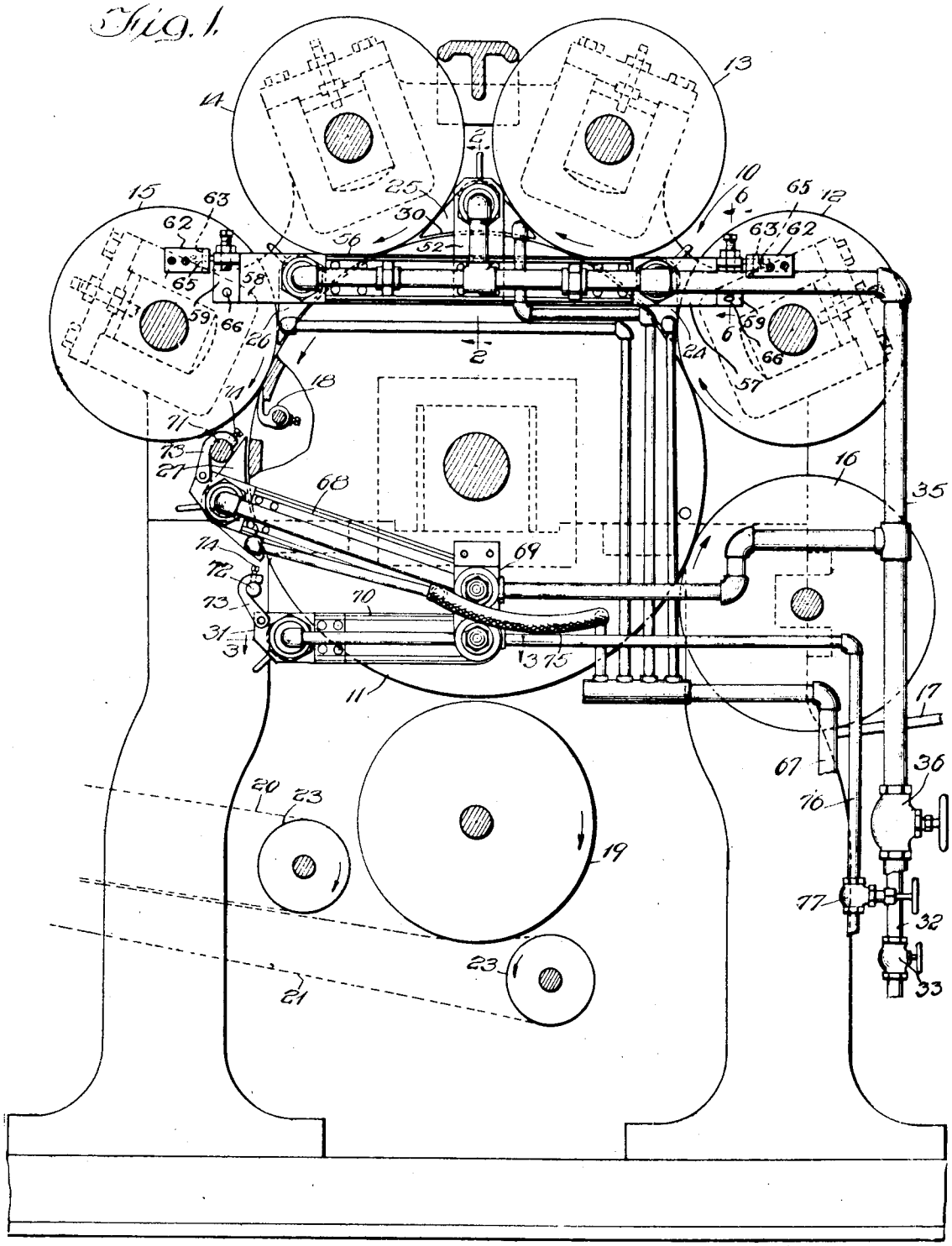
Aug. 13, 1929. N. DE LONG 1,724,644

MEANS AND METHOD OF TREATING SHEET MATERIAL

Original Filed May 5, 1924 3 Sheets-Sheet 1

Fig. 1.



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Aug. 13, 1929. N. DE LONG 1,724,644

MEANS AND METHOD OF TREATING SHEET MATERIAL

Original Filed May 5, 1924 3 Sheets-Sheet 2

Fig. 2.

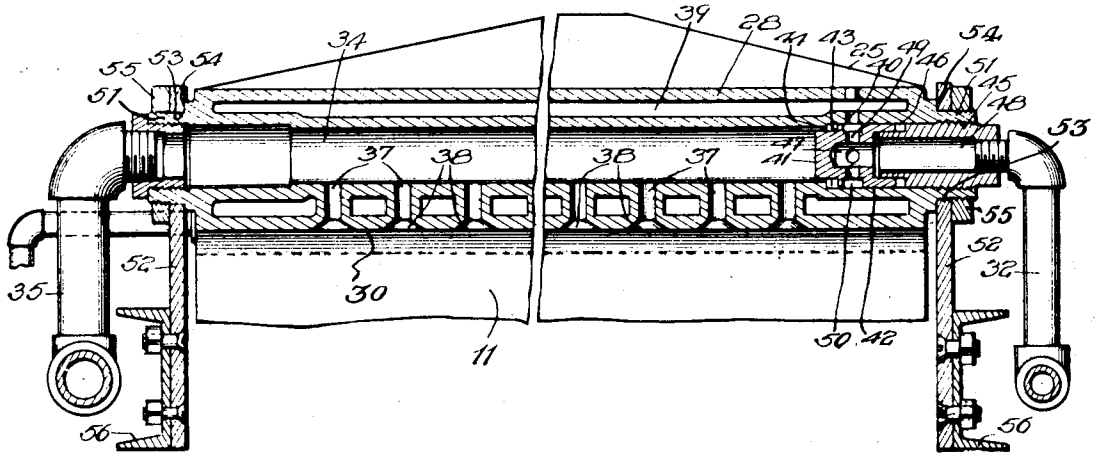


Fig. 4.

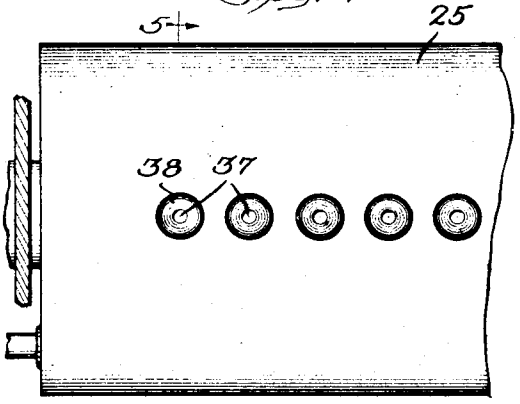


Fig. 7

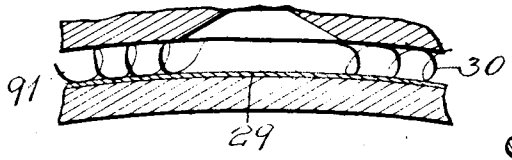


Fig. 5.

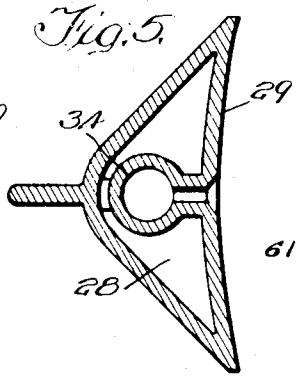
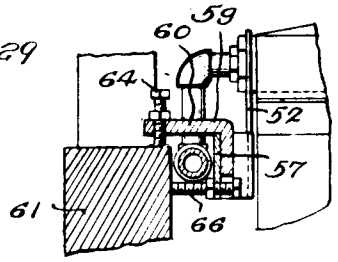


Fig. 6.



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Aug. 13, 1929. N. DE LONG 1,724,644

MEANS AND METHOD OF TREATING SHEET MATERIAL

Original Filed May 5, 1924 3 Sheets-Sheet 3

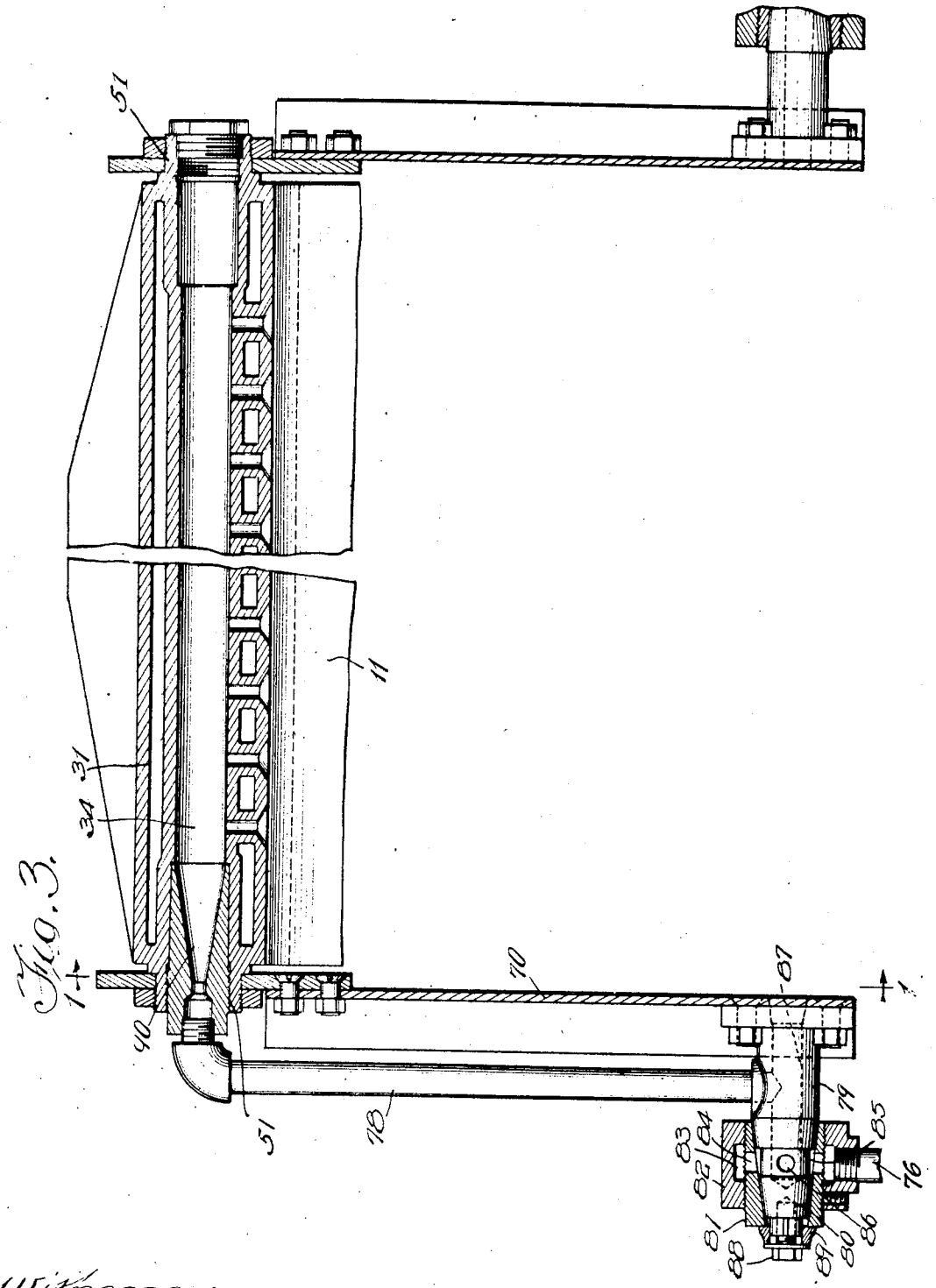


Fig. 3.

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Patented Aug. 13, 1929. 1,724,644

UNITED STATES PATENT OFFICE.

NELSON DE LONG, OF CHICAGO, ILLINOIS, ASSIGNOR TO BENJAMIN B. SALVATY, OF CHICAGO, ILLINOIS.

MEANS AND METHOD OF TREATING SHEET MATERIAL.

Application filed May 5, 1924, Serial No. 711,159. Renewed January 10, 1929.

My invention relates to improvements in means and methods of operating on sheet material, such as paper, and is directed particularly to the provision of simple means and methods of substantially instantaneously drying applied liquid material, such as ink, to the end that further applications of ink can be immediately made without smearing or offsetting and without the use of smut sheets.

A further object of my present invention is to be able to print sheets of paper and stack the printed sheets in a pile without interposed smut sheets and without danger of offsetting the printing from one sheet to the sheet in contact therewith.

By means of my invention I am enabled to increase the speed of such printing presses, thus reducing another element of cost.

While I have herein illustrated and described my invention as applied to a four color printing press of a well known type, it should be understood that such is but typical of my invention and that my invention is much broader in its possibilities of application and that it is not to be limited to the particular steps or constructions herein described and shown.

My invention will be more readily understood by reference to the accompanying drawings forming part of this specification, and in which I have illustrated the application of my invention to a four color press and the printing on such a press of successive sheets of paper.

In said drawings:—

Figure 1, is a vertical sectional view of a four color cylinder press equipped in accordance with my invention and taken just inside of one side frame substantially on the line 1—1 of Figure 3;

Figure 2, is a fragmentary vertical transverse section on the line 2—2 of Figure 1;

Figure 3, is a section similar to Figure 2 and taken on the line 3—3 of Figure 1;

Figure 4, is a fragmentary inner plan view of one of the applicators;

Figure 5, is a section on the line 5—5 of Figure 4;

Figure 6, is a detail vertical sectional view on the line 6—6 of Figure 1; and

Figure 7, is a diagrammatic sectional view, very much enlarged, and particularly illustrating the action of the air in the thin film in transmitting heat to or from the sheet material or the coating thereon.

In said drawings, 10 illustrates a four color printing press of the type having a large central cylinder 11 around which the paper to be printed is carried and four impression or printing rolls or cylinders 12, 13, 14 and 15, arranged in succession around the cylinder 11 and spaced apart circumferentially. The rollers and fonts for supplying ink to the printing cylinders are omitted. In advance of the first impression cylinder 12 there is a sheet transfer cylinder 16 which is adapted by means of paper clips of well known character to pick up the sheets to be printed from a feed table 17 and deliver them to the main cylinder which is provided with clips 18 of substantially the usual form for securing the forward edge of each sheet to the cylinder 11. Beneath the cylinder 11 is arranged a take-off cylinder 19 which is adapted by means of the usual clips to take the printed sheets from the cylinder 11 and deliver them to a delivery mechanism, shown in the drawings, as comprising two sets of tapes 20 and 21 trained around suitable pulleys or cylinders 22 and 23, all of which is well known construction.

In the operation of such a press two features have so far not been satisfactory, either in operation or results. One of these detrimental features has been the necessity of preparing and using only such inks as would not smear, blot or run, in the operation of the several successive impressions, and the other was the necessity of using smut sheets or blotters to be interposed between the printed sheets as they are delivered from the press to prevent the off-setting of the printed impression from the face of one sheet upon the back of the next sheet as they lay in the delivered pile or stack.

By means of my invention I am enabled to eliminate both of these detrimental features, to obtain a wider range of inks which can be used and to speed up the production to some extent.

While air, both heated and cold, has been applied to printed sheets to hasten the drying and setting of the ink, so far as I am aware, before my present invention no suggestion has been made of any manner of

effecting the sufficient drying of one impression in the exceedingly small interval of time between impressions on such a press as that illustrated.

For the purpose of drying the ink applied by the impression cylinder 12 before the second application of ink by the cylinder 13, I provide means arranged between the two cylinders 12 and 13 for effectively drying the ink of the first application. For this purpose I provide what I term an applicator 24, by means of which I am enabled to substantially instantaneously extract all of the volatile ingredients from the ink and thus dry it sufficiently, so that the second impression will not smear the first impression. Likewise I provide similar drying device 25 and 26 between the impression cylinders 13 and 14, and 14 and 15, respectively, and another similar device 27 immediately after the last impression cylinder 15. Each of the applicators 24 to 27, inclusive, comprises a steam chest 28, having an inner curved surface 29 conformed to the cylinder 11 and equal in length therewith. The inner curved surface 29 of the applicator is curved on a slightly larger radius than the cylinder 11 to make room for the sheet of paper 29 and to provide a thin space 30 between the paper and the inner surface of the applicator. Through this thin space 30 I force an ink drying or setting gas, preferably either hot or cold air, as the case may be. In the drying applicators, so far mentioned, I preferably use hot air and additional heat, and I further provide an additional applicator 31 arranged beyond the applicator 27 and by means of which I effectively chill the ink and set it sufficiently to prevent the offsetting of the ink when the sheets are arranged in a deep pile immediately after being printed.

The drying applicators are, as have been termed, steam chests; each is connected to a steam supply pipe 32, a main shut-off valve 33 being provided to regulate the quantity of steam supplied. Each of these applicators has a central bore or passage 34 which extends longitudinally through the chest and is connected at one end to an air supply pipe 35 which is controlled by a main valve 36. The air for this purpose, which is preferably but a few pounds pressure, enters one end of the central passage 34 and is distributed to the space 30 between the applicator and the cylinder 11 through a central series of small ports 37 which end in flared or conically shaped outlets 38. The total area of the ports 37 and the large diameter of the conical outlets are such as to supply the air to the space 30 in sufficient quantities to prevent any material reduction of pressure at these points. Steam is admitted to the applicator from the steam supply pipe 32 at the other end of said central passage 34, but I provide means to prevent the steam entering said central passage and mixing with the air, and causing the steam to enter the chest outside of said central passage. The steam enters the chamber 39 in the chest outside of the central passage through ports 40 through the wall of the central passage 34. To prevent the steam entering into the passage 34, I provide a head 41 which fits within an enlargement 42 of the passage 34 and seats against a packing washer 43, which in turn is held against a circumferential shoulder 44. To hold the head with the packing washer clamped against the shoulder 44, I provide a screw plug 45 which is adapted to be screwed into the outer end of the central passage and bind a packing washer 46 between its inner end and the adjacent end of the head 41. The head 41 is provided with a central passage 47 which communicates through a central passage 48 with the steam supply pipe 32, and I provide radial ports 49 and a circumferential groove 50 in the outer surface of the head 41 for connecting the passage 47 with the ports 40 for admitting steam to the chest.

For mounting and holding the applicators, each is provided on each end with an externally threaded nozzle 51, and for applicator 25 I provide supports 52, having openings 53 for receiving said nozzles, and I clamp these supports on the nozzles and against end shoulders 54 by means of clamping nuts 55. It is desirable that the applicators be mounted so that they can be accurately adjusted to equalize the thin spaces 30 between the several applicators and the cylinder 11, and to make these spaces of uniform thickness throughout so that the air will be uniformly applied. For this purpose I provide support beams 56, one for each end, mount the applicators 24, 25 and 26 on these beams by means of the nozzles at the ends of the applicators, and suitable extension plates secured rigidly to these beams and to which the nozzles are secured by the nuts. On one end of each beam there is an extension plate 57 secured and on the other end a similar plate 58. These plates extend out horizontally. At the center of each beam the plate 52 for supporting the applicator 25 is secured. The applicator 24 is mounted on the plates 57 and the applicator 26 is mounted on the plates 58. For holding these beams with the three applicators accurately in position and so mounting them that they can be readily adjusted to provide the proper radial thickness of the spaces 30, I provide an L-shaped bracket 59 on each extension with one leg 60 extending out into alignment with the side frame 61 of the machine. There is also provided an L-shaped bracket 62 secured to the frame 61 and having an arm 63 pro-

jecting up along side of the arm 60 of the bracket 59. Adjustable set screws 64 and 65 in the arms 60 and 63, respectively, for engagement with the opposite arm serve to adjust the beams up and down and longitudinally, and set screws 66 mounted in the end plates 57 and 58 adapted to engage the inner surface of the machine frame serve to set the beams transversely of the frame. As the applicators are mounted on the supports by the trunnions 51 they can be tipped to conform with the cylinder 11, and by means of the adjusting screws just described they can be adjusted up and down and transversely. There is a slight adjustment allowed of the top applicator 25 in reference to its support plates 52 to permit this applicator to be adjusted to conform with the other two. Besides the steam supply pipe a drain pipe 67 is connected to each applicator to drain off the condensation.

The steam applicator 27 and the chilling applicator 31 are both mounted to be swung freely away from the cylinder 11 to give access to the cylinder. For this purpose the applicator 27 is mounted on the outer ends of arms 68 pivotally mounted at their other ends on a plate 69 secured to the side frame of the machine. Likewise the cold applicator 31 is mounted on the outer ends of arms 70 pivotally mounted at their inner ends on said plate 69. For holding these applicators in proper relation to the cylinder 11, there is provided cross supports 71 for the applicator 27 and 72 for the applicator 31, and I provide hooks 73 pivoted to the supporting plates and adapted to be swung up to engage over these supports and each provided with a set screw 74 in its end adapted to be adjusted in and out to raise or lower its applicator. The hooks are formed so that they can be swung clear of the supports to let their applicators swing down away from the cylinder 11. For connecting the drain pipe 67 with the hot applicator 27 a flexible drain pipe 75 is used, and a similar flexible pipe is used at the opposite end for connecting the steam pipe 32 to this applicator.

To produce a chilling effect, or rather to produce cold air for chilling the ink by the applicator 31, I preferably make use of air compressed to a relatively high pressure which is supplied through the pipe 76 controlled by the valve 77. This is connected to one end of the central passage 34 of the applicator 31 by means of a pipe 78 which is connected at its other end into a trunnion bearing 79 mounted on the inner end of the arm 70. This trunnion has a tapered bearing part 80 which fits within a sleeve bearing member 81, which is mounted within a housing 82, having an internal groove 83 connected to the supply pipe 76. Ports 84 are provided in the wall of the member 81 communicating with an external groove 85 in the inner member 80, and radial passages 86 are provided in the bearing member 80 to connect a central passage 87 therein with the groove 85 and the connecting pipe 78 connects with the central passage 87. The tapered member is held into its seat in the member 81 by a screw 88 and a washer 89 at its outer end. By means of this construction the applicator 31 can be supplied with high pressure air from the supply pipe 76 and yet be capable of freely swinging down away from the cylinder 11. The hot applicator 27 is similarly connected to the low pressure air supply pipe 35.

For the purpose of producing a chilling temperature in the cold applicator 31, I provide an expanding nozzle 90 at the point where the high pressure air enters the central passage 34 in the applicator 31, and the outlet passages are proportioned to cause a drop in the pressure from the high to a relatively low pressure. The air in this dropping in pressure expands and absorbs heat. In this instance the surrounding chamber 39 in the applicator constitutes a heat insulation chamber to protect the central passage and its cold air.

In Figure 7 I have illustrated the action of the air in the space 30 between the applicator and the sheet material, in transferring heat from one to the other. The air is driven with great velocity through the slot 30 from the air outlets 38, and as the paper is in motion and the applicator is stationary, there is a drag on the air adjacent to the applicator which causes an undulating or rolling motion to the air indicated by the advancing circles 91 in Figure 7. This action of the air greatly enhances the transfer of heat from one wall of the slot to the other and assists in transferring heat from the hot applicators to the air and to the ink, and in transferring heat from the ink, paper and air to the cold applicator.

Another feature of importance lies in the great velocity of the air in the thin film, this velocity reaching to about 5000 feet per minute, and is sufficient to bring each portion of the paper into contact with about 150 feet in length of the stream of air while the specific portion of the paper is passing between an applicator and the cylinder 11. I have therefore condensed into about 10 inches, as to drying results, what would ordinarily require about 150 feet of space to accomplish. If the air had to be preheated to a temperature to carry sufficient heat to the paper it would reach such a high temperature that it would ignite the paper. But by my improved method of transfer of heat I am enabled to accomplish the desired result without any danger. Furthermore, the air is maintained, while within the slot

30, at substantially its maximum temperature and consequently works at maximum efficiency.

While I have thus described a particular application of my invention, it should be understood that such application is merely typical of many other applications and uses, and that the invention is not to be limited to the exact sequence of steps or to the specific constructions herein shown and described.

I claim:

1. The herein described method of printing paper, which consists in putting separate sheets of paper successively into motion, and while they are in motion producing thereon successive impressions of ink, and between the impressions applying a drying gas in the form of a thin film flowing at high velocity, and during the application of the drying gas applying heat to the gas.

2. The herein described method of printing separate sheets of paper, which consists in successively putting the sheets into motion and while they are in motion applying to each sheet successive ink impressions, and between each two impressions applying a drying gas to the sheet and controlling it to cause it to flow along the surface of the paper in the form of a thin film flowing at high velocity, the sheets being adapted to be piled in a stack without any intervening material.

3. The herein described method of printing a sheet of paper, which consists in moving the sheet edgewise in a cylindrical path, and while it is being thus moved applying several ink impressions to the sheet, and between the ink impressions applying an ink drying gas and controlling the gas to cause it to flow along the paper in the form of a thin film at high velocity.

4. The herein described method of printing a sheet of paper, which consists in applying several ink impressions in rapid succession to the sheet, between each two impressions applying an ink drying gas in the form of a thin film and flowing over the surface at a relatively high velocity, and after the last impression applying an ink chilling gas in the form of a thin film flowing at high velocity.

5. The herein described method of printing sheets of paper, which consists in successively putting the sheets into motion and while they are in motion applying to each sheet successive ink impressions, and between each two impressions applying hot air in the form of a thin film and flowing over the surface at a relatively high velocity, and after the last impression applying an ink chilling gas in the form of a thin film flowing at high velocity.

6. The herein described method of printing a sheet of paper, which consists in rapid succession applying several ink impressions to the sheet, and after each ink impression applying hot air in the form of a thin film and flowing over the surface at a relatively high velocity, and after the last impression applying an ink chilling gas in the form of a thin film flowing at high velocity.

7. The herein described method of printing a sheet of paper, which consists in applying several ink impressions in rapid succession to the sheet, between each two impressions applying hot air in the form of a thin film and flowing over the surface at a relatively high velocity, and after the last impression applying an ink chilling gas in the form of a thin film flowing at high velocity.

8. The herein described method of printing separate sheets of paper, which consists in successively putting the sheets into motion and while they are in motion applying to each sheet successive ink impressions, and between each two impressions applying air to the sheet and controlling it to cause it to flow along the surface of the paper in the form of a thin film flowing at high velocity and simultaneously applying heat, the ink being dry enough to permit the piling of the sheets in a stack without any intervening material.

9. The herein described method of printing separate sheets of paper, which consists in putting the sheets into motion successively and while they are in motion applying several ink impressions to the sheet, and after each ink impression applying air and controlling it to cause it to flow along the surface of the paper in the form of a thin film flowing at high velocity and simultaneously applying heat.

10. The herein described method of printing a sheet of paper, which consists in applying several ink impressions in rapid succession to the sheet, between each two impressions applying air in the form of a thin film flowing at high velocity, and after the last impression applying cold air in the form of a thin film flowing at high velocity.

11. A printing press of the kind described, comprising a paper sheet moving cylinder, ink impression cylinders spaced around the paper moving cylinder, and means for applying a drying gas in the form of a thin film to the exposed surface of the sheet after each ink impression.

12. A printing press of the kind described, comprising a paper sheet moving cylinder, ink impression cylinders spaced around the paper moving cylinder, and means arranged for applying pre-heated air in the form of a thin film to the exposed surface of the sheet between each two impressions and means for simultaneously applying heat to the air during its application to sheets.

13. A printing press of the kind described, comprising a paper sheet moving cylinder, ink impression cylinders spaced around the paper moving cylinder, means between the ink impression cylinders for applying a drying gas in the form of a thin film to the exposed surface of the sheet, and means beyond the last ink impression cylinder for chilling the impressed ink.

14. A printing press of the kind described, comprising a paper sheet moving cylinder, ink impression cylinders spaced around the paper moving cylinder, means between the ink impression cylinders for applying air in the form of a thin film to the exposed surface of the sheet and simultaneously applying heat, and means beyond the last impression cylinder for applying cold air to chill the impressed ink.

In testimony whereof, I have hereunto set my hand, this 18th day of April, 1924.

NELSON DE LONG.