June 6, 1939. R. REINARTZ 2,160,906

SHEET FEEDING AND REGISTERING DEVICE

Filed Jan. 22, 1937 2 Sheets-Sheet 1

Fig.1

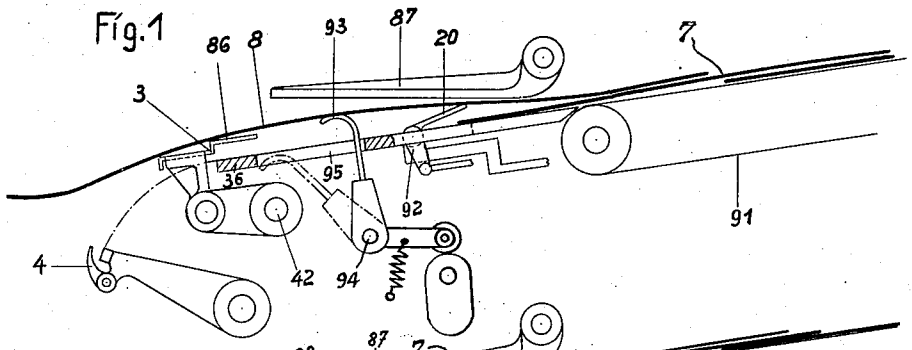


Fig.2

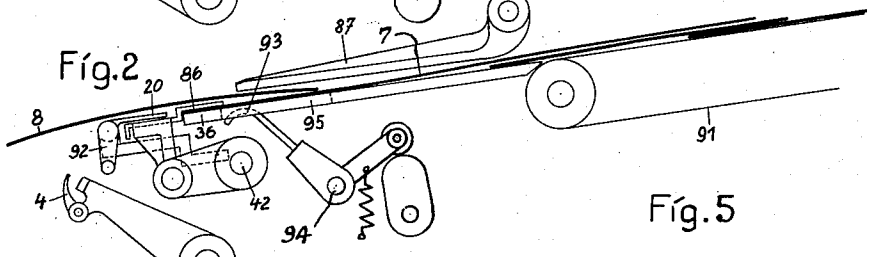


Fig.5

Fig.3

Fig.4.

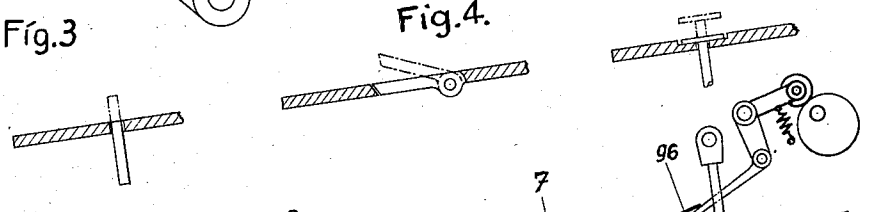


Fig.6

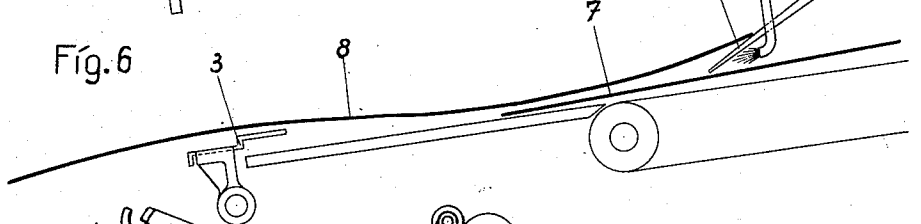
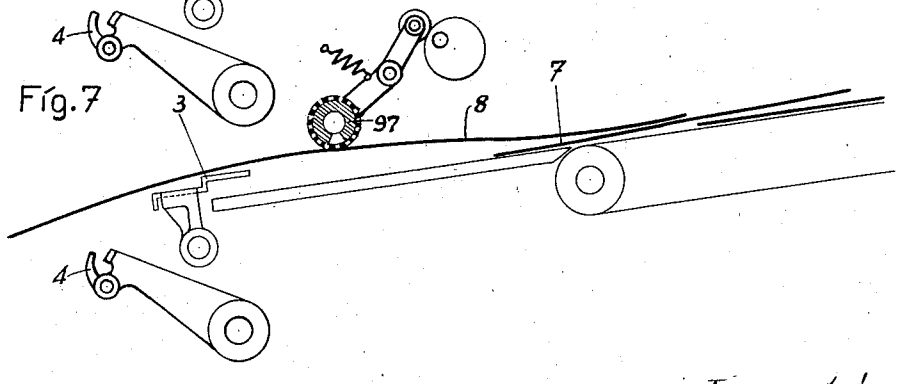


Fig.7



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June 6, 1939. R. REINARTZ 2,160,906

SHEET FEEDING AND REGISTERING DEVICE

Filed Jan. 22, 1937 2 Sheets-Sheet 2

Fig. 8

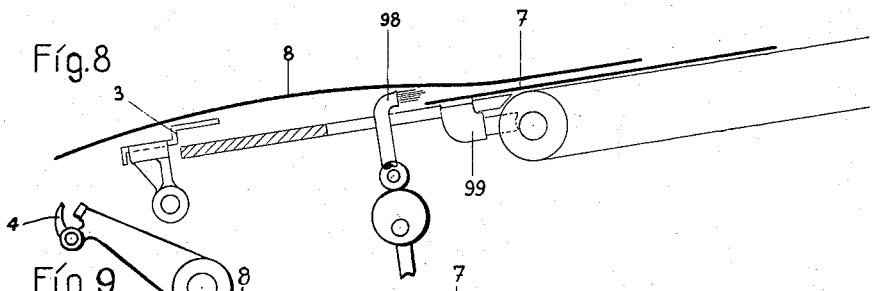


Fig. 9

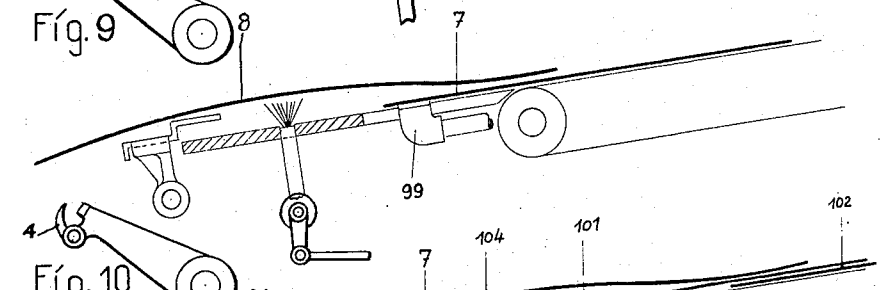


Fig. 10

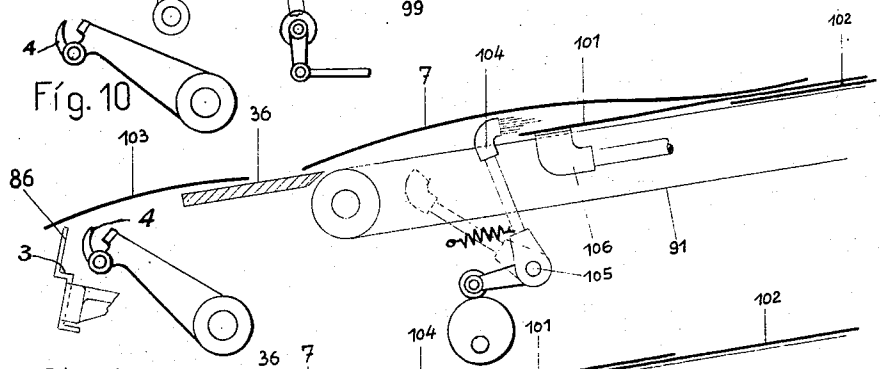


Fig. 11

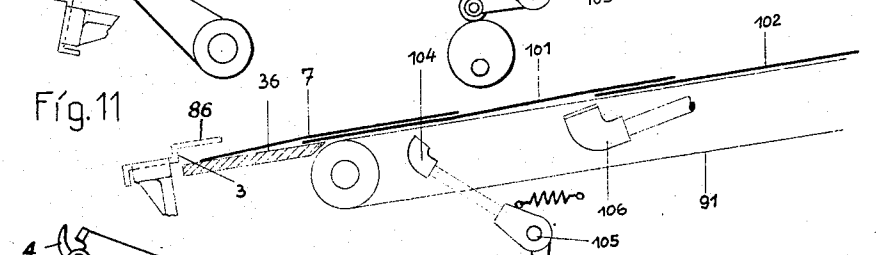
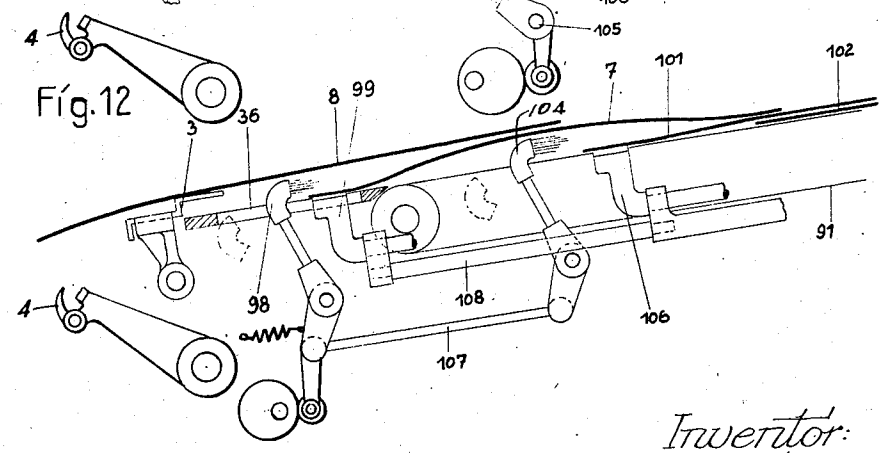


Fig. 12



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Patented June 6, 1939 2,160,906

UNITED STATES PATENT OFFICE

2,160,906

SHEET FEEDING AND REGISTERING DEVICE

Robert Reinartz, Offenbach, near Frankfort-on-the-Main, Germany, assignor, by mesne assignments, to Faber & Schleicher, A. G., Offenbach-on-the-Main, Germany, a corporation of Germany

Application January 22, 1937, Serial No. 121,805
In Germany January 23, 1936

17 Claims. (Cl. 271—53)

The invention relates to feeding and registering devices applied to printing machines or any other machine where exact registration of the sheets to be fed is essential, and especially to devices of that class in which the sheets to be registered are fed in lapped sequence.

One of the main objects of the invention is to diminish friction between lapped sheets to be registered.

Another object of the invention is to lift either the sheet to be registered or the covering sheet or both of them by mechanical means or by a blast of air, or by suction means.

A further object of the invention is to apply such lifting action over the entire width of the sheet and thereby to prevent the sheet to be deflected at a right angle to its motion.

A still further object of the invention is to complete the lowering of the sheet before the registration of a sheet begins and to maintain merely a thin film of air between the sheet to be registered and the adjacent lapped sheet.

Other objects of the invention will appear from the following description and appended claims:

Referring to the drawings:

Figs. 1–2 are side elevations of one embodiment showing two different positions.

Figs. 3–5 are sections of different modifications of the sheet lifting device.

Figs. 6–9 are side elevations of modified devices.

Figs. 10–11 show two different positions of a further embodiment and

Fig. 12 is another modification.

The essential of my invention consists in the diminishing of the influence of the adjacent sheets on a sheet to be registered. This may be accomplished by introducing air between adjacent sheets at a proper time and place, which in particular, as far as an underlying sheet is concerned, must be done, and as far as a covering sheet is concerned, can be done in such a way that during registration merely a thin film of air separates relatively lapped sheets. Although this essential is the same for all embodiments described by way of example, we deal, first with the applications of the invention to a covering sheet and to an underlying sheet separately and therefore I begin with the description of devices whereby the covering sheet is lifted.

With registering devices in which a sheet is reigstered in front or laterally, or in both ways, while a part of the preceding sheet still covers at least the front guides, it has proved to be useful, that the covering sheet while being forwarded into the printing machine or the like is lifted near the front or lateral guides to thereby for instance prevent the sheet to be registered from being taken along with the moving sheet. Such lifting has heretofore been accomplished by the guides themselves, by special members associated with the guides, or by the grippers themselves while they are open.

When the lifting function occurs near the guides only, then the lifting effect is limited to individual points along the width of the sheet. In consequence thereof the covering sheet is deflected on a line extending over the width of the sheet with the further consequence that it is not fed to the impression cylinder or other working part of the machine in a flat condition necessary for obtaining a precise register all over the sheet, and sometimes even creasing of the sheet is inevitable. If to the contrary the covering sheet is lifted by the opened grippers in consequence of the grippers being distributed all over the width of the sheet it will form a straight line vertical to the direction of its motion and thus the draw back of the point like lifting is overcome. But lifting the sheet by the grippers has the draw back that the grippers concerning the time and place of their functioning are bound to their chief task of gripping and forwarding the registered sheets. The consequence is that they cannot be made to function at the place and time most desirable for the lifting effect.

Therefore I provide special means which shall be operated independently of any of the other mechanism and which has the only task to lift the covering sheet from the sheet next to be registered whereby the lifting device lifts the sheet so that a line extending over the whole width of the sheet essentially remains a straight line.

Referring to Figs. 1 and 2 the general arrangement and operation of the device shown may be of any suitable and conventional type. Preferably, I use and have illustrated mechanism similar, although somewhat modified, to that illustrated and described in my prior Patent 2,011,776. Therefore I apply the same reference numbers as in said prior patent for the parts to be mentioned in connection with the present invention. But although I refer to that prior patent for the purpose of shortening this description, any details not mentioned herein as being of importance may be altered without departing from the scope of the present invention.

36 is a feeding plate over which by means of tapes 91 or the like a sheet 7 is fed against the front guides 3 provided with cover plates 86.

The sheets following sheet 7 are fed in underlapped condition by any of the customary means adapted therefore. The front guides 3 are given both a motion up and down and a motion forward and backward to the effect that a registered sheet may pass over them and that on the other hand a new sheet to be registered may first be introduced below the cover plate 86 and then while being registered may be held down and prevented from buckling by this plate. Slow down hooks 92 provided with movable covering plates 20 are also given a horizontal and vertical motion. In the position shown in Fig. 1 the covering plates 20 are lifted so that the oncoming sheet 7 may enter below them, but they are lowered before sheet 7 touches the abutting face of the hooks 92. During this operation the hooks may be moved forward to diminish the abutting shock, but afterwards their speed is diminished so that sheet 7 is made to abut to the front guides with low speed. The hooks 92 then pass in front of the sheet being registered and return after having been lowered.

Grippers 4, which may be of any conventional type, engage the registered sheet and then forward it to other gripping means. The operation of these sheet engaging means is so timed that the previously registered sheet 8 while being forwarded to the working parts of the machine still covers the front part of the sheet 7 to be registered during at least a part of the time needed for its registration. 87 are guide rods to hold down the sheet to be registered, eventually by intermediation of the covering sheet 8.

It is clearly to be seen that in a device containing but the parts mentioned the covering plates 20 and 86 touching the sheet 8 at a few points only will deflect it on a line extending over the width of the sheet.

According to one preferred form of my invention therefore the sheet lifters 93 are provided which are distributed across the entire width of the sheet. These lifters are fixed to a rocking shaft 94 and swing up and down as indicated in Fig. 2 as compared with Fig. 1. The means for operating shaft 94 may be of any conventional type such as I have indicated in said figures. Slots 95 may be provided in the feeding plate 35 to make room available for the motion of the lifters 93. These lifters being distributed across the entire width of the sheet the point like contact between the covering plates 20, 86 and the covering sheet 8 is rendered uneffective and thus the sheet 8 is forwarded in a perfectly flat condition. Thereby it is recommendable that the lifting means which act across the entire width of the sheet are raised prior to raising and for swinging out of the registering means 3 and/or 92 to prevent these latter members from acting on a sheet before it is properly raised by the lifters 93.

The described device besides the linear lifting of sheet 8 as compared with lifting by means of the covering plates 20, 86 or the like has several other advantages as compared with lifting by means of the grippers 4. Should one undertake to move these grippers up to the feeding plate 36 so early that they would lift the covering sheet 8 at the position shown in Fig. 1, this could be effected only by very strong accelerating forces because the grippers essentially have the quite different task to feed the sheet into the machine. Furthermore the lifting effect of the grippers would not be extended to the covering plates 20 of the slow down hooks which are rather distant from the grippers and these covering plates would therefore cause a deflection of the kind shown to be avoided. And finally the grippers which must remain open till the end of the registering operation would prevent the covering sheet 8 to be lowered during the registration and consequently buckling of the sheet to be registered could not be prevented by means of the guide rods 87 if one desires to do so. The special lifting means 93 to the contrary can be made effective by smooth motions at the place and at the time most suitable for the feeding and registering. In the embodiment according to Figs. 1 and 2 the light lifters 93 making a short motion only are easily controlled without sensible acceleration forces. Furthermore the effect of the lifters being arranged between the hooks 20 and the front guides 3 extends to both of them. And finally they may be lowered at about the same time as the covering plates 20 which on their turn may descend as soon as the sheet has entered beneath the covering plate 20.

I do not say that it is necessary or even recommendable in every case to lower the covering sheet at this early moment. But what I say is that provided the lifters are lowered at least when the sheet 7 is engaged by the front guides 3, the covering sheet 8 may lie flat on sheet 7 when this sheet abuts against said guides and in consequence thereof the sheet to be registered can be held down by guide rods 87 or the like with the interposition of the covering sheet 8 and thus may be prevented from buckling. If at the end of the registering operation the opened grippers return and lift the covering sheet again for a short while this does not matter any more.

Thereby experience has shown that even if the covering sheet 8 is lowered relatively early in consequence of its having been lifted all over its width, the introduction of air below the covering sheet is so effective that after its lowering a film of air is left and friction between the covering sheet 8 and the sheet 7 to be registered is still much less than in a device without the lifters 93. The possibility of combining the effect of a remaining air film and of holding the sheet down during registration is an essential advantage of the invention.

The side registering device which may be of any conventional form is not an essential part of the invention and therefore is not shown in the drawings.

The lifting device can be shaped, arranged and operated in different ways. It is possible f. i. to give it the shape of vertically arranged narrow plates passing through a slot in the feeding table according to Fig. 3. Or such a plate can be hinged in the feeding table (Fig. 4) so that its upper face after being swung down is about level with the surface of the feeding table. Plates of this kind could be divided into smaller individual plates. Furthermore the lifting device (Fig. 5) which after being lowered does not project over the surface of the feeding plate, could be fixed to vertical bolts or the like which pass through holes in the feeding plate.

If compared with vertically moved lifting devices those devices which have a combined motion up and down and forward and backward have the advantage that in cooperation with movable slow down hooks the point where the covering sheet is lifted may be arranged to advance at the same time as the hooks. Consequently they may lift the sheet 8 very near the rear edge of cover

plate 20 when the sheet 7 moves underneath this edge and nevertheless while being lowered may be made to move in front of the front edge of the sheet 7 without touching it and without hindering its motion. Vertically moved lifters must be arranged a certain distance in front of the oncoming next sheet to produce the same effect.

Although it may be recommendable to use slow down hooks of any desired type and especially hooks with a moyable cover plate of the kind shown in the drawings being flat when lowered, and although it may be so to apply flat covering plates with the front guides, these arrangements are not essential for the invention. It will be evident that any suitable and conventional forwarding means may be employed for the purpose of advancing the sheets toward the sheet registering mechanism; the adaptability inhering to the invention will allow in every case to provide the most suitable arrangement concerning time and place of lifting the covering sheet.

Thus the lifters 93 or any of the described lifting devices may be arranged nearer the front guides than shown in Fig. 1; this applies especially if no slow down hooks are provided. It will be readily understood that the lifters may be arranged to move in slots provided in the feeding plate and open toward the front. When lifted they may project backward over the front edge of the plate without any slots therein or they may remain in front of the front edge of the plate.

The lifting device can further be applied to the rear edge of the covering sheet according to Fig. 6. In this case it will be well to lift the sheet by means of tongues 96 or the like which are distributed over the width of the sheet and move forward with it after having advanced beneath its rear edge.

Instead of raising the sheet from underneath it can be lifted from its upper face. This can be done for instance by means of a suction roller 97 (Fig. 7) extending all over the width, by movable nozzles distributed all over the width or the like.

As shown in Fig. 8 the lifting device can be made out of hollow tubes 98 and blast air may be introduced between the covering shet 8 and the sheet next to be registered 7 or lifting may be effected merely by jets of blast air as shown in Fig. 9.

The blast air can also be applied from the rear edge of the sheet in combination with the tongues 96 shown in Fig. 6.

Whenever the covering sheet 8 is lifted near the front edge of the next sheet 7 it may be recommendable to apply suction nozzles 99 as shown in Figs. 8 and 9 moving forward together with sheet 7 and preventing its front edge from being lifted together with sheet 8. To nozzles of this kind all the details described in my U. S. Patent No. 2,087,997 may be applied.

Although I have mentioned that in the described devices the previously registered sheet covers the sheet to be registered during at least a part of the time needed for its registration, the invention fully applies in every instance when a registered sheet being pulled away from the feeding table or other support has to be lifted by parts which in themselves would deflect it on a line vertical to its motion. If for instance in Fig. 1 the sheet forwarding means were so timed that sheet 8 still covers the slow downs 92 while the lifted covering plates 20 allow sheet 7 to pass underneath, but because of a higher speed imparted to sheet 8 the lapped relation of the sheets would have terminated before sheet 7 is engaged by the front guides 3, there would be no covering during the final registration and sometimes not even when sheet 7 is preregistered by touching the abutting face of the slow downs, nevertheless, the covering plates 20 would lift the rear part of sheet 8 in an undue manner. In a case like this the sheet lifters 93 distributed all over the width of the sheet could be applied with the same useful effect as in the devices described before. By the way it may be mentioned that in such a device the front guides could be of the ordinary type i. e. be arranged above the path of the sheets so that they would be lowered in order to register them.

While in the cases where friction between the sheet to be registered and a covering sheet has to be diminished the lifted sheet could be kept up until the next sheet is engaged by the front guides, it is not so when friction between the sheet to be registered and the underlying sheet is concerned. For in this case the sheet to be registered would be in a deflected condition or even buoying on an air cushion and if blast air is applied this would further disturb the registration. When speaking about this second application of the invention, I always assume that the lifted sheet is allowed to descend at least before it abuts against the front guides, or if there are preregistering means, at least before it abuts against the final registering guides. Of course it may be lowered at an earlier moment, for instance before it abuts against the preregistering means.

But otherwise the relation between the sheet to be registered and either a covering or an underlying sheet are very similar to each other, namely if the invention were not applied, the friction between either the covering or the underlying sheet being in motion, and the sheet to be registered being arrested, would have the same effect of pushing the sheet to be registered against the front guides, and if the invention is applied, both the covering sheet and the sheet to be registered starting to be lifted before the sheet to be registered is arrested by the guides, the relative position between two succeeding sheets is alike. Very much the same lifting devices can therefore be applied to lift the sheet to be registered from the underlying sheet as have been described to lift the covering sheet from the sheet to be registered.

An embodiment with lifting of the sheet to be registered is shown by way of example in Figs. 10 and 11. 36 is the feeding plate over which the sheets 7, 101 and 102 are fed in underlapped sequence by means of the tapes 91. The front guides 3 in Fig. 10 are swung away to allow the previously registered sheet 103 to pass over them. This sheet 103, in consequence of the forwarding means, such as the grippers 4, being timed accordingly, in this instance does not any more cover the sheet to be registered at the moment shown in Fig. 10. In Fig. 11 the front guides are shown at the moment when the sheet 7 to be registered just passes underneath the covering plate 86.

To lift the sheet 7 to be registered blast nozzles 104 are provided which are secured to shaft 105 and rock between the tapes 91 or pass through openings in the feeding table. The conventional operating means that may be used for shaft 105 may comprise a cam and roller mechanism such as are commonly used for producing reciprocating motion.

Suction nozzles 106 are provided the suction face of which is moving forward in the plane of the tapes and moving backward a little below

this plane. These suction nozzles may be raised over said plane to catch a sheet if the front edge of it is curled upwards. Said nozzles may be moved forward at sheet feeding speed, or they may be decelerated in order to slow down the sheet engaged thereby.

In operation the sheet 7 to be registered is lifted by the blast nozzles 104 and blast air is introduced into the space between sheet 7 and the following sheet 101 held down by suction nozzles 106 while these two sheets and the following sheets are fed forward. The preceding sheet 103 has been forwarded to the machine meanwhile. According to the movement of the sheets 7 and 101 the blast nozzles 104 are moved forward and downward so that the sheet 101 does not touch them. At a suitable moment the blast air and the suction are stopped and the nozzles 104 being sufficiently lowered, sheet 7 will descend down unto the support and approach the front guides 3 which meanwhile have been moved back, as shown in Fig. 11, the sheet 7 lying flat on the feeding table and the succeeding sheet with an air film being left underneath it.

While it has already been told that all modifications of the devices in which lifting of a covering sheet is applied are applicable when lifting the sheet to be registered, I may add that different combinations of the two cases are within the scope of the invention:

(1) There may be no covering sheet and the sheet to be registered is lifted (as in Figs. 10 and 11 f. i.);

(2) There is a covering sheet which is not lifted, but the sheet to be registered is;

(3) The covering sheet is lifted, but the sheet to be registered is not (as in Figs. 1 and 2 f. i.);

(4) Both the covering sheet and the sheet to be registered are lifted (as in Fig. 12).

In the latter case operating means for the sheet lifters and eventually for the holding down suction nozzles can be partly or totally combined. An embodiment of this possibility is shown in Fig. 12. 8 is the sheet covering the front guides 3 which would lie on the sheet 7 approaching to the front guides 3, if it were not lifted by the blast nozzles 98. The suction nozzles 99 again hold down the sheet 7 to be registered and the nozzles 106 have the same effect on the following sheet 101. The blast nozzles 104 lift the sheet to be registered. The blast nozzles 98 and 104 as well as the suction nozzles 99 and 106 in this case may be arranged to follow similar motions so that one may connect them by the connecting rods 107 and 108 and the operating means, which may comprise a conventional cam and roller mechanism as indicated, therefore need not be duplicated, this also applies to the valves controlling the two suction and blast nozzles.

I claim:

1. In combination with a sheet feeder adapted to feed sheets in lapped sequence, the provision of mechanism including a sheet support, sheet registering guides, means for advancing sheets over said support to said guides, means for removing registered sheets from said support, and sheet lifting means acting on a single sheet to raise it while located over said support, said lifting means extending across the entire width of a sheet and being operated independently of any other of said aforesaid means.

2. In combination with a sheet feeder adapted to feed sheets in lapped sequence, the provision of mechanism including a sheet support, sheet registering guides, means for advancing sheets over said support to said guides, means for removing registered sheets from said support, and sheet lifting means acting on a single sheet that is being removed from said support to raise it while located over said support, said lifting means extending across the entire width of a sheet and being operated independently of any other of said aforesaid means.

3. In combination with a sheet feeder adapted to feed sheets in lapped sequence, the provision of mechanism including a sheet support, sheet registering guides, means for advancing sheets over said support to said guides, means for removing registered sheets from said support, and sheet lifting means acting on a sheet to raise it in order to reduce friction between said sheet and a sheet in lapped relation thereto, and while located over said support, said lifting means extending across the entire width of a sheet and being operated independently of any other of said aforesaid means.

4. In combination with a sheet feeder adapted to feed sheets in lapped sequence, the provision of mechanism comprising a sheet support, front registering guides, cover plates on said guides, sheet slow down means adapted to receive sheets to be registered and convey them toward said registering guides, means for removing registered sheets from said support, and sheet lifting means arranged intermediate the cover plates of said registering guides and said slow down means and acting on a sheet to raise it while located over said support, said lifting means extending across the entire width of a sheet and being operated independently of any other of said aforesaid means.

5. In combination with a sheet feeder adapted to feed sheets in lapped sequence, the provision of mechanism comprising a sheet support, front registering guides, cover plates on said guides, sheet slow down means adapted to receive sheets to be registered and convey them toward said registering guides, cover plates on said slow down means, means for removing registered sheets from said support, and sheet lifting means arranged intermediate the cover plates of said registering guides and of said slow down means and acting on a sheet to raise it while located over said support, said cover plates being adapted to cooperate with said lifting means to raise a sheet, and said lifting means extending across the entire width of a sheet and being operated independently of any other of said aforesaid means.

6. In combination with a sheet feeder adapted to feed sheets in lapped sequence, the provision of mechanism including a sheet support, sheet registering guides, means for advancing sheets over said support to said guides, means for removing registered sheets from said support, and sheet lifting means acting on the rear portion of a sheet to raise it while located over said support, said lifting means extending across the entire width of a sheet and being operated independently of any other of said aforesaid means.

7. In combination with a sheet feeder adapted to feed sheets in lapped sequence, the provision of mechanism including a sheet support, sheet registering guides, means for advancing sheets over said support to said guides, means for removing registered sheets from said support, and sheet lifting means acting on the rear portion of a sheet that is being removed from said support to raise it while located over said support, said lifting means extending across the entire width

of a sheet and being operated independently of any other of said aforesaid means.

8. In combination with a sheet feeder adapted to feed sheets in lapped sequence, the provision of mechanism including a sheet support, sheet registering guides, means for advancing sheets over said support to said guides, means for removing registered sheets from said support, and sheet lifting means including lifting tongues and air nozzles cooperating to act on a sheet to raise it while located over said support, said lifting tongues extending across the entire width of a sheet and being operated independently of any other of said aforesaid means.

9. In combination with a sheet feeder adapted to feed sheets in lapped sequence, the provision of mechanism including a sheet support, sheet registering guides, means for advancing sheets over said support to said guides, means for removing registered sheets from said support, and sheet lifting means including suction means arranged to act on a sheet and raise it while located over said support, said suction means extending across the entire width of a sheet and being operated independently of any other of said aforesaid means.

10. In combination with a sheet feeder adapted to feed sheets in lapped sequence, the provision of mechanism including a sheet support, sheet registering guides, means for advancing sheets over said support to said guides, means for removing registered sheets from said support, means for raising a sheet while located over said support and suction means to hold down a sheet to be registered while a previously registered sheet is being removed, said means for raising a sheet extending across the entire width of a sheet and being operated independently of any other of said aforesaid means.

11. In combination with a sheet feeder adapted to feed sheets in lapped sequence, the provision of mechanism including a sheet support, sheet registering guides, means for advancing sheets over said support to said guides, means for removing registered sheets from said support, means for raising a sheet while located over said support during its removal therefrom, and suction means to hold down a sheet to be registered while a previously registered sheet is being removed, said means for raising a sheet extending across the entire width of a sheet and being operated independently of any other of said aforesaid means.

12. In combination with a sheet feeder adapted to feed sheets in lapped sequence, the provision of mechanism including a sheet support, sheet registering guides, means for advancing sheets over said support to said guides, means for removing registered sheets from said support, suction means to hold down a sheet to be registered while a previously registered sheet is being removed, and air jets arranged intermediate said registering guides and said suction means to raise a sheet while located over said support, said air jets extending across the entire width of a sheet and being operated independently of any other of said aforesaid means.

13. In combination with a sheet feeder adapted to feed sheets in lapped sequence, the provision of mechanism including a sheet support, sheet registering guides, means for advancing sheets over said support to said guides, means for removing registered sheets from said support, suction means to hold down a sheet to be registered while a previously registered sheet is being removed, and movable air jets arranged intermediate said registering guides and said suction means to raise a sheet while located over said support, said air jets extending across the entire width of a sheet and being operated independently of any other of said aforesaid means.

14. In combination with a sheet feeder adapted to feed sheets in lapped sequence, the provision of mechanism including a sheet support, sheet registering guides, means for advancing sheets over said support to said guides, means for removing registered sheets from said support, and sheet lifting means acting on a sheet to be registered in order to raise it while located over said support, said lifting means extending across the entire width of a sheet and being operated independently of any other of said aforesaid means.

15. In combination with a sheet feeder adapted to feed sheets in lapped sequence, the provision of mechanism including a sheet support, sheet registering guides, means for advancing sheets over said support to said guides, means for removing registered sheets from said support, and two sets of lifting means, one of said sets raising a previously registered sheet while it is being removed from said support, the other one of said sets raising a subsequent sheet while over said support.

16. In combination with a sheet feeder adapted to feed sheets in lapped sequence, the provision of mechanism including a sheet support, sheet registering guides, means for advancing sheets over said support to said guides, means for removing registered sheets from said support, and two sets of lifting means, one of said sets raising a previously registered sheet while it is being removed from said support, the other one of said sets raising a subsequent sheet while over said support, said two sets of lifting means extending across the entire width of a sheet and being operated independently of any other of said aforesaid means.

17. In combination with a sheet feeder adapted to feed sheets in lapped sequence, the provision of mechanism including a sheet support, sheet registering guides, means for advancing sheets over said support to said guides, means for removing registered sheets from said support, and sheet lifting means acting on a single sheet to raise it while located over said support and again lower the sheet before it reaches its final registering position, said lifting means extending across the entire width of a sheet and being operated independently of any other of said aforesaid means.

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