

PATENT SPECIFICATION

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(54) TRANSFER DRUM FOR PRINTING MACHINES WHICH IS ADJUSTABLE TO VARIABLE SHEET LENGTHS

(71) We, HEIDELBERGER DRUCK-
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Germany, do hereby declare the invention,
for which we pray that a patent may be
granted to us, and the method by which it
10 is to be performed, to be particularly de-
scribed in and by the following
statement:—

The invention relates to transfer drums
for printing machines which are adjustable
15 to accommodate sheets of various lengths.

As is well known, perfecting printing
machines usually include three transfer
drums between each two successive printing
units. The sheet to be printed is transferred
20 during the running of the sheet in perfect-
ing printing from the first drum to the
second drum with the front edge of the
sheet foremost. After being transferred the
sheets are aligned on the second drum, so
25 that the transfer of the sheet in correct
register is ensured.

The sheet aligned in this manner is now
guided past the common tangential point
between the second transfer drum and the
30 following drum. As soon as the rear edge
of the sheet held by the suction devices of
the second drum reaches the tangent point,
it is gripped by the gripping mechanism of
the third turning drum.

At the same time the front edge of the
sheet is freed by the front gripper of the
second drum and the sheet is transferred
by the third drum, with the rear edge fore-
most, to the next impression cylinder for
40 the printing of the reverse side of the sheet.

For the transfer of the sheet in correct
register between the successive printing
units in perfecting work it is therefore par-
ticularly important that the sheet should be
aligned in correct register on the second
transfer drum, particularly its rear edge
45 which, on the transfer of the sheet to the
following turning drum, becomes the lead-
ing edge and thus the front edge of the
sheet in the following printing unit. Even if
50 there should be extremely small deviations
of the position of the rear edge of the sheet
on the second transfer drum, inaccurate
register will occur in consequence of incon-
gruent back transfer of ink by the back-
55 pressure cylinder of the second printing
unit on the printing on the front side of
the sheet, and this will be visible in the
form of mackling.

German Patent Specifications (Offen-
legungsschriften) 2 227 151, 2 228 671,
2 316 161, German Patent Specification
No. 1 611 241, German Utility Model
6 949 816, and German published specifi-
65 cation (Auslegeschrift) 2 358 223, describe
various types of transfer drums of the kind
indicated above. All these known devices
have the common disadvantage that the
transfer drums are composed of a larger or
smaller number of individual sheet carrier
discs or segments which are disposed side
70 by side on a carrier shaft. Some of these
sheet carrier discs, which are provided with
the gripper device for gripping the front
edge of the sheet, are made fast to the
75 carrier shaft while the other sheet carrier
discs, provided with the rear edge grippers
or suckers, are mounted rotatably on the
carrier shaft.

Since every bearing entails bearing play 80

resulting from the necessary tolerances of both the shaft and the bore, an arrangement of this kind has an extremely detrimental effect on the true running of the sheet carrier discs. This results in faulty peripheral and lateral register.

Apart from these disadvantages, the assembly of known transfer drums can be problematical because of their numerous components.

In addition, in the devices of German patent specification 1 611 241, German published specifications (Offenlegungsschriften) 2 227 151, 2 228 671, 2 316 161, and of German Utility Model 6 949 816, connecting and control parts for the gripper or sucker devices pass through the carrier discs, which must therefore be provided with corresponding cutouts and slots, thus leading to a weakening of the individual carrier discs and impairing their rigidity. This construction also places a limitation of the range of sheet sizes in which the transfer drums can be adjusted.

Because of the limitation of sturdiness of construction which necessarily results from the spacing of the individual segments and the dimensions of the apertures, and because of the consequently small dimensions of the control parts for the gripping or suction devices for the front or rear edges of the sheet, the individual components may be subject to vibration and bending, which may lead to inaccurate register both in single sided printing and in perfecting work. In the case of the transfer drums of German published specifications (Offenlegungsschriften) 2 227 151 and 2 228 671 this is further enhanced by the relatively loose connection of the individual components.

Finally, the elaborate construction of all the known devices mentioned above also entails high manufacturing costs and difficult assembly of the transfer drums which require time-consuming adjustment of the individual sheet carrier discs.

According to the invention there is provided a transfer drum for a printing press which comprises a main drum body which consists of at most two parts and is equipped with the device for gripping the front edge of the sheet, and on which a hollow body, partly surrounding the main body of the drum and equipped with the device for gripping the rear edge of the sheet, is disposed as a rotatable sheet carrier unit.

More specifically, the invention provides a transfer drum for a printing machine which is adjustable to accommodate sheets of various lengths and comprising a main drum body provided with sheet carriers or arms and a hollow body rotatably mounted on and partly surrounding the main drum

body and provided with sheet carriers interdigitated with the arms or sheet carriers on the main drum body such that relative rotation between the said bodies serves to provide for adjustability for various sheet lengths, the main drum body being constructed in at most two parts and carrying a device for gripping one edge of a sheet, said hollow body carrying a device for gripping the opposite edge of the sheet, and forming a rotatable sheet carrier unit.

A simple construction of this kind comprising a small number of components permits rational production with low manufacturing costs, easy and rapid assembly of the transfer drum not affecting the accuracy already achieved in manufacture, and ease of operation. In particular, through the elimination of the bearing tolerances of the numerous individual sheet carrier discs of known devices because of the small number of bearings required enables maximum accuracy to be achieved in respect of the true running of the entire transfer drum, which naturally has an extremely advantageous effect on accuracy of register, particularly in perfecting work.

Since the gripper device for gripping the front edge of the sheet is fastened to the solid main body of the drum and not to individual rotatable sheet carrier discs as in all known devices, absolutely correct sheet transfer is also ensured, particularly in single-sided printing.

A particularly simple construction, which promotes cost-saving manufacture and ease of assembly and exchangeability of one of the two sheet carrier units in the event of damage, comprises constructing the main body of the drum in two parts as a cylinder having a separate axle, while the hollow body is made in one piece.

In another advantageous development of the invention, which serves to improve the compactness of the construction of the transfer drum and its rigidity, the main body of the drum is made in one piece and the hollow body is composed of a plurality of parts.

In order to achieve a construction which is particularly rigid and free from vibration, both the main body of the drum and the hollow body are provided with integrally cast sheet carriers.

The hollow body can be finished as a component, so that a completely uniform surface is obtained which has minimum deviations between the individual sheet carriers of the casting and the accuracy of which cannot be affected by the assembly. Because of the continuous sheet support rail and of the consequent positioning of the largest possible number of suction points on the rear edge of the sheet, irrespective of the spacing of the segments,

accurate transfer of sheets in register is in addition achieved even in perfecting work.

The invention is explained more fully below in the form of a basic embodiment and of further alternative exemplary embodiments with the aid of the drawing, in which:

Figure 1 is a diagrammatical general view of the basic construction of the transfer drum, partly in section,

Figure 2 is a vertical cross-sectional view of the basic construction of the transfer drum for working with large sheet sizes, adjusted to maximum sheet size, the section being taken on the line A—B in Figure 1,

Figure 3 is a similar view of the transfer drum to that in Figure 2, but with the drum adjusted to minimum sheet size,

Figure 4 is a vertical cross-sectional view of a first form of construction of the transfer drum for working with medium sheet sizes, adjusted to maximum sheet size, the section being taken on the line A—B,

Figure 5 is a similar view to that in Figure 4, but with a drum adjusted to minimum sheet size,

Figure 6 is a vertical cross-sectional view of a second form of construction of the transfer drum for working with small sheet sizes, adjusted to maximum size, the section being taken on the line A—B,

Figure 7 is a similar view to Figure 6, but with the drum adjusted to minimum sheet size,

Figure 8 is a front view of a third form of construction of the transfer drum, adjusted to maximum sheet size, and

Figure 9 is a longitudinal section on the line C—D in Figure 8.

As shown in Figures 2 to 7, a transfer drum 3 whose diameter is twice that of the impression cylinder is disposed between preceding and following transfer and impression cylinders 1, 2 respectively. The main drum body 4 of the transfer drum 3 is in the form of a vaned wheel and is preferably made solid by casting and provided with integrally cast bearing journals 5. It may however also be of two-part construction in the form of a cylinder 6 with a separate axle 7, and also may be of forged or welded construction (Figures 8 and 9).

The main body 4 of the drum has a core cross-section which is widened in order to increase stiffness and which on both sides is tapered in cross-section in the form of arms extending towards its surface.

In the surface of the two arms of the main body 4 of the drum there are provided recesses 8 lying side by side at intervals, so that the surface of the body 4 is composed of alternate projections and depressions. As extensions of these surface projections the base body 4 of the drum is

provided on one side of each of its two arms with integrally cast sheet carriers 9 having the shape of an arc of a circle and likewise extending at intervals side by side over the entire width of the drum (Figures 1 to 5).

The opposite side of the arms of the main body 4 of the drum to that where the integrally cast sheet carriers 9 are disposed is kept plane and is aligned radially to the axis of rotation 10 of the transfer drum 3. On each of these plane sides a device 12 for gripping the front edge of the sheet is screwed, the largest possible number of fastening points being provided on the main body 4 of the drum. The device 12 for gripping the front edge of the sheet is in the form of a gripper device comprising a continuous gripper bar 13 and grippers 14, as can be seen in Figure 1. The grippers 14 are controlled by means of a cam roller 16 fastened on the end of the control shaft 15 (Figure 1).

The main body 4 of the drum together with the journal 5 and the circularly curved sheet carriers 9 can thus be composed of a casting and be finished conjointly, and together with the gripper bar 13 screwed to it forms a solid, sturdy, fixed sheet carrier unit.

As can be seen from Figures 1 to 7, the main body 4 of the drum is provided on its end faces with attachments 17 on which a hollow body 18 is mounted without play and with the finest fit tolerance as a rotatable sheet carrier unit. The hollow body 18 is composed of two lateral adjusting discs 19 and of a peripheral wall 20 inserted between them. The peripheral wall may be made in one or more parts; in practice it is preferably made in two parts in the embodiments illustrated in Figures 1 to 7.

The attachments 17 of the main drum body 4 are paired with the bores of the adjusting discs 19 in the form of matched selected fits in order to eliminate any play. In addition, it would be entirely conceivable to equip the two remaining bearings with special adjusting means (not shown), such as eccentric rollers for example, in order to eliminate play.

In a basic construction of the transfer drum which is illustrated in Figures 1 to 3, and in the first example of embodiment in Figures 4 and 5, each part of the peripheral wall 20 is made in one piece in the form of a solid casting which is continuous over the entire width of the drum. One end of the casting 21, which when clamped between the adjusting discs 19 faces the drum channel 11, is considerably widened in cross-section and constructed as a cross-member which serves for the screw connection of the casting 21 between the two

adjusting discs 19 and also in particular as a sturdy carrier for the screw on device 22 for gripping the rear edge of the sheet. Like the gripper bar 13 in the basic construction of the transfer drum 3, the device 22 for gripping the rear edge of the sheet is equipped with a continuous sheet support rail.

Since the casting 21 extends continuously over the entire width of the drum and therefore no segment spacing has to be taken into account, the suction bar 22 can be fixed at any desired number of points on the casting 21. In addition the largest possible number of suckers or suction points 23 can be provided without being dependent on segment spacing.

Like the main drum body 4 together with the screwed-on gripper bar 13, the integrally cast sheet carriers 9, and the journals 5, the solid castings 21 screwed fast between the adjusting disc 19, together with the suction bars 22 fastened thereto, also form a sturdy sheet carrier unit which in particular is vibration-free.

The hollow body 18 is mounted for rotation on the attachments 17 of the main drum body 4 by means of the adjusting discs 19. In front of the hollow body 18 mounted in this manner clamp rings 24, which are fastened to the main drum body 4, are disposed on both sides of the journals 5. On the two adjusting discs 19 are disposed clamp plates 25 which cover the clamp rings 24 and can be fastened by means of clamp screws 26 (Figure 1).

In the basic construction of the transfer drum 3 (Figures 1 to 3), which is in particular used for working with large sheet sizes, the recesses 8 in the surface of the arms of the main drum body 4 are not made continuous, but are provided only in a part of the surface. This provides the advantage that the sheet support surface on which the front edge of the sheet comes to lie can be made continuous. For the adjustment of the transfer drum 3 for working with the smallest possible size in this large sheet size range the sheet carriers 27 of the castings 21 are moved so far that they extend into the recesses 8 in the main drum body 4.

In an alternative embodiment of the invention, which is illustrated in Figures 4 and 5 and which is particularly suitable for working with sheets in the middle size range, the recesses 8 in the surface of the arms of the main drum body 4 are made continuous, so that for the adjustment of the transfer drum for the purpose of working with the smallest possible sheet size in accordance with Figure 4 the sheet carriers 27 of the castings 21 can be moved through the recesses 8. As the result of this arrangement the sheet size range is considerably

extended, that is to say working with smaller sizes is also made possible. In this case however, the ends of the rotatable sheet carriers 27 which extend beyond the gripper bar 13 and into the drum channels 11 must be provided with a recess 28 so that sheet gripping means of the preceding or following transfer or impression cylinder 1, 2 can penetrate into the path of rotation of the transfer drum 3.

A further example of construction of a transfer drum, which is modified in relation to Figures 1 to 5 and which is intended particularly for working with very small sheet sizes, is illustrated in Figures 6 and 7. Since the diameter of the transfer drum 3 is correspondingly reduced in machines for smaller sizes, in this embodiment less deflection and vibration occurs than with larger transfer drums, because of the smaller masses, for which reason the necessary rigidity can be achieved with a rather lighter construction.

As a modification of all the embodiments previously described, no sheet carriers are integrally cast on the main drum body 4, because the surface of the two arms of the main drum body 4 already functions as a sheet carrier surface. As a further modification of the basic embodiment and of the first example of embodiment, a part of the peripheral wall 20 of the hollow body 18 consists in each case of a sturdy suction bar 29 having an extremely large cross-section and on which circularly curved sheet carriers 30 are screwed side by side at intervals on an attachment, thus likewise forming a coherent unit.

In this embodiment the recesses in the surface of the arms of the main drum body 4 are in the form of continuous guide grooves 31 in which the screw-on sheet carriers 30 passing through can be supported radially.

A still further example of construction of the transfer drum 3, which is illustrated in Figures 8 and 9, has a one-piece hollow body 32, which is preferably a casting, but which may also be produced in other ways, for example by welding. The main drum body is here in the form of a cylinder 6, is provided with a bore 33, and is fastened by means not shown on the separate axle 7.

On both sides of the one-piece hollow body 32 mounted without play on the separate axle 7 there are fastened on the axle 7 fastening discs 34 on which the hollow cylinder 32 can be secured by means of the clamp base 25 screwed thereto and of clamp screws 26.

The adjustment of the transfer drum 3 to the sheet length to be handled is effected in the following manner. The firm connection between the main drum body 4 or 6

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and 7, together with the fixed sheet carrier unit, and the hollow body 18 or 32, together with the rotatable sheet carrier unit must first be released. This is achieved
 5 by unscrewing the clamp screws 26 on the clamp plates 25, whereby the press connection between the clamp rings 24 and the adjusting discs 19 for fastening discs 34 and the one-piece hollow body 32 is released.
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Thereupon the multi-part hollow body 18 together with the adjusting discs 19 or the one-piece hollow body 32 can be turned in the peripheral direction either by hand or automatically with the aid of means not illustrated or described, and adjusted to the desired sheet length. After the adjustment has been made the clamp screws 26 are tightened again, so that the adjusting discs 19 or the fastening discs 34 are pressed and clamped by means of the clamp plates 25 against the clamp rings 24 fastened in the main drum body 4 or against the one-piece hollow body 32. The transfer drum 3 adjusted in this manner is ready for operation.
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The embodiments of the invention described above reduce or eliminate the disadvantages of known devices mentioned earlier, and provide transfer drums for working with variable sheet sizes, in which as the result of a compact construction the greatest possible rigidity is ensured and in connection with the requirement of a small number of bearings and components the highest accuracy is ensured in respect of the true running of the drum.
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The invention is in no way limited to the special embodiments illustrated in Figures 1 to 7 and described in the description, since these are simply to be regarded as examples and are not intended to limit the invention. Other embodiments with numerous modifications in respect of constructional details, which lie within the defined scope of the invention, are also conceivable.
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WHAT WE CLAIM IS:—

1. A transfer drum for a printing machine which is adjustable to accommodate sheets of various lengths and comprising a main drum body provided with sheet carriers or arms and a hollow body rotatably mounted on and partly surrounding the main drum body and provided with sheet carriers interdigitated with the arms or sheet carriers on the main drum body such that relative rotation between the said bodies serves to provide for adjustability for various sheet lengths, the main drum body being constructed in at most two parts and carrying a device for gripping one edge of a sheet, said hollow body
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carrying a device for gripping the opposite edge of the sheet, and forming a rotatable sheet carrier unit.

2. A transfer drum according to claim 1 wherein the main drum body is constructed in two parts as a cylinder and a separate axle, and the hollow body is made in one piece.
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3. A transfer drum according to claim 1 wherein the main drum body is made in one piece and the hollow body is composed of a plurality of parts.

4. A transfer drum according to any one of claims 1 to 3, in which both the main drum body and the hollow body are provided with integrally cast sheet carriers.
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5. A transfer drum according to claim 3 wherein the multi-part hollow body is formed of a peripheral wall divided into two and secured between two adjusting discs mounted on the main drum body.
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6. A transfer drum according to claim 5 wherein in each case, a part of the peripheral wall divided into two is in the form of a casting which is continuous over the entire width of the drum and which on one side is widened in cross-section as a cross-member, and on which is fastened the device for gripping the edge of the sheet, together with a continuous sheet support rail.
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7. A transfer drum according to claim 5 wherein in each case, a part of the peripheral wall divided into two is composed of a suction bar of substantial cross-section and having a continuous sheet support rail on which sheet carriers are screwed side by side at intervals.
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8. A transfer drum according to any one of claims 1 to 7, wherein the hollow body is fastened on the main drum body by means of a securing device.

9. A transfer drum according to claim 8, wherein the hollow body comprises a plurality of adjusting discs and is adapted to be anchored by means of clamp screws and clamp plates on a clamp ring fastened in the main drum body.
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10. A transfer drum for a printing machine substantially as hereinbefore described with reference to Figures 1 to 3, or Figures 4 and 5, or Figures 6 and 7 or Figures 8 or 9 of the drawings.
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11. A printing machine incorporating a transfer drum according to any one of claims 1 to 10.

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(11)

and 7, together with the fixed sheet carrier unit, and the hollow body 18 or 32, together with the rotatable sheet carrier unit must first be released. This is achieved by unscrewing the clamp screws 26 on the clamp plates 25, whereby the press connection between the clamp rings 24 and the adjusting discs 19 for fastening discs 34 and the one-piece hollow body 32 is released.

Thereupon the multi-part hollow body 18 together with the adjusting discs 19 or the one-piece hollow body 32 can be turned in the peripheral direction either by hand or automatically with the aid of means not illustrated or described, and adjusted to the desired sheet length. After the adjustment has been made the clamp screws 26 are tightened again, so that the adjusting discs 19 or the fastening discs 34 are pressed and clamped by means of the clamp plates 25 against the clamp rings 24 fastened in the main drum body 4 or against the one-piece hollow body 32. The transfer drum 3 adjusted in this manner is ready for operation.

The embodiments of the invention described above reduce or eliminate the disadvantages of known devices mentioned earlier, and provide transfer drums for working with variable sheet sizes, in which as the result of a compact construction the greatest possible rigidity is ensured and in connection with the requirement of a small number of bearings and components the highest accuracy is ensured in respect of the true running of the drum.

The invention is in no way limited to the special embodiments illustrated in Figures 1 to 7 and described in the description, since these are simply to be regarded as examples and are not intended to limit the invention. Other embodiments with numerous modifications in respect of constructional details, which lie within the defined scope of the invention, are also conceivable.

WHAT WE CLAIM IS:—

1. A transfer drum for a printing machine which is adjustable to accommodate sheets of various lengths and comprising a main drum body provided with sheet carriers or arms and a hollow body rotatably mounted on and partly surrounding the main drum body and provided with sheet carriers interdigitated with the arms or sheet carriers on the main drum body such that relative rotation between the said bodies serves to provide for adjustability for various sheet lengths, the main drum body being constructed in at most two parts and carrying a device for gripping one edge of a sheet, said hollow body

carrying a device for gripping the opposite edge of the sheet, and forming a rotatable sheet carrier unit.

2. A transfer drum according to claim 1 wherein the main drum body is constructed in two parts as a cylinder and a separate axle, and the hollow body is made in one piece.

3. A transfer drum according to claim 1 wherein the main drum body is made in one piece and the hollow body is composed of a plurality of parts.

4. A transfer drum according to any one of claims 1 to 3, in which both the main drum body and the hollow body are provided with integrally cast sheet carriers.

5. A transfer drum according to claim 3 wherein the multi-part hollow body is formed of a peripheral wall divided into two and secured between two adjusting discs mounted on the main drum body.

6. A transfer drum according to claim 5 wherein in each case, a part of the peripheral wall divided into two is in the form of a casting which is continuous over the entire width of the drum and which on one side is widened in cross-section as a cross-member, and on which is fastened the device for gripping the edge of the sheet, together with a continuous sheet support rail.

7. A transfer drum according to claim 5 wherein in each case, a part of the peripheral wall divided into two is composed of a suction bar of substantial cross-section and having a continuous sheet support rail on which sheet carriers are screwed side by side at intervals.

8. A transfer drum according to any one of claims 1 to 7, wherein the hollow body is fastened on the main drum body by means of a securing device.

9. A transfer drum according to claim 8, wherein the hollow body comprises a plurality of adjusting discs and is adapted to be anchored by means of clamp screws and clamp plates on a clamp ring fastened in the main drum body.

10. A transfer drum for a printing machine substantially as hereinbefore described with reference to Figures 1 to 3, or Figures 4 and 5, or Figures 6 and 7 or Figures 8 or 9 of the drawings.

11. A printing machine incorporating a transfer drum according to any one of claims 1 to 10.

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