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PATENT SPECIFICATION

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(54) SHEET-FED ROTARY PRINTING PRESSES

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SCHAFT, a body corporate organised
under the laws of Germany, of 69
Heidelberg, Alte Eppelheimer Strasse
15—21, Germany, do hereby declare the
invention for which we pray that a patent
may be granted to us, and the method by
which it is to be performed, to be
particularly described in and by the
following statement:—

The invention relates to sheet-fed rotary
printing presses. Such machines usually
include a looping drum, for receiving sheets
from a first impression cylinder, a turning
drum, for feeding sheets to a second
impression cylinder, a storage drum for
transferring sheets from the looping drum
to the turning drum, and an adjusting
mechanism is required for converting the
machine between first and perfection
printing.

Adjusting mechanisms of this type are
necessary in all convertible perfecting
printing presses. For perfecting, the sheet
to be printed is transferred from the first
looping drum to the second looping drum
(storage drum) which normally is twice the
diameter of the adjacent drums, and is then
lead by its front edge past the common
tangential point of the storage drum and the
turning drum. As soon as the rear edge of
the sheet, which is retained by suction
elements, reaches the common tangential
point, it is gripped by the gripping
mechanism of the turning drum. The
release of the front edge of the sheet from
the grippers of the storage drum occurs at
the same time and the sheet is transferred
with its rear edge leading to the next
impression cylinder. Previous mechanisms for
converting the machine between first and
perfection printing have been of
complicated design, difficult to supervise
and therefore responsible for lack of
confidence in the press operators. In these
mechanisms the conversion or adjustment
has to be performed from different points
on the printing press through separate

adjusting devices and through separate
scales associated with the individual
adjusting means, thus giving rise to
discrepancies. Depending upon the number
of the adjusting means, these inaccuracies
cumulate and have an unfavourable
influence upon the quality of the printing.
For instance, in the case of perfecting they
lead to inaccuracies of register which
necessitate corrections to the adjustment,
whereby further errors may be introduced.

The adjustment of the various individual
functions also demands a very strong sense
of responsibility on the part of the machine
operators and also a considerable length of
time, during which the press is inoperative.
The productivity of the press is therefore
considerably reduced. Furthermore, the
individual adjustments have an
unfavourable influence upon the
operational reliability and safety of the
press, so that if one important individual
adjustment is overlooked, there is a risk of
damage to the press.

With some conversion devices,
furthermore, a large number of different
tools are required for the individual
adjusting operation, thereby increasing the
complexity of the conversion and hence the
uncertainty of the operators.

German Patent Specification No.
1,107,246 describes a sheet fed rotary
printing press having a plurality of printing
units connected by transfer cylinders,
wherein the transfer cylinders are equipped
with a first set of grippers and with a second
set of grippers which can be operated
selectively. With this known construction,
the individual functions have to be
converted consecutively by means of
separate adjusting means.

Thus, e.g. to convert the system of the
press from first form to perfecting, the
relative angular disposition of the
individual printing units to one another
must first be adjusted. After this, it is
necessary to pivot a disc cam, which is used
only in two-colour printing, by means of a
hand lever into a rest position outside the

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orbit of two cam followers, and a second disc cam, which is used only in perfecting, has to be adjusted along a guide track so that it is in the correct position for operation of the grippers. Separately from this, groups of suction heads retaining the rear edge of the sheet have to be adjusted to the position corresponding to the trailing ends of sheets on the transfer cylinder.

In view of the multiplicity of these individual adjustments, all of which have to be performed by means of separate adjusting means from different points outside the press and are read off from a plurality of adjusting wheels associated with the adjusting means, discrepancies and inaccuracies will inevitably arise. Furthermore, uncertainty in the mind of the operator is increased by the adjustment of the various individual functions, and if one important individual adjustment is overlooked, there is a risk that the press may be damaged. Furthermore quite long standstill times are required for the conversion, leading to reduced productivity in the press.

In addition the cam which is only required for perfecting remains in its operative position, even when the press is first form printing. The grippers are therefore opened unnecessarily, resulting in an unnecessarily high degree of wear.

German Auslegeschrift (laid open specification) 2,126,258 discloses a sheet transfer device for a sheet fed rotary printing press having a plurality of printing units connected together by three transfer cylinders and which also embodies a conversion device. In this construction, there is arranged on a central transfer cylinder a gripper opening cam which causes the opening of sheet grippers when the sheet is passed on to a third transfer cylinder, this cam being employed both for first form and for perfecting. Conjointly with an externally-toothed tooth segment ring attached firmly to it, is a adjustable peripherally by means of a gearwheel driven by an adjusting element, such as a handwheel, and is lockable by a tooth segment.

The use of the same gripper opening cam both for first form and also for perfecting necessitates a wide range of adjustment corresponding to that of the range of formats of sheets carried on the press. It is this very long adjustment distance which makes the adjustment of the process difficult. Furthermore the conversion times and hence the standstill times of the press are considerably increased.

Another disadvantage is the stepwise adjustment of the time opening of the gripper tongs of the transfer cylinder is conformity with the tooth pitch of the

toothed segment ring and of the tooth segment. For a gear of module m , the tooth pitch $t_p = m \cdot \pi$, and in the case of module 2, corresponds approximately to 6mm. As a result, the adjustment is rough and inaccurate, and the sheet travel can be impaired by too early or too late release of the sheet, which inevitably leads to defects in the printing process. For example, if the release occurs late, the sheet may be damaged or torn owing to the position of the turning grippers.

In order for the sheet to be accepted at its front edge in the first form printing, the latter must first travel to the tips of the grippers, so that a relatively wide angle of opening of the grippers is necessary, whereas in the case of perfecting where the sheet is accepted by its rear edge, the grippers need only be opened slightly more than the maximum sheet thickness. Thus, in view of the fact that the same gripper opening cam is employed for first form and for perfecting, the grippers open unnecessarily wide when perfecting. Consequently, the parts causing the opening and closure of the grippers, such as e.g. gripper shaft, gripper bearing, etc., are subject to increased wear.

Quite apart from these disadvantages, the conversion of the system from first form to perfecting or vice versa necessitates a plurality of adjusting operations by separate adjustment means and each from different points outside the press. Moreover, the suction elements retaining the end of the sheet are not included in the process of adjustment; instead, they have to be adjusted to the sheet end by separate adjusting elements.

German Patent Specification No. 1,611,241 relates to a sheet transfer cylinder for printing presses, wherein the leading front edge of the sheet is gripped by grippers and the trailing rear end of the sheet by devices which are movable in the direction of rotation of the cylinder.

The devices gripping the rear edge of the sheet are constructed in this case as suction and blast heads and are arranged on shaft support wheels which are adjustable through the intermediary of an annular supporting part. By rotating this supporting part relatively to the shaft of the transfer cylinder, the suction and blast heads can be moved towards the grippers and away from them and can thus be adjusted to match the trailing edge of sheets of paper of various length.

However, the range of adjustment of this device is limited because the adjustment can be performed only within the limits of circular arcuate slots which are cut in sheet support wheels fastened on the shaft of the transfer cylinder and in which the vacuum

arm shafts to which the suction and blasts heads are secured move in the peripheral direction.

Furthermore, the relative rotation of the printing units has to be performed in a separate adjustment operation by separate adjusting means. Consequently the possibilities of error, the dangers if the adjustment of one individual function of the press is overlooked, and the uncertainty on the part of the operators, referred to hereinbefore, is not eliminated.

German Offenlegungsschrift (laid open specification) No. 2,228,671, discloses a device for gripping a sheet of paper on a transfer cylinder of a printing press for multi-colour printing and for perfecting in which the conversion of system and/or format of the press is effected by rotating a pinion by means of which an adjustable annular segment on which the gripper cam is fastened can be controlled. The cam attached to the annular segment co-operates in this case with two followers which in turn control the grippers through levers. The magnitude of the rotation in this case can be read off visually on a scale with a needle.

In this adjusting operation the suction elements are automatically included in the conversion, so that the distance between the suction elements and the grippers of the following looping drum does not change. However, this operation represents only the conversion of one individual function of the machine. For example, for perfecting the adjustment to the format to be processed has to be performed in a separate operation. Due to this, the difficulties already referred to hereinbefore are not eliminated. Apart from the increased time outlay for the separate adjusting functions, the inaccuracies which inevitably arise in the individual adjustments can be aggregated and have a negative influence upon the quality of the printing, rendering further adjustment corrections necessary.

There has also been previously disclosed, in German printed specification 2,227,151, a conversion device for an apparatus for tensioning sheets of paper, more particularly in a sheet turning device on multi-colour printing presses. In order to adjust the format, the two printing units are converted by driving gearwheels, so that the grippers of the transfer cylinder are moved into an appropriate surrender position to the next transfer cylinder. By rotating an additional gearwheel which is connected to the support tube of the suction elements, the suction elements participate in the adjustment and a constant position with respect to the grippers of the next looping drum is thereby maintained at all times.

This known construction therefore likewise embraces only one part of the conversion, whereas the adjustment of the remaining functions (adjustment of the gripper opening cams both for first form and for perfecting) has to be effected by separate means and the inaccuracies and dangers due to the individual adjustments which have been referred to still remain. Furthermore, in printing presses of modern construction which are equipped with a cylinder drive encapsulated, trickled with oil or running in an oil bath, it is impossible to employ such a construction because the driving gearwheels are located outside the side walls.

According to the present invention there is provided a sheet fed rotary printing press comprising a looping drum, a turning drum, a storage drum for transferring the sheets between the looping drum and the turning drum, releasable adjustable members adjustment of which is effective to convert the printing press between first-form and perfecting and also to adjust the press to accommodate sheets of different format sizes, a scale on which the state of adjustment of the press is indicated, adjusting means for adjusting the said members and comprising two adjusting pinions arranged on an axially slidable adjusting shaft, the pinions being, in an operative position of the adjusting shaft, coupled simultaneously to the adjusting members for effecting both the said conversion and the said adjustment of the format of the press, and a safety mechanism for preventing release of the adjustable members whilst the adjusting shaft is not in its operative position and for preventing operation of the press during the said adjustment.

By the combination of the adjustment of all the individual functions from a common point located outside the press and by means of only one adjusting element, and by the positively synchronous cycle of the individual conversion operations, the conversion itself is rendered uncomplicated and easy to supervise and the conversion times required are considerably reduced.

Advantageously, the press further comprises an axially slidable control shaft mounted parallel to the axis of rotation and outside the circumference of the storage drum across the total width thereof, means associated with the control shaft for the adjustment of the sheet support surface and sheet gripping means on the storage drum and for adjusting the period of operation of a suction air control valve for the storage drum, the control shaft being operatively associated with the adjusting shaft through an adjustment member and coupled to the

adjusting shaft for axial sliding movement therewith by means of two entraining members.

The simultaneous adjustment of the position of the suction bar relatively to the tongs gripper of the following turning drum and the synchronous adjusting of the suction air control time has an extremely favourable influence upon the precision of register, so that an optimum accuracy in the printing process is thereby ensured.

An adjusting part is preferably mounted rotatably in a bearing bushing integral with the housing of the press in loose operative association with a cam element for operating the grippers of the storage drum for perfecting, while the cam element is mounted slidably on a cam element bracket which is secured on a shoulder of the bearing bushing.

Advantageously a groove corresponding to the rest position and a recess associated with the operative position are provided in the adjusting shaft for the locking and securing of the rest position and of the operative position, and in front of the driving wheels a guard is fixed to the outside of the side walls which is provided with a bore and with an orifice and with a pivotable latch, while the adjusting shaft extends through the bore and the latch is engaged either with the groove or with the recess depending upon the axial positioning of the adjusting shaft.

There is conveniently fastened to the outside of the side wall a limit switch which is operatively associated in the operative position of the adjusting shaft, with a switch hub mounted fixed on the latter.

Above the adjusting shaft the side wall preferably has a tensioning screw for locking the toothed wheel, on which screw a tensioning nut is arranged outside the side wall, and that to the tensioning nut there is fastened a plate which secures the axial displacement of the adjusting shaft in its operative position, which is operatively associated with a switch hub arranged fixed on the adjusting shaft.

By those special further developments, the press is advantageously secured in such a way that an adjustment during the running of the press is totally excluded, whilst on the other hand the press switches on again only after conversion has been completed. They therefore serve to protect not only the press, but also to protect the operators against risks of accident. In order to permit an accurate adjustment and rapid reading off of the conversion values, a rotatable ring gear is tensioned by means of tensioning screws and tensioning claws on a shoulder of a driving wheel of the turning drum, being in mesh with a driving gear of the storage drum and having arranged on it

a scale with which a needle fastened to the drive wheel is associated.

In order that the invention may be better understood, a preferred embodiment thereof will now be described, by way of example only with reference to the accompanying drawing, wherein:

Figure 1 shows a partial cross-section of the looping drum, storage drum and turning drum with drive and adjustment device.

Figure 2 shows an end elevation (according to section A—A of Figure 1) of the looping drum, storage drum and turning drum in the first form position for maximum format, and (chain dotted lines) in the perfecting position for maximum format.

Figure 3 shows the same view as Figure 2, but along the line of section B—B of Figure 1.

Figure 4 shows the same view as Figure 3, but in the perfecting position for minimum format, during sheet transfer.

Figure 5 shows a partly sectioned elevation of the adjusting device.

Figure 6 shows a view in the direction of the arrow from Figure 5 and

Figures 7—14 show various positions of the latch in co-operation with the adjusting shaft.

As may be seen from Figures 1 to 4 of the drawing, there are mounted in the side walls 1 and 2, consecutively considered in the direction of circulation of the sheet, a looping drum 3 with grippers 4, a storage drum 5 and a turning drum 6 with tongs grippers 7. The storage drum 5 comprises front segments 8 which are firmly attached to a shaft 9 of the storage drum 5, and rear segments 10 which are arranged rotatably on the shaft 9.

A gripper bridge 11 with a gripper shaft 12 and grippers 13 is screwed to the fixed front segment row 8. Cam followers 14 fastened to the gripper shaft 12 by means of cam levers are provided for controlling the grippers 13. On the two outermost of the front segments 8, tensioning straps 15 and 16 are fitted which are adjustable by means of tensioning screws 17 and 18 to the two outsides of the two extreme front segments 8. A suction bar 19 is screwed to the rotatable rear segment row 10, a wheel 20 to the extreme rear segment 10 confronting the side wall 1, and a toothed ring 21 to the outside of the rear segment 10 confronting the side wall 2 (Figure 1).

The suction bar 20 is connected by a connecting tube 22 to a control wheel 23 which is firmly screwed to the extreme rear segment 10 confronting the side wall 2 and which controls the suction air for holding the sheet rear edge 24. To the inner side wall 2 there is fastened a suction air control

valve 25 which is connected by a supply pipe 26 to a suction air unit, not shown.

According to Figures 1 to 5, a shaft 27 is mounted with axial sliding mobility above the storage drum 5 and outside its circumference. Between the outermost of the rear segments 10 and the side wall 2 there is fastened on the shaft 27 an adjusting pinion 28 which can be brought into engagement with the toothed ring 21 by axial displacement of the shaft 27. A second adjusting pinion 29 is fastened on the end of the shaft 27 located outside the side wall 1. This adjusting pinion is coupled non-detachably by means of entraining wheels 30 and 31 arranged on both sides, to an adjusting pinion 32 of an adjusting shaft 33.

The adjusting shaft 33 is supported with sliding mobility on a bearing block 34 arranged fixed on the side wall 1 and in the side wall 1. It is provided at its outer end with a crank 35 by means of which it can be displaced axially from a rest position 36 into an operative position 37 and can also be rotated. In front of the crank 35 there is let into the adjusting shaft 33 a groove 38 which is associated with the rest position 36 of the adjusting shaft 33 and which exhibits three different diameters 39, 40, 41. The adjusting shaft 33 is also provided with a second recess 42 which is provided for locking an operative position 37 of the adjusting shaft 33. The groove 38 exhibits a diameter equal to that of the recess 42. The adjusting shaft 33 is constructed with a diameter 43 between the groove 38 and the recess 42.

On the side confronting the side wall 1, there is keyed to the adjusting shaft 33 behind the eye of the bearing block 34 a control hub 44 which, in the operative position 37 of the adjusting shaft 33, co-operates with a limit switch 45 which is secured in manner not shown to the exterior of the side wall 1. Between the control hub 44 and the side wall 1, there is fastened on the adjusting shaft 33 an adjusting pinion 32 which is permanently in mesh with the adjusting pinion 29 already mentioned hereinbefore. On the inner end of the adjusting shaft 33 there is mounted fixed an adjusting pinion 46 which can be brought into mesh with a toothed wheel 47 in the operative position 37.

In front of the driving gear-wheels 71, 72, 76, 77 and 78, there is fastened to the exterior of the side wall 1 a guard 48 which is provided with a bore 49 and an orifice 50. The adjusting shaft 33 extends through the bore 49, whereas the orifice 50 is provided for the plugging-in of a tool, e.g. a box spanner. Also attached to the guard 48 is a latch 51 which is of angular construction with two arms. An inner surface 52 of one

of the two arms is provided with a lug 53, while the surface 52 and the lug 53 are engaged, depending upon the axial positioning of the adjusting shaft 33, in one of the three diameters 39, 40, 41 of the groove 38 let in to the adjusting shaft 33, or into its recess 52. The upwardly directed pivoting travel of the latch 51 is limited by a stop bolt 54 which is fastened to the guard 48 above the latch 51.

In the side wall 1 at the height of the circumference of the storage drum 5, there is arranged a tensioning screw 55 with which the toothed wheel 47 can be firmly clamped, by means of a tensioning nut 56 arranged externally upon it, to the interior of the side wall 1. Approximately in the centre of the tensioning nut 56 there is fastened a plate 57 which, in the open state of the tensioning nut 29 and in the operative position 37 of the adjusting shaft 33 assumes a position behind the control hub 44 and blocks the latter against axial displacement. In the correctly tightened state of the tensioning nut 56, the plate 57 is pivoted so that it clears the path for the axial displacement of the adjusting shaft 33.

The toothed wheel 47 lockable by means of the tensioning screw 55 is mounted rotatably on a bearing bushing 58 integral with the housing. It is provided on a part of its circumference with a circular arcuate slot 59 through which there extends a bolt 60 fastened to the side wall 1 and penetrating the latter. Upon this bolt there is pivotably mounted a gripper opening cam 61 for first form, which is provided on its underside with a cam gradient 62, and the free end of which is sprung by a traction spring 63 on a shoulder of the bearing bushing 58. A cam element 64 which co-operates with the cam gradient 62, is also screwed to the toothed wheel 47 beneath the slot 59.

On the shoulder of the bearing bushing 58 there is fastened a gripper closing cam 65 part of which is of circular arcuate construction and is provided with a guide means 66, which may be executed e.g. in T-shape, as a dovetail or in a similar manner. A gripper opening cam 67 for perfecting is mounted slidably in this guide means 66. An entraining bore 68, which is engaged loosely by an entraining bolt 69 fastened to the toothed wheel 47, is made in the gripper opening cam 67.

On a shoulder of the shaft 70 of the turning drum 6 there is arranged the drive wheel 71 which is in mesh with the drive wheel 72 of the impression cylinder, not shown of the second printing unit, and also, in the operative position 37 of the adjusting shaft 33, with the adjusting pinion 32. On a lug of the drive wheel 71 there is firmly tensioned by means of tensioning claws 73

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and tensioning screws 74 a ring gear 75 which is operatively associated with the drive wheel 76 of the storage drum 5, with the double width drive wheel 77 of the looping drum 3, and with the drive wheel 78 of the impression cylinder of the printing unit, not shown. To the drive wheel 71 there is fastened a needle 79 with which a scale 80 arranged on the ring gear 75 and having a zero mark 81 is associated.

The principle of operation of the above-described device is explained more fully hereinbelow.

The drive occurs through the drive wheel 78 of the impression cylinder, not shown, of the first printing unit and is transmitted progressively by the double width drive wheel 77, the drive wheel 76 and by the ring gear 75 and the drive wheel 71 to the drive wheel 72 of the impression cylinder, not shown, of the second printing unit.

For conversion the press must first be brought, by mechanical inching forward, into a position in which the O-mark 81 of the scale 80 is approximately vertical.

The latch 51 engaged into the groove 38 in the rest position 36 of the adjusting shaft 33 masks the orifice 50 in the guard 48 sufficiently to prevent any tool being inserted. In a first step, the latch 51 must be lifted out of the diameter 40 of the groove 38 marking the rest position 36 sufficiently for its lug 53 to strike the diameter 39 of the groove 38. In this position the inner surface 52 of the latch 51 occupies a height at which the adjusting shaft 33 can be slid axially outwards with the diameter 41 of the groove 38 until the diameter 43 of the adjusting shaft 33 following the groove 38 strikes against the arm of the latch 51 (Figures 9 and 10).

During this axial adjustment of the adjusting shaft 33, the limit switch 45 is pressed by the control hub 44, whereby the running of the machine is blocked. The depression of the limit switch occurs at a time when the adjusting pinion 32 is not yet in mesh with the drive wheel 71. In order to establish the operative position 37 the adjusting shaft 33 must be slid still further axially outwards in a second step. For this purpose the latch 51 is lifted out of the diameter 41 of the groove 38 and is pivoted towards the stop bolts 54 until its lug 53 has emerged from the diameter 43, (Figure 11). The adjusting shaft 33 is now slid axially into its operative position 37 and the latch 51 is engaged into the recess 42.

In this operative position 37 of the adjusting shaft 33, fixed by the recess 42, the orifice in the guard 48, which was previously masked by the latch 51 is now exposed, and a tool can now be inserted through it to loosen the tensioning nut 56.

The security by the different diameters 39 to 43 of the adjusting shaft 33 therefore makes it possible for the clamping of the toothed wheel 47 to be released only in the operative position 37 of the adjusting shaft 33, and in the event of careless handling of the crank 35 during the running of the press, it can be moved from the rest position 36 into its operative position 37 only with considerable delay, so that by that time the switching off of the press through the limit switch 45 would already be fully effective.

In this operative position 37, the adjusting pinion 32 is in mesh with the drive wheel 71, and the adjusting pinion 46 with the toothed wheel 47. Also, due to the positive co-sliding of the shaft 27 during the adjustment by the permanent connection to the adjusting shaft 33, the adjusting pinion 28 is coupled with the ring gear 21.

By slackening the tensioning nut 56 through the orifice 50 of the guard 48, now exposed, the tensioning of the toothed wheel 47 to the inner slide wall 1 by means of the tensioning screw 55 is released. Simultaneously, the plate 57 fastened on the tensioning nut is pivoted into a position in which it comes to stand behind the control hub 44 and secures the adjusting shaft 33 against an inward axial displacement. A decoupling of the adjusting pinion 32 from the drive wheel 71 can therefore likewise only occur when the tensioning nut 56 is retightened with a specific torque, so that the plate 57 is pivoted out of the region of the control hub 44 and once more releases the axial displacement of the adjusting shaft 33.

These security measures by means of the plate 57 and of the blocked orifice 50 of the guard 48 likewise prevent an accidental premature release of the clamping of the toothed wheel 47 and a premature decoupling of the adjusting pinions, 28, 32 and 46 from their toothed counterparts 21, 47, 71. The possibility of an insufficient tightening of the tensioning nut 56, which would result in an adjustment of the toothed wheel 47 with the gripper opening cam 67 for perfecting during the running of the machine, is also completely eliminated by this means.

The tensioning straps 15 and 16 must now be released by means of the tensioning screws 17 and 18, whereby the firm connection of the rotatable segment row 10, to which the suction bar 19 is fastened, with the stationary segment row 8, on which the gripper unit 11, 12 and 13 is fastened, is cancelled. After this the tensioning of the ring gear 75 to the drive wheel 71 is cancelled by slackening the tensioning screw 74 of the tensioning claws 73, so that the ring gear 75 becomes freely rotatable.

The press is now ready for the actual adjustment.

For the system adjustment of the press from first form to perfecting for a maximum format size, the following individual functional adjustments are now operated simultaneously by rotating the crank 35.

The turning drum 6 and the following printing unit, not shown, are rotated by a specific phase relatively to the storage drum 5 and to the printing unit, not shown, in front thereof. The rotatable segment row 10 with the suction bar 19 fastened to it is co-rotated by the adjusting pinion 28 through the ring gear 21 so that the position of the suction bar 19 with respect to the tongs gripper 7 of the following turning drum 6 remains constant. By the rotation of the toothed wheel 47 by means of the adjusting pinion 46, the gripper opening cam 67 for perfecting is slid in the guide means 66 of the gripper closing cam 65 through the entraining bolt 69 into a position in which it causes the gripper opening in conformity with the desired format length. Simultaneously, the cam element 64 fastened to the toothed wheel 47 travels past beneath the cam gradient 62 of the gripper opening cam 61, whereby the gripper opening cam 61 for first form pivots inwards by the traction effect of the traction spring 63 into an inoperative position in which it is ineffective. Due to the fastening of the control wheel 23 of the air control valve 25 to the rotatable rear segment row 10, the suction air control time for the suction bar 19 for holding the sheet rear edge 24 is automatically co-adjusted.

The adjustment to smaller format sizes in the perfecting position of the machine is effected by means of further rotation of the crank 35 in the same direction of rotation, during which the position of the suction bar 19 relatively to the tongs grippers 7 of the turning drum 6 is not changed, but the distance between the suction bar 19 and grippers 13 of the storage drum 5 is changed in conformity with desired format length and the gripper opening cam 67 for perfecting is moved automatically into the correct position for the appropriate format.

After the conversion has been completed, the wheel 20 and the ring gear 21 must be firmly clamped once more to the stationary front segment row 8 by means of the tensioning straps 15 and 16 by tightening the tensioning screws 17 and 18. After this the ring gear 75 must again be firmly clamped on the drive wheel 71 by means of the tensioning claws 73 and tensioning bolts 74. Finally, the toothed wheel 47 must be locked to the interior of the side wall 1 by means of the tensioning screw 55. This is effected by tightening the tensioning nut 56, while simultaneously the

plate 57 fastened to the latter is pivoted out of the region of the control hub 44 and thus releases the axial adjustment of the adjusting shaft 33 once more. Only after this last securing of an adjusting element, namely of the toothed wheel 47, has been performed, can the adjusting shaft 33 be slid inwards into its rest position 36 after the latch 51 has been lifted out of the recess 42. The limit switch 45 is then released by the control hub 44 and the blockage of the running of the press is thereby cancelled.

The press is then ready for operation for perfecting in the desired format.

The operations for the reverse system adjustment of the press from perfecting to first form are performed in the same sequence, for which only the direction of rotation of the crank 35 is opposite.

The embodiment of the invention described above provides a problem-free conversion device for a storage drum which positively ensures the precision dictated by manufacture and already adjusted during assembly, both for first form and for perfecting, and which permits the processing of all required format sizes. Furthermore, all the operations independent of necessarily dictated tensionings and lockings of the adjusting elements and of screw securing means for the conversion of the press dictated by its function are reduced to a minimum. A basis is also created for a simple and uncomplicated conversion of the press, while the necessary operations both for the system conversion and also for the format adjustment and for the system restoration are synchronous in number and sequence. Furthermore, the entire adjustment of function is adjustable by means of a single control element from one point located outside the press with the shortest possible adjustment path and is readable on a common scale for better supervision. Lastly, the possibility of the occurrence of operating errors and the resulting danger of damage to the press is reduced to a minimum by the incorporation of safety devices.

WHAT WE CLAIM IS:—

1. A sheet fed rotary printing press comprising a looping drum, a turning drum, a storage drum for transferring the sheets between the looping drum and the turning drum, releasable adjustable members adjustment of which is effective to convert the printing press between first-form and perfecting and also to adjust the press to accommodate sheets of different format sizes, a scale on which the state of adjustment of the press is indicated, adjusting means for adjusting the said members and comprising two adjusting

The press is now ready for the actual adjustment.

For the system adjustment of the press from first form to perfecting for a maximum format size, the following individual functional adjustments are now operated simultaneously by rotating the crank 35.

The turning drum 6 and the following printing unit, not shown, are rotated by a specific phase relatively to the storage drum 5 and to the printing unit, not shown, in front thereof. The rotatable segment row 10 with the suction bar 19 fastened to it is co-rotated by the adjusting pinion 28 through the ring gear 21 so that the position of the suction bar 19 with respect to the tongs gripper 7 of the following turning drum 6 remains constant. By the rotation of the toothed wheel 47 by means of the adjusting pinion 46, the gripper opening cam 67 for perfecting is slid in the guide means 66 of the gripper closing cam 65 through the entraining bolt 69 into a position in which it causes the gripper opening in conformity with the desired format length. Simultaneously, the cam element 64 fastened to the toothed wheel 47 travels past beneath the cam gradient 62 of the gripper opening cam 61, whereby the gripper opening cam 61 for first form pivots inwards by the traction effect of the traction spring 63 into an inoperative position in which it is ineffective. Due to the fastening of the control wheel 23 of the air control valve 25 to the rotatable rear segment row 10, the suction air control time for the suction bar 19 for holding the sheet rear edge 24 is automatically co-adjusted.

The adjustment to smaller format sizes in the perfecting position of the machine is effected by means of further rotation of the crank 35 in the same direction of rotation, during which the position of the suction bar 19 relatively to the tongs grippers 7 of the turning drum 6 is not changed, but the distance between the suction bar 19 and grippers 13 of the storage drum 5 is changed in conformity with desired format length and the gripper opening cam 67 for perfecting is moved automatically into the correct position for the appropriate format.

After the conversion has been completed, the wheel 20 and the ring gear 21 must be firmly clamped once more to the stationary front segment row 8 by means of the tensioning straps 15 and 16 by tightening the tensioning screws 17 and 18. After this the ring gear 75 must again be firmly clamped on the drive wheel 71 by means of the tensioning claws 73 and tensioning bolts 74. Finally, the toothed wheel 47 must be locked to the interior of the side wall 1 by means of the tensioning screw 55. This is effected by tightening the tensioning nut 56, while simultaneously the

plate 57 fastened to the latter is pivoted out of the region of the control hub 44 and thus releases the axial adjustment of the adjusting shaft 33 once more. Only after this last securing of an adjusting element, namely of the toothed wheel 47, has been performed, can the adjusting shaft 33 be slid inwards into its rest position 36 after the latch 51 has been lifted out of the recess 42. The limit switch 45 is then released by the control hub 44 and the blockage of the running of the press is thereby cancelled.

The press is then ready for operation for perfecting in the desired format.

The operations for the reverse system adjustment of the press from perfecting to first form are performed in the same sequence, for which only the direction of rotation of the crank 35 is opposite.

The embodiment of the invention described above provides a problem-free conversion device for a storage drum which positively ensures the precision dictated by manufacture and already adjusted during assembly, both for first form and for perfecting, and which permits the processing of all required format sizes. Furthermore, all the operations independent of necessarily dictated tensionings and lockings of the adjusting elements and of screw securing means for the conversion of the press dictated by its function are reduced to a minimum. A basis is also created for a simple and uncomplicated conversion of the press, while the necessary operations both for the system conversion and also for the format adjustment and for the system restoration are synchronous in number and sequence. Furthermore, the entire adjustment of function is adjustable by means of a single control element from one point located outside the press with the shortest possible adjustment path and is readable on a common scale for better supervision. Lastly, the possibility of the occurrence of operating errors and the resulting danger of damage to the press is reduced to a minimum by the incorporation of safety devices.

WHAT WE CLAIM IS:—

1. A sheet fed rotary printing press comprising a looping drum, a turning drum, a storage drum for transferring the sheets between the looping drum and the turning drum, releasable adjustable members adjustment of which is effective to convert the printing press between first-form and perfecting and also to adjust the press to accommodate sheets of different format sizes, a scale on which the state of adjustment of the press is indicated, adjusting means for adjusting the said members and comprising two adjusting



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- pinions arranged on an axially slidable adjusting shaft, the pinions being, in an operative position of the adjusting shaft, coupled simultaneously to the adjusting members for effecting both the said conversion and the said adjustment of the format of the press, and a safety mechanism for preventing release of the adjustable members whilst the adjusting shaft is not in its operative position and for preventing operation of the press during the said adjustment.
2. A printing press according to claim 1 further comprising an axially slidable control shaft mounted parallel to the axis of rotation and outside the circumference of the storage drum across the total width thereof, adjusting means associated with the control shaft for adjusting the sheet support surface and sheet gripping means on the storage drum for adjusting the period of operation of a suction air control valve for the storage drum, the control shaft being operatively associated with the adjusting shaft through an adjusting member and being coupled to the adjusting shaft for axial sliding movement therewith by means of two entraining members.
3. A printing press according to claim 1 or claim 2, wherein an adjusting part rotatably mounted in a bearing bushing integral with the housing of the printing press is loosely operatively associated with a cam element for actuating grippers on the storage drum for perfecting, while the cam element is mounted slidably on a cam element bracket which is fastened on a lug of the bearing bushing.
4. A printing press according to claim 3 wherein the adjusting part is a toothed wheel which, in the operative position of the adjusting shaft, is in a mesh with one of the adjusting pinions, and the cam element is constructed as gripper opening cam for perfecting and is mounted slidably in a guide on a gripper closing cam provided as a cam element bracket, while an entraining bolt protruding loosely into an entraining bore of the gripper opening cam is fastened in the toothed wheel in order to slide the gripper opening cam.
5. A printing press according to claim 4, wherein a bolt is secured in a side wall of the press above the bearing bushing and extends through a slot in the toothed wheel and a cam element is mounted pivotably on the bolt for actuating the grippers of the storage drum for first form printing.
6. A printing press according to claim 5 wherein the cam element is constructed as a gripper opening cam for first form printing and is biased by means of a traction spring fastened to its end against the bearing bushing and is operable by means of a cam element fixed to the toothed wheel.
7. A printing press according to any one of claims 1 to 6 wherein for the purpose of preventing operation of the press during adjustment a groove associated with the rest position and a recess associated with the operative position are provided in the adjusting shaft, and a guard is fastened to the exterior of a side wall of the press, the guard being provided with a bore, through which the adjusting shaft extends, and with an orifice and a pivotable latch carried by the guard is in engagement either with the groove or with the recess depending upon the axial positioning of the adjusting shaft.
8. A printing press according to claim 7 wherein the groove is provided with three portions of different diameters the inner portion being of equal diameter to the recess.
9. A printing press according to claim 7 or claim 8 wherein the latch comprises two arms extending at an angle to each other and is provided with a lug, the inner surface of one latch arm and the lug being engageable with the groove.
10. A printing press according to any one of claims 7 to 9, wherein a stop bolt is fastened to the exterior of the guard above the pivoting region of the latch.
11. A printing press according to any one of claims 1 to 10 wherein the protecting means comprises a limit switch fastened to the exterior of the side wall and operatively associated, in the operative position of the adjusting shaft with a control hub arranged fixed on the latter.
12. A printing press according to claims 1 to 11 wherein a tensioning screw is provided in a side wall of the press adjacent the adjusting shaft for this purpose of locking the adjusting part, a tensioning nut is arranged outside the side wall on the tensioning screw and a plate is fastened on the tensioning nut securing the axial displacement of the adjusting shaft in its operative position, the plate being engageable with a control hub arranged and fixed on the adjusting shaft.
13. A printing press according to any one of claims 1 to 12 wherein the storage drum comprises a first set of segments which are fixedly mounted on a shaft, and second set of segments which are rotatable on the shaft, tensioning straps fastened with tensioning screws to the two extreme ends of the front segments, and a wheel screwed to the extreme rear segment confronting a side wall of the press, and a ring gear is screwed to the extreme rear segment confronting the opposite side wall of the press, the wheel and the ring gear being clampable by means of the tensioning straps and the tensioning screws.



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5 14. A printing press according to claim 13 wherein a suction air control valve is fixed on the interior of a side wall of the press, and to the exterior one of the second set of segments there is fastened a control wheel which is connected by a connecting tube to the suction bar arranged on the rotatable rear segments.

10 15. A printing press according to any one of claims 1 to 14 wherein a rotatable ring gear is mounted on a lug of a drive wheel of the turning drum and is tensioned by means of tensioning screws and tensioning claws,

the ring gear being in mesh with a drive wheel of the storage drum carrying the scale with which a needle fixed to the ring gear is associated. 15

16. A printing press substantially as hereinbefore described with reference to the accompanying drawings. 20

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