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A sheet transfer drum for a sheet-feed rotary printing press which may be changed over between straight printing and perfecting

The present invention relates to a sheet transfer drum for a sheet-feed rotary printing press which may be changed over between straight printing and perfecting, the drum having a gripper system for the lead edge of a sheet and a suction system for the tail of a sheet and having the function of pulling tight the sheet in its direction of motion and normal thereto, and smoothing the sheet.

The purpose of such a design is that of stopping loss of form or creasing and making certain of smooth forwarding of the sheet tail to the next part of the press without damage. Such a sheet pulling tight system furthermore has the purpose of exact forwarding of the sheet tail on perfecting so as to keep the sheet in register in the circumferential and axial directions.

A transfer drum of the sort in question is to be seen in German patent 2,452,096. It is said in the characterizing part of claim 1 of this patent that the suction system is made up of a number of turning suction feet, whose suction faces have eccentrically placed suction openings and are in the circumferential face of the transfer cylinder, the suction feet being turned for pulling tight the sheet tail. In this system the component of the pulling tight motion running in the circumferential direction of the sheet transfer drum is not along a circumferential line of the drum and in fact the direction of motion of the turning feet may be said much more to be along a tangent to the transfer drum. Because furthermore the suction

holes are at different distances from the middle point of the suction foot, different suction levels are produced at different distances from the middle point of the sheet transfer; this is more specially in the case of thin papers likely to be responsible for uneven pulling on the sheet being transported.

A further system for pulling tight a sheet in the direction of running and normal thereto is to be seen in German patent 1,155,145 using pre-tensioned suction heads which in part are at an angle to the direction of running of the sheet. Such a system, however, only gives the desired outcome, if the pulling tight motion of all suction heads takes place at the same time under the same effect. This is however not possible because small differences, which are in any case present, in the resistance of the screws in the suction head and in the different sealing effects of the paper sucked up against the suction head on the suction holes and furthermore uneven thickness of the paper are responsible for uneven pulling tight of the sheet, this being responsible for creasing. For this reason this system has not gone down well in the printing trade. The system furthermore makes a relatively high suction level necessary for forcing together the springs in the suction heads. Because of this high suction force, damage to paper, more especially thin paper, will be likely. In the case of the two known systems there is furthermore in all cases a connection in function between the axial or sideways and the circumferential pulling forces, something which is not in line with the different conditions which have to be produced on processing narrow and broad sorts of paper so that the paper

is not pulled tight and smooth at its tail.

Taking as a starting point such prior art systems, one purpose of the present invention is that of designing a system, for pulling tight and
5 smoothing the sheet in its direction of motion and normal thereto, which takes care of the shortcomings noted and more specially makes certain that the sheet is not damaged in the machine. A further purpose of the invention is that of taking care of trouble
10 conditions produced on working on narrow or broad papers in the prior art.

These and other purposes are effected in the invention by the system as given in the characterizing part of claim 1. As the latter
15 indicates, the axial pull on the sheet can be adjusted or changed separately from, and without having any effect on, the circumferential pull. Even with suction systems wherein separate suction hole groups are moved axially along different
20 distances, it is nevertheless possible to make certain that the distance along which they move in the circumferential direction (for pulling the paper tight) is kept constant over the full breadth of the sheet. The fact that the pulling operation takes
25 place evenly and with a single value of the pulling force makes certain that the paper is processed without any damage at any time. The further developments of the invention, of which an account is to be given, are more specially designed for use with
30 thin and soft papers, in which respect, further, over-narrow printing on the paper is put an end to. It is possible to use a very great number of suction holes, and this makes the suction system more troublefree at

high machine speeds. The way in which a sheet is pulled tight at points in, or generally in, the drum radius puts an end to any loss of form or creasing of the sheet.

Developments of the invention of good effect will be seen in the dependent claims and a more detailed account of them will be given using the figures.

Figure 1 is a view of a transfer drum having suction levers, together with the system for causing the circumferential motion pulling the sheet tight.

Figure 2 is a side view of the transfer drum of figure 1 with the system for causing the sheet to be pulled tight in the axial direction.

Figure 3 is a view of the suction openings as placed in the suction levers, and the driving system with its cam.

Figure 4 makes clear the way in which a sheet may be pulled tight in the system of figures 1 to 3.

Figure 5 is a changed form of the first working example of the invention with a single-piece shaft and only one cam for pulling the sheet tight circumferentially.

Figure 6 is a view of part of drum of figure 5 with the system for controlling axial or sideways pulling tight of the sheet.

Figure 7 is a section through a suction lever as in figure 5.

Figure 8 is a view of a further possible system for axially pulling tight the sheet using separately moving suction plates on the suction levers.

Figure 9 is a cross-section through a suction lever as in figure 8 with the suction plate placed thereon.

Figure 10 is a section through the same suction lever, it having however a rubber suction foot on the suction plate placed on it.

Figure 11 is a plan view of a suction lever as in figure 10.

Figure 12 is a view of a second working example of a transfer drum, in which case suction holes are placed within the back sheet guiding segments themselves.

Figure 13 is a side view of this second working example with the system for pulling the sheet tight axially.

The working example of the invention to be seen in figures 1 and 2 has a sheet transfer drum 1, to which a sheet 2 of paper is forwarded from a transfer cylinder 3, this being done in a normal way using grippers 4 and 5 on the two cylinders. While in the case of straight printing (single-sided printing) the sheet 2 is handed over by the grippers 4 of the transfer cylinder to the grippers 6 of the perfecting cylinder 7, in the case of perfecting the tail of the sheet is firstly taken up by the perfecting cylinder 7 so that the sheet 2 may then, after being turned, be handed on to the next printing unit. The circumferential size of the transfer drum 1 is equal to twice the circumferential size of the transfer cylinder 3 and of the perfecting cylinder 7.

The transfer drum 1 is made up of separate sheet guiding or supporting segments 8 and 9 which may be turned in relation to each other about the shaft 10 of the drum, i.e. for this

purpose the back sheet guiding segments-9 may be turned about the shaft 10 for the purpose of changing the outer face, supporting the sheets, to be in line with different paper sizes.

The tail of the sheet is acted upon by a suction system 11 which is made up of separate suction-levers 12 having suction holes 13 having branches-14. The suction levers 12 are keyed on two pipes 15 which are parallel to the drum's shaft 10 and are bearinged in the back sheet guiding segments 9. By way of these pipes 15 suction of air takes place using suction connections 16 (figure 2) and valves, which are not detailed in the figure. The back sheet guiding segments 9 are joined together by two cross-pieces 17. Circumferential motion of the suction levers 12 is caused by spring loaded roller followers 18 with rollers 19 and circumferential, that is to say radially acting, cams 21 fixed to side walls 20. The spring 22 for driving each follower 18 is supported against a stop 23 fixed to the back sheet guiding segment 9 and takes effect by way of a push rod 24, it forcing (by way of a lever 25 fixed to each pipe 15) the roller followers 18 against the radially acting cam 21.

As will be clearly seen from figure 2, the axial or side-ways pulling tight of the paper is due to axially acting cams 26, fixed to the side walls 20 as well, and acting by way of roller followers 27 placed in the outer ends of pipes 15. In each case two pipes 15 placed end to end are so pushed away from each other by spring 28 as to be moved in opposite directions, the outcome being a diagonal pulling tight of the paper sheet as will be seen from figure 4. In figure 2 it is

furthermore possible to see the keying of the suction levers 12 on pipes 15 by using pins 29 and the keying of the front sheet guiding segments 8 on the drum's shaft 10 using pins 30.

In figure 3 a view of the suction system 11 on a greater scale will be seen. Using an adjustment screw 31, screwed into an arm on a suction lever 12, the motion in an axial direction for pulling the paper tight may be limited. This view furthermore makes clear the connection of the back sheet guiding segments 9 by way of cross-piece 17 and pins 32.

Figure 5 gives a further possible way of turningly supporting the suction levers 33 and the suction air line. The suction levers 33 are keyed by way of pins 35 on two outer pipes 34 which for their part are bearinged in the back sheet support segments 9. In the outer pipes 34, a rod 36 running along the full length of the sheet transfer drum 1, is bearinged and is locked thereto so that it may not be twisted in relation thereto. This locking is effected by straight pins 37 fixed in the outer pipes, each pin being able to be moved in a slot 38 in rod 36. The control of the circumferential motion for pulling tight the paper is in this case only by way of spring loaded roller follower 18 and takes effect by way of rod 36 and outer pipe 34 on the suction levers 33. The spring loading effect is in this case the same as in figure 1 and the system for producing it is not to be seen in figure 5, so as to make the figure more straightforward. The two outer pipes 34 are so pushed away from each other by spring 39 that, using the system for controlling the axial motion pulling tight, the paper motion of the suction

levers 33 in opposite directions is produced.

Suction is produced in the space between the outer pipe 34 and the rod 36 by a suction air connection 40 in each case.

In figure 6, which is a view of the structure of figure 5 but at 90° to the direction in which figure 5 is taken, it is possible to see the system for producing or controlling the axial pulling tight motion, and in this case on each of the two outer, back sheet guiding segments 9 there is a small plate cam 41, whose angle in relation to the back sheet guiding segment 9 may be changed by an adjustment-screw 42. On turning the outer pipe 34 for causing circumferential motion of the suction levers 33, the outer pipe 34 and the push rod 43 fixed at its end will be moved along parallel to the outer face of plate cam 41 so that this sideways or axial pulling tight motion is produced. From this it will be seen, although the one pulling tight motion is the outcome of the other motion, separate control is nevertheless possible because of the separate form of adjustment.

A section through the suction lever 33 (see figure 7) will make clear the positioning of the suction holes 13 and their branches 14. Furthermore it will be seen that the suction lever 33 is keyed on outer pipe 34 by pin 35 while the outer pipe 34 is keyed on rod 36 by pin 37.

One possible way of separately controlling the axial or sideways pulling tight motion of each group of suction openings will be seen in figure 8, in which respect as well, as was the case with the working example of figures 5 and 6, the plate

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cams 41 and adjustment screws 42 are used. Such cams are used with push rods 44, each one of which is fixed to one end of one suction plate 45. Plates 45 are pushed by way of compression springs 46 towards cam plates 41, the other ends of springs 46 resting against the next sheet guiding segments 9. The suction plates 45 themselves are movingly supported in pockets 47 of the same form in the suction levers 48 so that such plates may be moved in the direction of their length, and if desired their place may be taken by new ones, see figures 9 and 10. The suction levers 48 are in this respect-keyed by way of coned pins 49 on a single-piece pipe 50 running from one side to the other. Pipe 50 is for its part turningly bearinged in the back sheet guiding segments 9 and it has the system for controlling or producing the circumferential pulling tight motion.

A pin connection 51 between the roller lever followers 18 and the pipe 50 makes it possible for the circumferential pulling tight motion to take effect on the suction levers 48. Pockets 52 machined into the suction plates 45 and the back sheet guiding segments 9 take up compression springs 46, safely guiding them while the suction levers 48 are being moved for circumferentially pulling the paper tight (figure 11). For producing the suction effect use is made of a suction connection 40 and the inside of pipe 50. The supply of vacuum through the pipe 50 by way of a suction hole 13 in the suction lever 48 running to the suction plates 45 will be seen in figures 9 and 10. Because the suction plates 45 may be taken off and other ones used in their place, the machine may be changed over for different sorts of papers by using different suction plates. To this end as well a rubber suction foot 53 may be used (figure 10)

more specially for stiffer sorts of papers (boards). In this respect a possible way of placing the rubber suction feet 53 and furthermore the placing of the driving parts 41, 42 taking effect on the suction plate 45 will be seen in figure 11.

A further design of the transfer drum will be seen in figures 12 and 13 in which the back adjustment guiding segments 54 are joined together by two pipes 15 and directly joined up with the suction holes 13 and suction branches 14. The vacuum supply is by way of connections 16 and through pipes 15. The control of the circumferential motion of the back sheet guiding segments 54, and for this reason of the suction system 11, may be undertaken as in the prior art (see German Offenlegungsschrift specification 2,559,735) and is not to be seen in the present figure, in order to make the figure more straightforward. The further parts of the design are generally as in the working example of the invention of figures 1 to 3.

Figure 13 is a view of the back and front sheet guiding segments 54 and 8, the figure further making clear the control of the axial or sideways pulling tight motion. By way of adjustment screws 55 screwed into the back sheet guiding segments 54 it is possible for the axial or sideways pulling tight motion to be limited using the front sheet guiding segments 8 used as a stop. In the case of the working example of figures 12 and 13 the radius of turning of the suction system 11 is equal to the radius of the sheet transfer drum 1, this putting an end completely to any loss of form of the sheet on being pulled tight and smoothed.

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in the design to be seen in figures 5 to 11 for controlling the axial pulling tight motion and the different possible designs, noted in this connection, of the parts, may be readily used, with some small changes, in the case of the working example of the sheet transfer drum of figures 12 and 13.

List of Components

- 1 - sheet transfer drum
- 2 - sheet
- 3 - transfer cylinder
- 4,5,6 - grippers
- 7 - perfecting cylinder
- 8,9 - supporting segments
- 10 - shaft
- 11 - suction system
- 12 - suction levers
- 13 - suction holes
- 14 - branches
- 15 - pipes
- 16 - suction connections
- 17 - cross-pieces
- 18 - roller followers
- 19 - rollers
- 20 - side walls
- 21 - cams
- 22 - spring
- 23 - stop
- 24 - push rod
- 25 - lever
- 26 - cams
- 27 - roller followers
- 28 - spring
- 29,30 - pins
- 31 - adjustment screw
- 32 - pin
- 33 - suction lever
- 34 - pipes
- 35 - pins
- 36 - rod
- 37 - cylinder pin
- 38 - slot
- 39 - spring
- 40 - suction air connection
- 41 - plate cam
- 42 - adjustment screw
- 43 - push rod
- 44 - push rod

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- 45 - plates
- 46 - springs
- 47 - pockets
- 48 - suction lever
- 49 - coned pins
- 50 - pipe
- 51 - pin connection
- 52 - pockets
- 53 - rubber suction foot
- 54 - sheet guiding segments
- 55 - adjustment screws
- 56 - middle axis



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CLAIMS

1. A sheet transfer drum for a sheet-feed rotary printing press which may be changed over between straight printing and perfecting, the drum having a gripper system for the lead edge of a sheet and a suction system for the tail of a sheet and having the function of pulling tight the sheet in its direction of motion and normal thereto, and smoothing the sheet, characterized in that: the suction system comprises suction components (12, 33, 48, 54) which are disposed side-by-side in the axial direction of the drum shaft (10), and are capable of being collectively tilted and capable also of being moved in the drum axis direction, tubes (15, 34, 50) being provided which are connected with the said suction components and which both carry the latter and conduct suction air away from them; to produce the tilting movement of the said suction components, which effects the pulling tight of the sheet in its direction of motion, at least one radially acting cam (21) is provided, and, to produce a transverse pulling-tight movement (in a direction transverse to the sheet's direction of motion), axially acting cams (26, 41) are provided, which radially and axially acting cams, by way of connection parts (15, 18, 19, 27, 34, 36, 43, 44, 50) have such an effect on the said suction components, considered collectively, that diagonal pulling-tight movements are produced acting on the sheet symmetrically with respect to the middle axis (56) of the drum; the pulling distance in the direction transverse to the sheet's direction of motion being adjustable by means of adjusting elements cooperating with the components producing the said transverse pulling-tight motion.

2. A sheet transfer drum as claimed in claim 1, characterized in that the said adjusting elements



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comprise adjustment-screw stop means (31, 42, 55).

3. A sheet transfer drum as claimed in claim 1, characterized in that for each suction system (11) a number of suction holes with suction branches (14)

5 are present.

4. A sheet transfer drum as claimed in any one of claims 1

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to 3, characterized in that the suction holes (13) are placed in suction levers (12), which are placed side-by-side and are fixed to pipes (15) which are turningly supported in the back, adjustable sheet support segments (9), the pipes being parallel to the drum shaft (10), and in that furthermore the circumferential motion of the suction levers (12) is produced by spring-loaded roller followers (18) and radially acting cams (21), while the axial pulling force is produced by axially acting cams (26) fixed to the side walls (20) of the printing press, such cams (26) acting on follower rollers (27) fixed to the ends of the pipes (15).

5. A sheet transfer drum as claimed in claim 4, characterized in that a spring (28) is placed between each two pipes (15) at the middle axis (56) of the sheet transfer drum (1) pushing the pipes away from each other in opposite directions and moving the suction levers (12) fixed thereto towards the nearest outer edge of the sheet transfer drum (1), the distance moved on such pulling motion being able to be adjusted by adjustment screws (31).

6. A sheet transfer drum as claimed in anyone of claims 1 to 3, characterized in that suction levers (33) are present, which in each case are turningly supported on a rod (36), stretching over the full length of the transfer drum, by way of outer tubes (34), in that the suction levers (33) are keyed on each outer pipes (34) and the last-named is keyed on the rod (36) so that it may be moved along it and the outer tubes are pushed away from each other by springs so as to be moved



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in opposite axial directions, axial motion being adjusted by plate cams (41), fixed to the back sheet support segments (9) and able to be adjusted by adjustment screws (42) in angle, push rods (43) on the casing pipes (34) moving along such plate cams when moved circumferentially.

7. A sheet transfer drum as claimed in claim 6, characterized in that the rod (36), stretching along the full length of the transfer drum, has the function of moving the suction levers (33) circumferentially, the rod (36) having for this purpose a spring-loaded roller follower (18), a radially acting cam (21) and a keying system (37, 38) between the rod (36) and the outer pipe (34).

8. A sheet transfer drum as claimed in anyone of claims 1 to 3, characterized in that there are suction levers (48) keyed on a pipe (50) stretching along the full length of the transfer drum, such suction levers (48) having top parts, for contacting the paper sheet (2) to be pulled tight, with suction plates (45), such plates (45) being able to be moved in the axial direction in relation to the suction levers (48) and being replaceable.

9. A sheet transfer drum as claimed in claim 8, characterized in that the axial pulling motion is produced by single plate cams (41), whose adjustment is possible in angle using adjustment screws (42), such cams (41) taking effect by way of push rods (44) directly on the suction plates (45) and making possible stepless adjustment of the axial pulling motion.



10. A sheet transfer drum as claimed in anyone of claims 1 to 3, characterized in that the suction holes (13) are in the back feed support segments (54) themselves so that the outer radius of turning of the suction system (11) is the same as the radius of the sheet transfer drum (1), while the separate sheet support segments (54) are joined together by two pipes (15) furthermore used for suction supply.



11. A sheet transfer drum for a rotary printing press, substantially as described with reference to any Figure or Figures of the accompanying drawings.
