plate belt. By using this procedure, an ink which is very stable at average temperatures can be employed and yet can be given the necessary fluidity to properly transfer to the plate belt, and then to the endless blanket belt. For certain types of work, the ink can be handled without heating, if desired.

A support roller 33 is provided under the upper run of the blanket belt, this run being hereafter referred to as the supply run, because this is where the ink is supplied to the blanket belt. The support roller 33 is located along with the support rollers 34, 36, and 37 so that an apex or crown is provided in the blanket belt where engaged by the support rollers. To provide uniformity of the crowning action of the support rollers, and to be sure that the best contact is obtained between the plate belts and the blanket belt, it is desirable to have the axis of each of the support rollers and the plate belt roller adjacent thereto on a radial line from a center which is common to the radial line for each of the other support rollers and plate belt rollers adjacent thereto. In FIG. 1, the common center is designated by reference numeral 38 and the radial lines extending therefrom are broken to conserve space in the drawing. To adjust the amount of compression between the plate belt and the blanket belt, an adjustable cam 39 is provided for each of the support rollers. This cam can increase or decrease the distance between centers of the support roller 33 and the belt roller 27 to the extent desired.

An important advantage of using a series of plate belts as described herein rather than a plate cylinder for each of the colors, is the fact that the amount of material to be printed can be substantially larger and yet the blanket belt can be comparatively short, much shorter than it could be if large plate cylinders were contacting it directly.

An ink cooling unit 41 is provided adjacent the upper surface of the belt in the supply run at a point past the first transfer station 42 where ink is applied to the blanket from the plate belt 22. This quickly cools the ink so that it will remain on the blanket just as applied and will not smear or run. Just ahead of the second transfer station 43, a platen 44 is provided under the blanket belt. A similar platen 46 is provided just beyond the second transfer station 43. These platens support the belt and have electromagnetic means therein establishing a field through the steel cord 17 in the belt to hold the belt snug against the platens. The degree of magnetic attraction can be controlled as desired. The purpose of these platens is to prevent any possibility of slapping or waving of the belt as it passes between the plate belt and the support roller. Vacuum or other means may be employed also at these locations. These platens are provided both in front of and behind each of the transfer stations. Likewise, a cooling unit 47 is provided behind the second transfer station and a third cooling unit 48 is provided behind the third transfer station. Each of these cooling units immediately cools the ink which has been applied at the station immediately preceding it. In this way, the marrying of the various colors of ink applied to the blanket for a given picture can be controlled. The final temperature control device 51 behind the last transfer station either cools or heats the blanket to the optimum temperature for transfer of the ink to the paper 52.

The paper or other print base 52 moves downwardly from the supply roll 53 to the take-up roll 54. It simply passes over the roller 56, between the rollers 57 and 58, and between the rollers 18 and 59 and around roller 61 to the take-up roll 54. It is seen that between the rollers 56 and 61, the path of the paper is straight and the paper actually makes only two turns from the supply roll to the take-up roll.

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The roll 59 may be a portion of another ink applying press identical to that already described and may be used to print the backside of the print base at the same that the belt 11 is printing the front side. For this purpose, a blanket 62 is provided. If it is not desired to simultaneously print both sides of the print base, a roll directly contacting the underside of the paper may be employed in lieu of the roll 59. In order to cure the ink after application to the paper and to properly condition the paper for rolling onto the take-up roll, a curing unit 63 and conditioning unit 64 are provided between the printing station 66 and the roll 61.

Where the print base is paper, the rolls 57 and 58 are heated to drive moisture out of the paper. The ink curing unit is a dryer to dry the ink and the paper conditioning unit is a humidifier to return a desirable degree of moisture to the paper to avoid brittleness. At the same time, it eliminates static electricity from the paper.

On the return run of the blanket belt, that is the run back from the roller 18 to the roller 19, the belt may be cleaned and reconditioned for the fresh application of ink. Continuous cleaning is not necessary for each pass of the blanket belt if the lengths of the blanket belt and plate belts are such as to provide automatic continuous registry. Otherwise, however, cleaning is required continuously. For cleaning the blanket belt, a cleaning unit 67 is provided and a conditioning unit 68 is provided following the cleaning unit. The conditioning unit primarily dries the belt, but may include means for any other purpose. In this way, if the cleaner is used continuously, each time an image is inked onto the blanket, it goes onto a fresh surface.

It should be understood that for printing a single picture, an image will be provided on each of the plate belts and which will take the appropriate color of ink at the proper places so that, when the image on each of the belts contacts the blanket belt, the negative picture will be formed on the blanket belt with all of the colors in the proper places. This negative picture is then transferred to the print base 52 as the blanket belt and the print base pass between the rollers 18 and 59.

Operation

Assume that a picture is to be printed in full color. Although the order of application of colors to the blanket may be immaterial, assume that the belt 22 will apply the black ink, the belt 23 will apply the red ink, the belt 24 the blue ink, and the belt 26 the yellow ink. To provide the picture, the appropriate image 69 takes up the black ink on the plate belt 22 and, when it reaches the blanket, transfers the black part of the picture onto the blanket. The black portion of the picture then moves into position at the second printing station 43. Meanwhile, the red image 71 has been made on the plate belt 23. Therefore, when the black portion of the picture reaches the second station 43, the red portion of the picture will go onto the blanket. Meanwhile, the image 72 on the plate belt 24 will have passed under the blue inking rollers and will be approaching the third station. When the picture with the black and the red ink portions thereof provided, reaches the third station, the blue image will arrive simultaneously and will be applied. Meanwhile, the image 73 for the yellow ink will have been inked and will be approaching the fourth station. When the picture on the blanket arrives at the fourth station, the yellow image will arrive simultaneously and will be applied thereto. The picture is then ready in negative form to go onto the paper and will be transferred to the paper as a positive as the picture rounds roller 18. So it is seen that all colors go onto the paper simultaneously. They will all go on in the proper place too because the drive rollers for the blanket belt and plate belts are all synchronized and there is no stretching in the belts.

It can be readily appreciated that one way for synchronizing the blanket belt and plate belts could be by pro-

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viding perforations or drive teeth in the blanket belt and plate belts and mating drive teeth or perforations in the drive rollers or pulleys. The drive rollers can be connected together by chains or gear drives as indicated schematically by the dotted outlines to the drive motor 80. If relative adjustment between the driving elements is ever required, clutches 85 of the dry disc, cone, or other positive type can be used. However, there are some limitations to the versatility of an apparatus which employed perforations or drive teeth in the blanket belt and plate belts. Therefore, it is another feature of the present invention to provide control means both for assuring a positive non-slip drive of the blanket belt without drive teeth and perforations, but also will avoid belt slapping and waving and other undesirable belt actions. These control devices will now be described in some detail.

Referring first to FIGS. 3 and 4 along with FIG. 1, there is shown a pair of rollers 86 and 87 mounted in pillow blocks 88 secured to the base frame 89. Each of these rollers has a cylindrical outer surface engaging and supporting the lower face 91 of the blanket belt. A row of electromagnets 92 is provided across the frame 89, each having an upper magnetic pole 93 disposed immediately below the lower face 91 of the blanket belt. This series of magnets is provided with electrical energy from a supply source 94 through a controller 96 and a meter 97. Where direct current is used, the controller 96 may be a rheostat and the meter may be an ammeter. The controller is adjustable by the knob 98 to increase or decrease the power supply to the magnets.

The flux path between the poles of the magnets is completed through the ferromagnetic cord in the blanket belt as discussed briefly in col. 3 and through the rollers 86 and 87 and the machine frame and pillow blocks 88 and 89. If desired, however, the magnets can be arranged so that every other magnet in the series presents a south pole immediately under the blanket belt, the other magnets having their north poles immediately under the blanket belt. In any case, the magnetic field established by the magnets pulls the belt securely against the supporting surfaces of the rollers 86 and 87. The amount of force applied can be varied by adjusting the knob 98 on the controller 96. The meter 97 can be calibrated in any desirable units to indicate to the pressman the amount of pressure or degree of adhesion of the belts to the rollers. The controller and meter may be conveniently mounted to a control panel 99 for the use of the pressman.

Where it is desired to hold the belt flat against a platen, the construction shown in FIG. 5 can be used. In FIG. 5, the platen is typically made of a flat nonmagnetic, low-friction material such as some of the presently known and available plastics, for example. The lower face 91 of the belt lies flat on the upper face 101 of the platen. A series of magnets 102 is provided under the platen, and the upper end poles 103 thereof may be flush against the lower face 104 of the platen or may actually project slightly upwardly into the platen so as to be closer to the ferromagnetic cord layer in the blanket belt. In this instance as in the construction shown in FIG. 4, all of the magnets may be arranged with their north or south poles closest to the belt with the magnetic flux path being completed through the belt and the frame. However, if the entire platen is made of a plastic, it may be desirable to invert alternate ones of the magnets so that the flux paths are completed directly from one magnet through the belt cord to the adjacent magnet and back through the ferromagnetic frame member 106. In this example also, electrical energy from a power supply 94 is coupled through an adjustable controller 107 and the meter 108 to the magnets. By controlling the power supply to the magnet, the amount of flattening pull against the platen can be controlled.

From time to time, it may be found desirable to move the blanket transversely of the frame or to pull it to one side or the other. For this purpose, a side guide unit

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is typically provided such as shown in FIGS. 6 and 7. This side guide unit 109 includes a frame 111 mounted to the machine frame 89 and supporting a series of rollers 112 having co-planar vertical axes in horizontally spaced relationship. A series of electromagnets 113, 114, 116, 117 and 118 is provided, each of these electromagnets being disposed with its magnetic poles on a horizontal axis perpendicular to the direction of movement of the blanket belt. Also, the horizontal axis of each of the magnetic cores is in a common plane with a portion of the ferromagnetic layer in the blanket belt. This is illustrated in FIG. 6. As in the previously described control units, electrical energy is provided for these magnets from a supply source 94 through an adjustable controller 119a and a meter 120. These are all mounted on the control panel 99. The amount of power supplied to the magnets can be varied by the adjustment of the control knob 119. To establish the desired flux path through the ferromagnetic layer, it may be desirable that the poles 121 and 122 of the magnets 113 and 114 be of opposite magnetic polarity. Such an arrangement has previously been mentioned for the other control means described. As indicated, the electrical connections to every other magnetic coil in FIG. 7 are reversed to obtain this effect. The opposite ends of the poles may be connected by the common frame member 111 if it is ferromagnetic or they can be connected directly to form horseshoe magnets.

These side guide units can be incorporated anywhere along the blanket belt that side guiding or control is desired.

In order to provide a precision drive for the blanket belt without the use of mating drive teeth and perforations, a roller construction shown in FIGS. 8 and 9 can be substituted for roller 18 of FIG. 1. Referring specifically to FIGS. 8 and 9, roller 18a is provided with a nonmagnetic hollow cylindrical body 123, the ends 124 and 126 of which are mounted by two series of ball bearings to the support discs 127 and 128, the latter being supported in the frame 89 and secured in place by the set screws 131. The end plate 126 is provided with an externally toothed gear 132 thereon which is driven by the motor 80 in synchronism with the drives for the other belt driving rollers.

In order to hold the blanket belt tightly against the outer cylindrical surface 133 of the roller 18a, two series of electromagnets are provided. The first series 134 includes the magnets 136 mounted to a ferromagnetic magnet support 137 which has the legs 138 and 139 extending radially inwardly therefrom toward the roller axis 141. Each of these legs is apertured and fittingly received on a frame support tube, the frame support tube 142 receiving the leg 138 and the frame support tube 143 receiving the other leg 139. These legs and the magnet support frame 137 are, therefore, mounted so as to be rotatable with respect to the axis 141. Similarly, a second series 144 of magnets 146 is mounted on a magnet support frame having the legs 147 and 148 received on the support tubes 143 and 142, respectively. This series of magnets is also rotatable with respect to the axis 141.

In order to facilitate the proper rotational positioning of each of the magnet support frames, an arm such as the arm 149 is provided at the end of the magnet support frame and extends through the roller mounting head 127 for access by the printing press operator. An arcuate slot 151 is provided in the head 127 to permit a substantial degree of rotational travel of the frame 137. Likewise for the second series of magnets, an arcuate slot 152 is provided. As shown schematically in FIG. 9, an electrical supply to the magnets is provided from the power supply 94 through the controller 153 and the meter 154 to the magnets. These are also provided on the mounting panel 99 and permit the degree of attraction of the belt to the roller to be controlled in the same

manner as previously described with reference to the other control apparatus. The rotational positions of the two series of magnets can be controlled as desired to concentrate the magnetic field wherever desired. Additional series of magnets may also be incorporated if desired. Whenever the desired rotational position is attained, the lock nuts 165 on the support tubes 142 and 143 may be tightened which secures the magnet support frame legs between the roller support discs and the flanges on the support tubes.

These magnetic control units are of a construction such that they can be positioned wherever desired along the blanket belt to attain the best control. Such units can also be incorporated with the plate belts if desired, and the plate belts can be made of ferromagnetic material or have ferromagnetic materials incorporated therein to make the best use of the magnetic control means. The type of control arrangement shown in FIGS. 8 and 9 can be incorporated in the rollers 33, 34, 36 and 37 also, if desired to solidify the contact between the blanket belt and rollers. Where such magnetic units are used, particularly on the driving rollers, it may be possible to avoid such a tight mechanical contact in the absence of electrical power supply to the magnets, to permit some sliding of the blanket with respect to the rollers in the absence of application of magnetic force. This would permit changes of registry during printing to the extent desired without even stopping the printing press. It will be apparent that by the use of stroboscopic light as the press is in operation, to observe the registry condition, the appropriate changes could be made by merely adjusting the controller knobs of the driving rollers.

Referring back to FIG. 1, adjusting screw means 74 are provided for independent movement of each of the rollers such as roller 27 in a direction parallel to the direction of travel of the portion of the blanket belt in contact therewith, so that the registry can be changed as desired or required. Also, appropriate adjustment means 76 are provided for the large roller supporting the plate belts to facilitate the installation and removal of the plate belts and also facilitate the sliding around thereof, if desired, for initial registry.

A very important advantage of this described structure is the fact that it is not the paper with all of its idiosyncrasies which controls the registry, but it is the permanent component parts of the machine, all of which can be made of materials whose dimensions are essentially constant and under constant control. Therefore, once registry is established, it is maintained without further attention.

In the method of this invention which has been described, all ink application to the plate belts and blanket belt is done with hot liquid ink. Immediately after printing onto the blanket, the ink is refrigerated solid. Therefore, from one station to the next, the blanket is all ready for the next application of ink. This hot-cold treatment in the application of the ink enables the colors desired to be applied to the single picture on the blanket. The amount of heat desired can then be applied at the last unit 51 to return the ink to a flowing form so that it goes on the paper in the proper way. If desired, the rollers 57 and 58 may be heated or cooled to heat or cool the print base before application of the ink thereto.

By properly formulating inks to obtain the desired results, depending on the type of work to be performed and the amount of ink to be applied to the print base, it may be possible to omit heating and cooling units, or use various combinations of heating and cooling units, as desired.

By the use of the endless plate belts, and the blanket belt, a tremendous amount of material can be printed at one time, on one press, without stopping to change plates. Continuous prints of unbroken designs much longer than possible with presently known methods and apparatus, can be obtained by my invention. Complete

books or magazines can be done and both sides printed simultaneously.

With regard to the printing of a magazine, if page 1 requires four colors, we can print yellow, blue, red, and black on page 1. If page 2 requires black only, there will be no images on the appropriate spots on the yellow, blue, and red plate belts. However, there will be an image on the black plate belt and that image will be printed. If on page 3 we have black and green printing required, images will be provided on the yellow and blue plate belts to make the shade of green called for in the page 3, and an image will also be provided on the black plate belt for the black portion of the page.

From the foregoing description, it will be readily apparent that many types of equipment and materials now in use can be employed in carrying out the present invention. Moreover, while the embodiment described is web fed, the invention is applicable to sheet fed units. In either case, minimal travel of the print base is required and the equipment is not subject to the idiosyncrasies of the print base. In contrast, with present equipment, particularly web fed, there is continual adding of moisture to paper and ironing of the paper which cause fanning and weakening of the paper web and tendency to break the web. Where the invention is applied to sheet fed units, any apparatus required for handling sheets can be readily incorporated, because all printing on the print base is done at the one location.

This one-location feature has the additional advantage of making it easy to incorporate other units which the printing job may require such as folders, slitters, perforators, and cutters, for example.

By judicious selection of dimensions, it is possible to match the endless plate belts and endless blanket belt if desired to make one continuous print without any wasted space or overlapping.

The endless plate belts lend themselves to cleaning just as does the blanket belt.

If desired, the endless blanket could be used with conventional cylinders and plates, or the endless plates could be used with a conventional blanket, within the scope of this invention.

My invention lends itself to complete automation, which is not possible with presently known types of printing equipment.

Another advantage of application of the ink to the print base in just one location according to my invention is the fact that this location can be isolated from the rest of the apparatus. It can be in a separate room. In this way, the dust and dirt often associated with print base materials and the handling thereof, can be isolated from most of the components of the printing apparatus.

Another advantage of this one location printing is the fact that it gives extreme flexibility in that printing can be done on heavy gauge print bases or the thinnest gauges by only changing the spacing of pressing units 18 and 59 for the desired printing pressure. All other image transferring units of my invention can remain at a constant preset pressure regardless of the print base being used.

From the foregoing description, it is believed apparent that the present invention is well adapted to achievement of the objects set out herein as well as offering numerous advantages and features not specifically mentioned. While the invention has been disclosed and described in some detail in the drawings and foregoing description, they are to be considered as illustrative and not restrictive in character, as other modifications may readily suggest themselves to persons skilled in this art and within the board scope of the invention, reference being had to the appended claims.

The invention claimed is:

1. An offset printing apparatus comprising:

first and second pulleys 18, 19 having rotational axes in parallel spaced relationship;

a first endless belt 11 received on said pulleys and moved

continuously thereby, said first belt having an outer face 12 adapted to receive ink rolled thereon and thereby forming an endless belt offset printing blanket, said belt having means therein preventing stretching of said belt in the lengthwise direction thereof 5 and transversely thereof and yet permitting said belt to remain flexible and said belt having a ferromagnetic cord layer provided therein;

first, second, third, and fourth support rollers 33, 34, 36, 37 engaging the inner face of said first belt, each of said four rollers forcing said first belt outwardly at the point of engagement of the roller with the belt to provide a crown in the belt at said point of engagement, the crown extending the width of the belt and transverse to the length of the belt; 10

adjustable cams 39, each cam being connected to one of said support rollers for moving said roller outwardly and inwardly as desired;

adjustment means 21 provided on one of said first and second pulleys to change the spacing therebetween for changing the tension in said first belt; 20

a second endless belt, said second endless belt having an outer surface constituting a printing plate and adapted to the formation of positive ink images thereon by the application of imageless ink applicator rollers thereto and to transfer of said ink images therefrom to said blanket belt; 25

third and fourth pulleys having parallel spaced rotational axes and carrying said second endless belt, said third pulley holding said second belt against said first belt at the crown in said first belt provided by said first support roller thereby establishing a first transfer station to effect the transfer of ink images from said second belt to said first belt during the simultaneous passage of said belts between said third pulley and said first support roller; 30

adjusting means on one of said third and fourth pulleys for adjusting the tension in said second belt;

a first series of dampening rollers, at least one of said dampening rollers engaging said outer surface of said second belt as said second belt passes around said fourth pulley to thereby dampen predetermined areas of the exterior surface of said second belt to prevent the adherence of ink to said predetermined areas; 35

a first series of heated ink supplying rollers, at least one of said ink supplying rollers engaging the outer surface of said second belt at a point in the travel of said second belt behind the dampening roller, said inking rollers taking heated ink of a first color from a first heated ink fountain and applying said ink to the undampened portions of the outer surface of said second belt to thereby establish thereon inked images in said first color of ink; 40

a first ink cooling unit adjacent the outer surface of said first belt and located behind said first transfer station in the path of said first belt to solidify the ink retained by said first belt at said first transfer station; 45

a third endless belt like said second belt and having the outer surface thereof adapted to receive ink on predetermined areas from ink applicators; 50

fifth and sixth pulleys having parallel spaced rotational axes and carrying said third belt, with said fifth pulley being disposed adjacent said second support roller whereby said third and first belts are sandwiched between said fifth pulley and said second support roller thereby establishing a second transfer station for the transfer of ink from said third belt to said first belt during the simultaneous passage of said first and third belts between said fifth pulley and said second support roller; 55

a second series of dampening rollers, at least one of said dampening rollers engaging the outer surface of said third belt as said third belt is carried around said sixth pulley to dampen predetermined areas of said third belt; 60

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a second series of heated inking rollers, at least one inking roller of said second series engaging the outer surface of said third belt at a point in the travel of said third belt behind the dampening roller in contact therewith;

a second heated fountain supplying heated ink of a second color to the inking rollers of said second series whereby heated ink is applied to the undampened areas of the outer surface of said third belt as said belt passes around said sixth pulley;

a second cooler disposed adjacent the outer surface of said first belt at a location in the path of travel of said first belt behind said second transfer station to solidify the ink retained by said first belt at said second transfer station;

a fourth endless belt like said second belt and having the outer surface thereof adapted to receive ink on predetermined areas thereof;

seventh and eighth pulleys having parallel spaced axes of rotation and carrying said fourth belt and maintaining tension thereon, said seventh pulley being disposed adjacent said third support roller and cooperating therewith to sandwich a portion of said fourth belt and said first belt therebetween to provide a third transfer station for the transfer of ink from said fourth belt to said first belt;

a third series of dampening rollers, at least one roller of said third series contacting the outer surface of said fourth belt as said fourth belt passes around said eighth pulley to dampen predetermined areas of said fourth belt;

a third series of heated inking rollers, at least one of said rollers of said third series contacting the outer surface of said fourth belt as said fourth belt passes around said eighth pulley and at a point behind the dampening rollers of said third series;

and a third heated ink fountain applying heated ink of a third color to the inking rollers of said third series for application of heated ink to predetermined undampened areas of said fourth belt as said fourth belt passes around said eighth pulley;

a third cooling unit disposed adjacent the outer surface of said first belt behind said third transfer station for solidifying ink retained by said first belt at said third transfer station;

a fifth endless belt like said second belt and having the outer surface thereof adapted to receive ink on predetermined areas thereof;

ninth and tenth pulleys having parallel spaced axes of rotation, said ninth and tenth pulleys carrying and maintaining tension on said fifth belt, said ninth pulley being disposed adjacent said fourth support roller and sandwiching said fifth and first belts therebetween at a fourth transfer station for transfer of ink from said fifth belt to said first belt at said fourth transfer station during simultaneous passage of said first and fifth belts between said ninth roller and said fourth support roller;

a fourth series of dampening rollers, at least one of said rollers of said fourth series contacting the outer surface of said fifth belt as said fifth belt is carried around said tenth pulley to dampen predetermined areas on said fifth belt;

a fourth series of heated inking rollers, at least one inking roller of said fourth series contacting the outer surface of said fifth belt during passage thereof around said tenth pulley to apply ink to the outer surface of said tenth pulley on the undampened areas thereof;

a fourth heated ink fountain supplying heated ink to said rollers of said fourth series whereby the ink applied to said fifth belt is heated;

an ink conditioning unit disposed adjacent the outer surface of said first belt behind said fourth transfer station to liquify all of the ink retained by said first belt to condition the ink for application to a print base;

a supply reel and a take-up reel for a print base material 52, said print base material being carried from said supply reel to said take-up reel;

an eleventh pulley 59 having an axis of rotation in parallel spaced relationship to the axis of said first pulley 18 and cooperating with said first pulley to sandwich the print base material between said eleventh pulley and the outer surface of said first belt as the print base is moved from said supply reel to said take-up reel, the sandwiching of said print base material being at a point in the travel of said first belt behind said ink conditioning unit, whereby ink images are transferred from said first belt to the front side of said print base, with each of the images being printed onto the print base simultaneously in all four colors of said ink;

a dryer in the path of said print base behind the printing station and ahead of the take-up reel and drying the ink on the print base;

and humidifying means behind said dryer and ahead of the take-up reel for adding moisture to the print base with the images thereon for take-up on the take-up reel;

and a sixth endless belt carried on said eleventh pulley and having printed images thereon and engaging the rear side of the print base behind the line of engagement of the first belt with the front side thereof at the same time and in the same printing station as the front face is engaged by said first belt to simultaneously print images on the backside of said print base;

cleaning and drying means on the return run of said first belt to clean unwanted residue therefrom and dry said first belt when desired after printing therefrom onto said print base and prior to the reapplication of ink images thereto by said second, third, fourth, and fifth belts;

registry adjustment means on said third, fifth, seventh, and ninth pulleys, each being adjustable in a direction substantially parallel to the direction of movement of the portion of the first belt in contact with the pulley for registry adjustment;

heated rollers sandwiching said print base therebetween ahead of said printing station and driving moisture from said print base;

and platens below said first belt at points ahead of and behind said transfer stations and attracting said first belt to said platens to avoid waving of said first belt at said transfer station, one of said platens having a plurality of electromagnets with cores having vertical axes disposed in horizontally spaced relation, one pole of each magnet being disposed proximate the underside of said first belt and each magnet establishing a magnetic flux path from its said one pole through said ferromagnetic cord to its other pole thereby attracting said first belt to said platen;

electrical power supply means coupled through manually adjustable controller means and indicator means to said magnets, said controller means having a control member mounted to a panel for adjustment by an operator to control the magnetic fields established in said ferromagnetic cord by said magnets and thus control the force pulling said first belt flat against the upper surface of said one platen;

positive drive means on certain of said pulleys driving said belts;

and means coupled to said positive drive means for synchronizing all of said belts.

2. Offset printing apparatus comprising:

first and second rollers having rotational axes in parallel spaced relationship;

a first endless belt received on said rollers and moved continuously thereon, said first belt having an outer face adapted to receive ink rolled thereon and thereby forming an endless belt offset printing blanket, said belt having means therein preventing stretching of

said belt in the lengthwise direction thereof and transversely thereof and yet permitting said belt to remain flexible;

third and fourth rollers engaging the inner face of said first belt, each of said third and fourth rollers forcing said first belt outwardly at the point of engagement of the roller with the belt to provide a crown in the belt at said point of engagement, the crown extending the width of the belt and transverse to the length of the belt;

a second endless belt, said second endless belt having an outer surface adapted to the formation of positive ink images thereon by application of ink thereto from indiscriminate ink applicator means and to transfer of said ink images therefrom to said blanket belt;

fifth and sixth rollers having parallel spaced rotational axes and carrying said second endless belt, said fifth roller holding said second belt against said first belt at the crown in said first belt provided by said third roller thereby establishing a first transfer station to effect the transfer of ink images from said second belt to said first belt during the simultaneous passage of said belts between said fifth roller and said third roller;

first adjusting means operable to change the spacing between said fifth roller and said third roller to change the amount of force holding said second belt against said first belt;

a first series of heated inking rollers, at least one of said inking rollers engaging the outer surface of said second belt, said inking rollers taking heated ink of a first color from a first heated ink fountain and indiscriminately applying said ink to the outer surface of said second belt, the said surface retaining ink in predetermined areas to thereby establish thereon inked images in said first color of ink;

a first ink cooling unit adjacent the outer surface of said first belt and located behind said first transfer station in the path of said first belt to solidify the ink retained by said first belt at said first transfer station;

a third endless belt like said second belt;

seventh and eighth rollers having parallel spaced rotational axes and carrying said third belt, with said seventh roller being disposed adjacent said fourth roller whereby said third and first belts are sandwiched between said seventh roller and said fourth roller thereby establishing a second transfer station for the transfer of ink from said third belt to said first belt during the simultaneous passage of said first and third belts between said seventh roller and said fourth roller;

second adjusting means operable to change the spacing between said seventh roller and said fourth roller to change the amount of force sandwiching said third and first belts;

a second series of heated inking rollers, at least one inking roller of said second series engaging the outer surface of said third belt;

a second heated fountain supplying heated ink of a second color to the inking rollers of said second series whereby heated ink is applied indiscriminately to the outer surface of said third belt, said outer surface of said third belt retaining ink in predetermined areas to thereby establish thereon inked images in said second color of ink;

a second cooler disposed adjacent the outer surface of said first belt at a location in the path of travel of said first belt behind said second inking station to solidify the ink retained by said first belt at said second transfer station;

a supply reel and a depository for a print base material, said print base material being carried from said supply reel to said depository;

a print base supporting roller having an axis of rota-

tion in parallel spaced relationship to said first roller axis and cooperating with said first roller to sandwich the print base material between said print base supporting roller and the outer surface of said first belt as the print base is moved from said supply reel to said depository, the sandwiching of said print base material being at a point in the travel of said first belt behind both of said transfer stations whereby ink images are transferred from said first belt to the front side of said print base, with each of the images being printed onto the print base simultaneously in both colors of ink;

a dryer in the path of said print base behind the printing station and ahead of the depository and drying the ink on the print base;

and humidifying means behind said dryer and ahead of said depository for adding moisture to the print base with the images thereon;

and a fourth endless belt carrying printed images thereon and engaging the rear side of the print base at the same time and in the same printing station as the front face is engaged by said first belt to simultaneously print images on the backside of said print base;

cleaning and drying means on the return run of said first belt to clean unwanted residue therefrom and dry said first belt when desired after printing therefrom onto said print base and prior to the reapplication of ink images thereto by said second and third belts;

registry adjustment means on said fifth and seventh rollers, each being adjustable in a direction substantially parallel to the direction of movement of the portion of the first belt in contact with the roller for registry adjustment;

heated rollers sandwiching said print base therebetween ahead of said printing station and driving moisture from said print base;

and platens below said first belt at points ahead of and behind said transfer stations and attracting said first belt to said platens to avoid waving of said first belt at said transfer stations;

positive drive means on certain of said rollers driving said belts;

and means coupled to said positive drive means for synchronizing all of said belts.

3. Offset printing apparatus comprising:

first and second roller means having rotational axes in parallel spaced relation;

a first endless belt received on said roller means, said first belt having an exterior surface adapted to receive images thereon and thereby forming an endless offset printing blanket, said first belt having ferromagnetic means therein throughout the length thereof;

third and fourth roller means disposed with their rotational axes in closely spaced parallel relationship, said rollers having peripheral surfaces contacting a lower surface of said belt;

a series of electromagnets extending transversely of the direction of movement of said belt and disposed between said third and fourth roller means;

a source of electrical energy and a controller therefor coupled to the electromagnets and operable to control said electromagnets for establishing a magnetic field through said magnets and the ferromagnetic means in the portion of said belt adjacent said third and fourth roller means, the strength of the said magnetic field being thereby variable to increase and decrease a magnetic force thereby applied to said belt portion forcing said belt against said third and fourth roller means;

a series of rollers engaging a side marginal edge of said blanket belt;

a second series of electromagnets, certain magnets of said second series being disposed between rollers of

said series of rollers for establishing a magnetic field in said ferromagnetic material in a portion of said belt adjacent said rollers of said series to thereby attract said belt to the rollers of said series of rollers;

a source of electrical energy and second controller means therefor connected to the electromagnets of said second series to vary the strength of the magnetic field established thereby for changing the magnetic force applied thereby to said belt in a direction transverse to the direction of movement of said belt;

and a platen having a flat top surface disposed at the lower surface of said first belt;

a third series of electromagnets at said platen establishing a magnetic field in a portion of the ferromagnetic means in said belt above said upper surface of said platen;

a source of electrical energy and controller means therefor coupled to said electromagnets of said third series for controlling the strength of the magnetic field established by said electromagnets of said third series to increase and decrease a magnetic force pressing a portion of said belt against the upper surface of said platen.

4. Offset printing apparatus comprising:

first and second roller means having rotational axes in parallel spaced relation;

a first endless belt received on said roller means and moved continuously thereon, said first belt having an exterior surface adapted to receive images thereon and thereby forming an endless offset printing blanket, and said first belt having ferromagnetic means therein throughout the length thereof;

offset printing plate means engaging said endless blanket and transferring images thereto;

supply means for a print base material;

print base support means cooperating with means supporting said first belt to sandwich the print base material between said print base support means and the outer surface of said first belt as the print base is moved from said supply means, whereby images obtained from said printing plate means are transferred from said first belt to said print base as said first belt and print base pass between said belt supporting means and said print base support means;

positive drive means connecting said first roller means to a drive motor;

a first series of electro-magnets mounted on a frame extending across the interior of said first roller means in a direction generally parallel to the axes of said first roller means, said magnets having poles proximate the roller engaging face of said first endless belt, and said frame being mounted for rotation about the rotational axes of said first roller means and having means thereon extending to the exterior of said first roller means for selectively positioning said first frame and thereby said magnets of said first series inside said first roller means;

a second series of electro-magnets disposed on a second frame inside said first roller means, said second frame extending across said first roller means in a direction generally parallel to the rotational axes of said first roller means, said second frame being rotatable with respect to the rotational axes of said first roller means and said second frame having means thereon extending to the exterior of said first roller means and accommodating the selective positioning of said second frame rotationally in said first roller means;

a source of electrical energy coupled through manually operated controller means and through indicator means to said electro-magnets and supplying electrical energy thereto, said electro-magnets thereby establishing complete magnetic flux paths between their poles and through said ferromagnetic means

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in said endless blanket, thereby forcing said blanket into tight non-slip contact with said first roller means, said controller being manually adjustable to control the amount of magnetic force pulling said endless blanket against said first roller means and being adjustable to lower the amount of magnetic force; the extending means of said first and second frames accommodating the provisioning of various angular relationships of said flux paths.

References Cited by the Examiner

UNITED STATES PATENTS

306,778 10/1884 Ripley et al. 198—41 X
 369,925 9/1887 Davidson 101—181
 493,858 3/1893 Edison 198—41
 1,407,051 2/1922 Bethke et al. 198—41 X

1,989,375 1/1935 Meyercord 101—177
 2,147,651 2/1939 Jones et al. 101—211 X
 2,660,318 11/1953 Watson 198—41 X
 2,700,629 1/1955 Townsend 101—211 X
 2,788,738 4/1957 Wood 101—171
 2,887,312 5/1959 Zucker 101—179 X
 2,906,205 9/1959 Speers.
 3,067,056 12/1962 Remer 101—364 X
 3,067,718 12/1962 Kraft.
 3,179,240 4/1965 Kain 198—202

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FOREIGN PATENTS

959,315 5/1964 Great Britain.
 893,855 11/1944 Italy.

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