July 10, 1934. H. FISCHER 1,966,287

SHEET FED ROTARY PRINTING MACHINE

Filed April 1, 1932 3 Sheets-Sheet 1

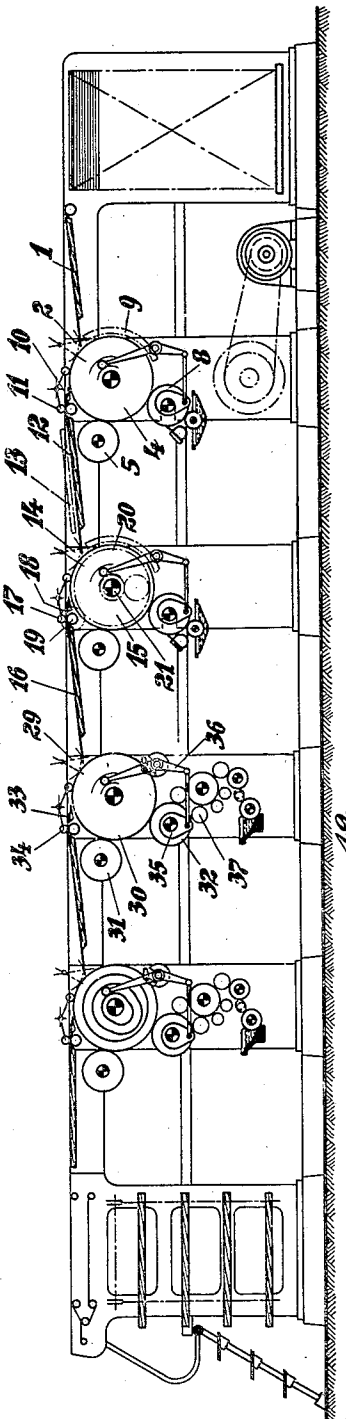

Fig. 1.

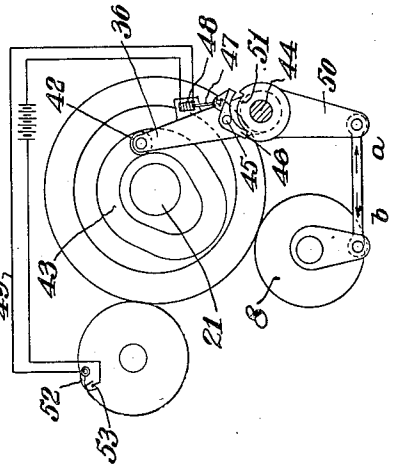

Fig. 7

Inventor:
Hans Fischer,
By Alfred Hahn
Atty

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Fig. 3.

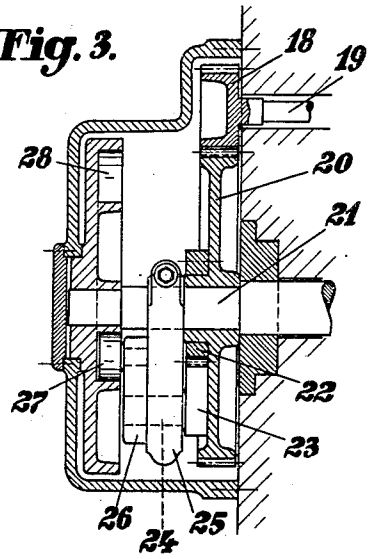
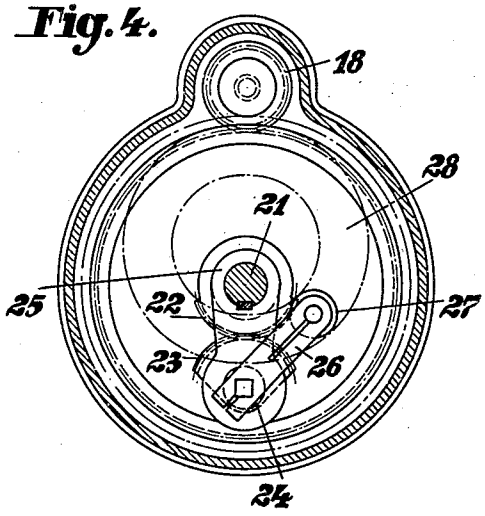



Fig. 4.



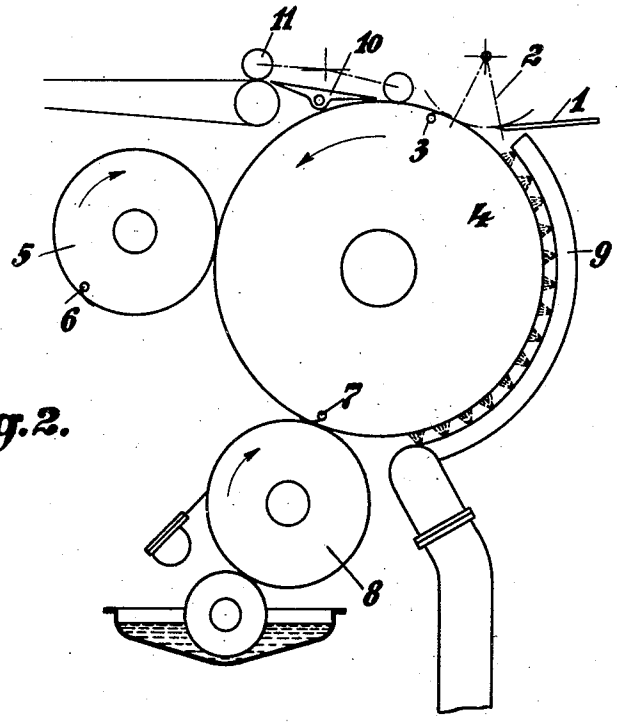




Fig. 2.

Inventor:
Hans Fischer,
By Alfred Ulmer
Atty.

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SHEET FED ROTARY PRINTING MACHINE

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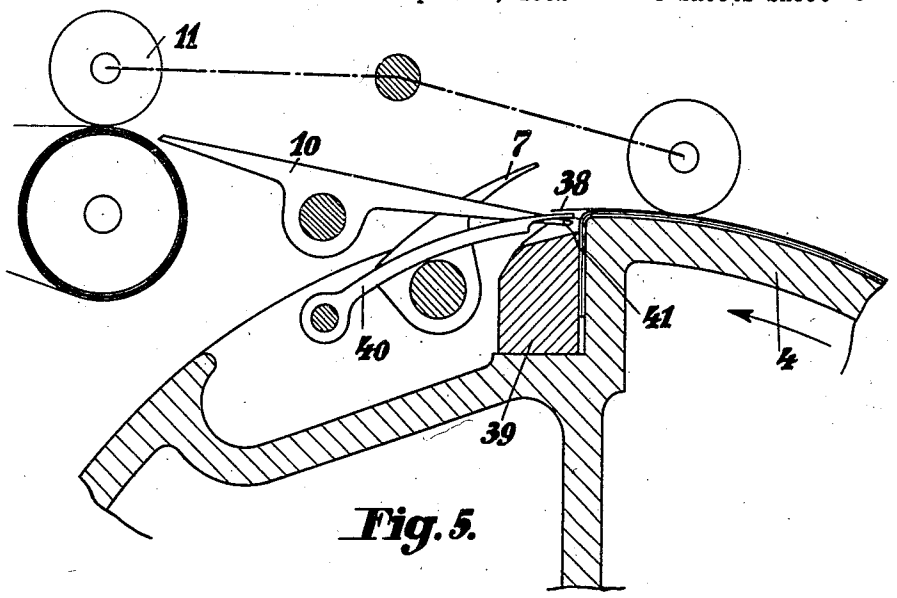


Fig. 5.

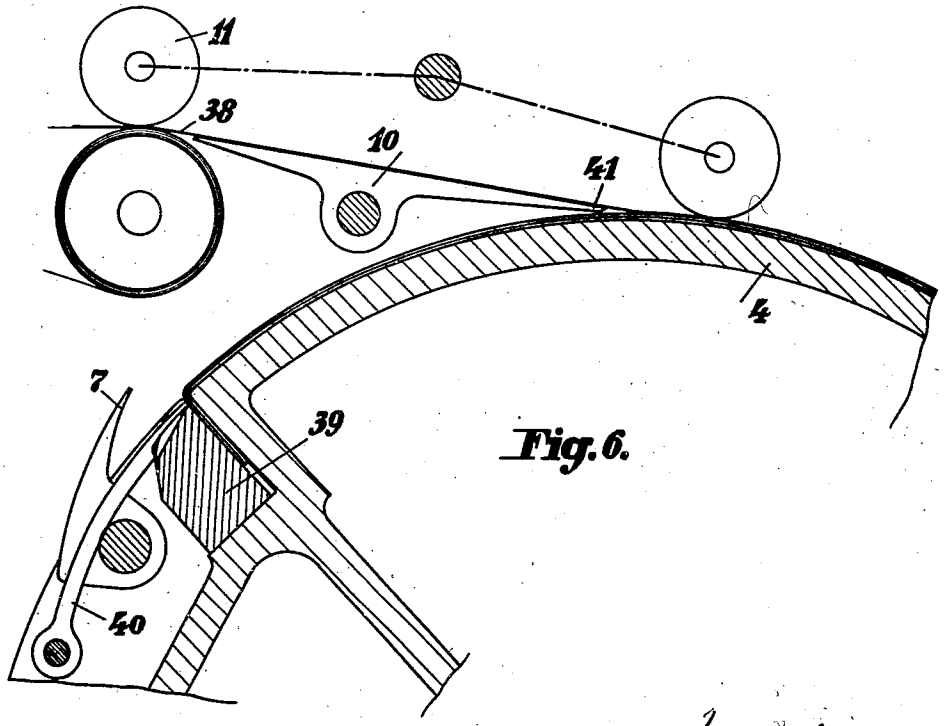


Fig. 6.

Inventor:
Hans Fischer,
By Alfred Ellis
Atty.

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# UNITED STATES PATENT OFFICE

1,966,287

## SHEET FED ROTARY PRINTING MACHINE

Hans Fischer, Augsburg, Germany, assignor to Maschinenfabrik Augsburg-Nürnberg A. G., Augsburg, Germany, a corporation of Germany

Application April 1, 1932, Serial No. 602,477
In Germany October 8, 1931

2 Claims. (Cl. 101—152)

The object of the present invention is a sheet fed rotary printing machine especially designed for multi-color work, having a plurality of printing units disposed in a row one behind the other. In known machines of this description the sheets are transmitted from one printing mechanism to the other by means of conveyor tapes or conveyor chains. The disadvantage of conveyor devices of this kind is, that the sheets, while they rest on the tapes or chains can, and frequently do, slide or shift, which in multicolor machines is particularly objectionable, because accurate register which in this case is absolutely indispensable, is seriously affected by such irregular movements of the sheets. Conveyor tape devices also require special driving mechanisms which complicate the structure of the machine; intermediary members of this kind also lower the efficiency of the machine.

In the novel printing machine according to this invention conveyor tapes of this kind are entirely dispensed with. By the positive guiding of the printed sheet all the way it is transferred from one printing unit to the feeding table of the next in such a manner, that during the passage no sliding or shifting of the sheet can possibly occur. As in known machines, the printed sheet is delivered face up, but in such a manner, that the delivery motion is also utilized for introducing the sheet into the receiving members of the feeder table of the next following printing unit.

The sheet on its passage from one printing unit to the other is thus positively guided and the danger of any irregular movement completely removed. In order to secure smooth delivery the motion of the tapes of the feeder table is alternately accelerated and retarded in such manner, that while the sheet is introduced into the grip of the transport rollers the tapes will move at even speed.

This novel method of transferring the sheet from one printing mechanism to the next necessitates, especially in case of rotogravure machines, the provision of certain special structural details in each separate printing unit appropriate to multicolor printing machines. It is well-known that the sheet freshly imprinted in a rotogravure machine has to be subjected to vigorous drying by air in order to prevent smudging or smearing. In the present multicolor rotogravure machines drying is effected on long drying stretches interposed between one printing mechanism and the next, which device however extraordinarily lengthens the machine, a disadvantage which in the new machine is avoided by the newly printed sheet being subjected to vigorous drying while it is still on the impression cylinder. According to this invention, the separate printing units which, as explained above, are intended to be assembled to form a multicolor machine are each provided with an impression cylinder and, in operative connection therewith, a form cylinder and a switch drum, the diameter of which form cylinder and switch drum is half that of the impression cylinder; the sheet before it is printed, is transferred to said switch drum, and blowing devices are provided in the space between the form cylinder and the feeder table for drying the newly printed sheet while it is still on the cylinder. The print consequently is already partly dry when it is delivered and, since it is delivered face up, it continues to be subjected to the drying action of the air. Additional drying devices may, however, be provided above the delivery mechanism of the first printing mechanism and the feeder device of the next printing unit.

The novel construction of the printing unit may also be applied to single-color machines. In this application it also possesses valuable features, such as great clearness of line, easy accessibility of all parts and consequent simplicity of service. Beyond that it offers a very valuable advantage, to wit the possibility for the printer to convert it into a multi-color machine by simply adding the requisite number of similar units at any convenient later date. The fact that the units of the novel multi-color machine are perfectly identical is an important advantage for the serial manufacture thereof.

The special construction herein described is also very valuable for sheet-fed letterpress rotary printing machines, especially for multi-color printing, although in this case the length of the drying stretch, which is the main advantage in a rotogravure machine, is not of great importance. But on the other hand another peculiarity will prove very valuable, namely the manner in which the tripping of the form cylinder is effected: the form cylinder is moved off the impression cylinder and the inking rollers, leaving both the impression cylinder which conveys the sheet, thus ensuring proper register, and also the inking rollers in their respective position occupied at the moment of tripping. This, on the one hand, is advantageous as it aids the attainment of faultless register in multi-color work and, on the other hand, simplifies service and construction. A further advantage of the novel construction is, that the inking mechanism comprises a lesser

number of inking rollers, because, since the form cylinder rotates twice during each printing period two or three inking rollers will ink the form to the same degree, as an inking mechanism having four or six inking rollers in a machine of the normal type. The machine, in consequence of the greater simplicity of its construction is also more efficient than the old sheet fed multi-color letterpress machines.

On the attached drawings showing, by way of illustration, a preferred embodiment of my invention,

Fig. 1 is a side view of a multi-color printing machine, having two rotogravure printing units for printing the pictures in two colors, and two letterpress printing units of which one may be used for printing the text matter in one color, while the other may serve for example to print in tints, ornamental work or the like in another color;

Fig. 2 is a side view of a rotogravure printing unit on a larger scale;

Fig. 3 shows in cross-section, and Fig. 4 in longitudinal section, the device for speeding up and slowing down the motion of the feeder tapes;

Figs. 5 and 6 drawn to a larger scale are cross sections of the device for conveying the sheet from one printing unit to the next, in two different positions;

Fig. 7 shows a tripping mechanism for withdrawing the form cylinder from the impression cylinder.

The sheet arriving from the feeder table 1 shown in Fig. 1 is, in well-known manner, seized by the fore-grippers 2 and by them is passed to the grippers 3 of the impression cylinder 4 (Fig. 2) of the first rotogravure unit which grippers, in turn, pass the sheet to the switch drum 5, the diameter of which is half that of the impression cylinder. The grippers 6 of the switch drum hold the sheet during one revolution of said drum and thereupon pass it to the grippers 7 of the impression cylinder 4 (Fig. 2). The grippers 7 which are situated diametrically opposite to the grippers 3 take the sheet past the form cylinder 8, whereby the sheet is imprinted. After having received an impression, the sheet, while still on the impression cylinder 4, is subjected to the action of blowing devices 9 which as shown in Fig. 2 are disposed along a portion of the circumference of cylinder 4 in the space between the form cylinder 8 and the feeder table 1. The sheet will then travel beneath the feeder table 1 and, gliding over the fingers 10 which bridge the gap between the impression cylinder and the transport rollers 11 of the feeder of the second printing unit, will be gripped by said transport rollers. The switch drum 5 insures, that the printed sheet will always arrive at the non-feed period of time, which makes it practicable to feed one sheet at every revolution of the impression cylinder.

The printed sheet is conveyed to the transport rollers of the feeder table of the second printing unit by the motion of the impression cylinder; being thus positively guided during its transit from one printing unit to the other the sheet can not possibly slide or slip in any irregular manner as in the case of ordinary conveyer tape devices where the sheet, to a certain extent, may move freely. If it is considered desirable additional blowing devices 13 may be provided above the feeder table 12, as shown in Fig. 1.

The exact position of the sheet previous to its being fed to the impression cylinder of the second printing unit is in well-known manner, secured by means of lay-marks, not shown on the drawings. By means of fore grippers 14, the sheet will then be delivered to the impression cylinder 15 of the second printing mechanism, wherein it receives the second impression, in a similar manner as in the first printing mechanism, but of another color, whereupon the sheet will be transmitted as above described to the feeder table 16 of the third printing unit. As in the preceding stage of the operation, it is the motion of the impression cylinder 15 which conveys the sheet into the grip of the transport rollers 17 of the feeder table 16. The motion of the tapes of the feeder tables 12 and 16, and also that of the transport roller pairs 11 and 17 will be accelerated in order to convey the sheet quickly across the feeder tables, and retarded during the feeding operation proper.

The device for speeding up and slowing down the motion of the transport tapes and transport rollers of any of the feeder tables is disposed upon the shaft of the impression cylinder of the preceding printing mechanism. In the case, for example, of the feeder table 16 the device for accelerating and retarding the motion of the transport tapes is placed upon the shaft of the impression cylinder 15. Figs. 3 and 4 show a preferred form of the speed controlling device, on a larger scale. The lower roller of the transport roller pair 17 (Fig. 1) is driven by means of a gear wheel 18 on an axle 19 (Fig. 3), which, in turn, is driven by a gear wheel 20 seated loosely on the shaft 21 of the impression cylinder 15. Fastened to the gear wheel 20 is a toothed segment 22 which engages another toothed segment 23, to which a bolt 24 is fastened the free end of which is journalled at one end of a crank 25 which is keyed to shaft 21. Attached to the bolt 24 is a lever 26 which, at its free end, carries the guide roller 27, which is adapted to glide in an eccentric 28. While the guide roller 27 glides along the circular section of the eccentric, the relative position of the segment 22 to the segment 23 will remain unaltered, and the roller 27 will consequently simply follow the movement of the segment 23. The gear wheel 20 and the shaft 21 then rotate with uniform speed. When, however, the eccentric 28 pushes the roller 27 more towards the center, the two segments will move relatively to one another, the gear wheel 20 will thereby receive an additional impulse, and consequently will rotate faster than the shaft 21. When, on the other hand, the roller 27 is pushed by the eccentric 28 further towards the periphery the rotary speed of the gear wheel 20 will be correspondingly lessened. The motion of the gear wheel 20 will be transmitted to the transport rollers 17 and the tapes of the feeder table by means of the gear wheel 18.

In order to make it practicable to utilize the rotary movement of the impression cylinder for introducing the sheet into the grip of the transport rollers 17, it is arranged that during this operation the guide roller 27 will travel within the circular section of the eccentric 28. The transport rollers 17 and the tapes of the feeder table 16 will consequently, during the transference of the sheet from the first to the second printing mechanism, move with uniform speed, corresponding to the circumferential speed of the impression cylinder 15. The sheet will now be lifted off the feeder table 16, by means of the fore grippers 29 which seize it and transmit it to the impression cylinder 30 of the letter press printing mechanism. Here, too, the sheet will next be made

to travel around a switchdrum 31, the diameter of which is, like that of the form cylinder 32 half that of the impression cylinder 30, and thereupon imprinted while passing between the impression cylinder 30 and the form cylinder 32. It will then, again by means of the impression cylinder motion be slid over the fingers 33 into the grip of the transport rollers 34 of the following printing unit. If the printing operation, for some reason or other is to be suspended, for example in case of a sheet failing to be fed, the form cylinder will be tripped, in well-known manner, by the rocking of a lever 35 at one end of which the form cylinder shaft is eccentrically journalled.

The tripping, as shown by Fig. 7, can, for example, be effected by a lever shown in said figure at 36, which lever at its free end carries a roller 42 which is guided in a cam groove 43 provided in a cam mounted on shaft 21 of the impression cylinder. The lever 36, being loosely mounted on a shaft 44 is rocked back and forth about this shaft by said cam. To lever 36 is secured a pin 45 on which is pivotally mounted a double pawl 46, which is controlled by a link 47 connected to the armature of an electro-magnet 48 included in an electric circuit, 49. On shaft 44 is also loosely mounted another lever 50, which is provided with a recess 51. Now, as the said link 47 is moved upwards or downwards by the magnet 48, the said double pawl 46, during the rocking movement of lever 36, will drop into either of the ends of recess 51, and consequently, lever 50 will be moved either in the direction of arrow *a* or arrow *b*, with the result that the form cylinder 8 is moved into operative or inoperative position, the latter being the case, when no sheet reaches the grippers 52, which then closes a contact shown at 53

The transmission of the sheet, by means of the impression cylinder motion, to the transport rollers of the next printing unit, which may be of like description in all the printing units, is, for clearness sake, shown in Figs. 5 and 6 in detail, at the beginning of the operation and shortly thereafter. The sheet 38 resting upon the surface of the impression cylinder 4 is released by the grippers 7 at the moment it is to be passed to the fingers 10. In order to lift the edge of the sheet off the abutment 39 as softly as possible, and to cause it to mount the incline formed by the fingers without any shock. the front edge of the sheet is, at the proper moment slightly raised by means of the throw off grippers 40 only so far that the forward moving sheet just misses the tips 41 of the fingers 10 and proceeds to glide over said fingers. Agreeable to this purpose, the fingers 10 are adapted to perform rocking motions. Previous to the arrival of the sheet, the ends 41 of the fingers will swing from their highest position shown in Fig. 6, into the lowest position shown in Fig. 5, only to return to their earlier position as soon as the edge of the sheet has slipped past the tips, thus lifting the edge of the sheet gently off the impression cylinder. In the course of the delivery movement the sheet 38 will be peeled off the impression cylinder, as shown in Fig. 6, and introduced into the grip of the transport rollers 11 of the next following printing unit.

The disposition and motions of the throw off grippers are such, that during the whole of the lifting off movement no part of the grippers will project beyond the surface of the impression cylinder 4.

Experiments have shown that in the manner just now described, the sheets may be passed upon the fingers without the slightest shock; it is thus made practicable to guide the sheet into the grip of the transport rollers of the next printing unit by means of the proper motion of the impression cylinder of the preceding printing unit.

I claim:

1. In a sheet-fed multi-color rotary printing machine, in combination two printing units disposed in a row one behind the other, each printing unit comprising an impression cylinder and a form-cylinder, a sheet feeding device for the second printing unit, members bridging the space intermediate said feeding device and the impression cylinder of the first printing unit, means on the impression cylinder of the first printing unit for passing the printed sheets over said bridging members directly into the grip of said feeding device, and drying means extending along one portion of said impression cylinders.

2. In a sheet-fed multi-color rotary printing machine comprising a plurality of printing units disposed in a straight row, each printing unit comprising a feeder table, an impression cylinder, a form-cylinder and a switch-drum cooperating with said impression cylinder and said form-cylinder, grippers on said switch-drums for successively seizing and holding the sheets during the non-printing revolution of the form cylinder, drying devices disposed along a portion of the circumference of the impression cylinder intermediate the form-cylinder and the feeder table, sheet-feeding devices for the second and successive printing units, a delivery mechanism for delivering the printed sheets to said feeding devices, transport rollers on said feeding devices, bridging members between successive printing units, and means on the impression cylinders of the various printing units for passing the sheets over said bridging members directly into the grip of said transport rollers.

HANS FISCHER.