

ARRANGEMENT FOR THE BUFFER STORAGE
OF FLAT PRODUCTS

This invention relates to an arrangement for the buffer storage and conversion of flat products, preferably occurring in a stream formation.

It is known to continuously supply to a roll hub, or core, flat products of the most varied types and to roll or wind same onto said hub or core (cf. eg German patent 2 207 556, Swiss patent application 1 788/86-0). Particularly in printing technology, the printed products are preferably in stream formation and are supplied to the winding station in this way and are wound up to form rolls. If the number of products to be processed in this way is greater than the capacity of a roll, as soon as the latter is full, measures must be taken in order to be able to wind the continuously arriving products onto another empty roll hub. In the simplest, but uneconomic manner, it would eg be possible to interrupt the working process and during said interruption to replace the full roll by an empty roll hub.

In addition, Swiss patents 654 553 and 654 554 disclose a process and an apparatus making it possible in the case of only a single winding station with an additional intermediate roll to replace the main roll of the winding station without interrupting the working process. However, the products must be wound in double layer form and for further processing must be subdivided by a special means back into two separate scale or stream flows. If a roll is to be further processed in another working area, such an additional means must be provided there for unwinding the double roll. As a function of the intermediate roll capacity and as a result of the

double layer form of the wound products on the main roll, in this process it is necessary to replace the roll at relatively short intervals.

DE-OS 33 04 219 discloses an apparatus for stacking printed sheets. The printed sheets supplied by means of a feed conveyor are transferred to a conveyor belt of the apparatus. It is obvious that during this transfer the phase relationship of the printed sheets, i.e. the information concerning the reciprocal overlap or displacement of the printed products, is lost and the sheets are necessarily differently arranged due to the feed taking place at right angles to the conveyor belt. Thus, said apparatus can only be used if there is a subsequent intermediate stacking of the printed products and no significance is attached to the modified phase relationship during further processing.

However, in many uses it is desirable or necessary to retain the phase relationship of the printed products throughout all the working stages and also during intermediate storage. Therefore, without additional complicated and expensive measures, said apparatus cannot be used for such purposes. In addition, with said apparatus it is not possible to freely select the reciprocal positioning of the printed sheets on the discharge conveyor. A further disadvantage is that it is not possible, or is only possible with considerable effort and expenditure to replace the individual rolls or storage rolls, because they are juxtaposed in parallel, access to the individual rolls is substantially impossible and consequently the apparatus can only be used to a limited extent as an offline buffer store.

It is known from DE-OS 25 44 135 to provide two alternately loadable winding stations, whereof articles are in each case supplied to one, whilst the full roll is removed from the other winding station. However, this solution in this form can only be used to a limited extent within an overall process, because the rolls must be supplied to another installation for further processing either manually, or at the best by using handling equipment, i.e. the apparatus

constitutes a "dead-end" within a continuous process. Additional stations must be provided for unwinding purposes. Moreover, the right-angled path of the conveyor belts at the transfer locations leads to problems as in the case of DE-OS 33 04 219, because the reciprocal arrangement of the products is necessarily and undesirably modified.

In many applications, eg in the printing field, the products for different processing operations occur in a specific arrangement. Thus, eg newspapers on conveyors are conveyed with the cording first whereas journals and magazines are conveyed with the head or bloom first. Obviously the reciprocal arrangement of the products can vary with regards to a number of other parameters (phase relationship, overshoot/undershoot conveying, spatial position, etc). In order to be able to process products with different parameters in a following, standardize process or special machines, it is consequently necessary to convert or standardize these parameters associated with the products. Apparatuses are generally known which, by means of rewinding convert printed products wound in undershoot manner on to a roll and which in the case of mere unwinding would be obtained in overshoot manner, into an undershoot product flow again. The hitherto known apparatuses of this type have always been specifically intended for given uses and consequently only permit a limited conversion of such parameters. These apparatuses also provide no possibility for the buffer storage of products.

The problem of the present invention is to provide an arrangement which avoids the aforementioned disadvantages and which is usable as both an offline buffer store and as a functional arrangement for the flexible conversion of parameters of the products within an overall system, whilst as far as possible achieving limited mechanical overall expenditure, particularly with regards to winding stations.

It is the further problem of the invention to provide an arrangement so that, even in the case of very

high working capacities, a problem-free replacement of the loaded rolls is possible without interrupting the process and consequently unlimited offline buffer storage, as well as achieving a flexible relationship with respect to the products supplied to and removed from the apparatus, both with regards to the quantity, the orientation and the reciprocal positioning of the products, whilst the inventive arrangement is to be positionable in a space-saving manner.

According to the present invention there is provided an arrangement for the buffer storage of flat articles, preferably printed products and preferably occurring in the form of a stream formation, comprising a buffer storage means with at least two roll modules, which are connected by means of switching points to a feed means and a removal means, characterized in that the winding planes as herein^{after}~~before~~ defined of all roll modules are ~~parallel and approximately~~ substantially co-planar in a vertical plane, in that the conveying directions of the feed means and the removal means both run substantially parallel to said vertical plane, in that the roll modules are arranged in succession between the feed means and the removal means, and in that the roll modules are freely accessible from at least one side in the vicinity of their roll mounts.

The invention permits a continuous supply of products of different kinds, preferably flexible and flat products, which are obtained in stream formation. Using a common feed means, a feed belt or conveyor, at least two successively arranged winding stations in the feed direction are loaded. As a function of the quantity of the products supplied and which is dependent on the process speed, two or preferably more winding stations are provided. The alternate charging or loading of these winding stations can be controlled in different ways. Through a suitable arrangement of a common removal belt or

a similar feed means, it is possible to simultaneously load one roll and remove products from the apparatus with another roll, a wide range of control settings being possible of the relationships between the products supplied and removed. As a result of the free accessibility to the individual roll modules, it is readily possible to bring full rolls from the apparatus into a store or to supply full rolls from an intermediate store to the apparatus, without influencing or interrupting the working process. By suitable measures, eg a rewinding device, within the arrangement, it is also possible to modify at random within the arrangement the reciprocal orientation or position of the products at the outlet with respect to those at the inlet or the feed belt. The phase relationship of the products can be kept constant during buffer storage. As a result of this winding method an optimum flexibility of the use possibilities during the winding on and off of the products is ensured and permits a continuous offline operation within an overall process or system.

In the arrangement according to the invention the roll modules preferably have interchangeable roll cores or rolls. The feed belt or a feed conveyor is passed through linearly over the winding stations and has a number of branching locations, or switching points corresponding to the number of winding stations. The individual branches to the winding stations carry the products preferably to the underside of the rolls. Each winding station has a connection to the removal belt, which is passed linearly beneath the winding stations. In order to be able to give the reciprocal arrangement of the products in random manner at the outlet, advantageously within the apparatus is provided at least one device for the rewinding of the rolls or for modifying the intake parameters of the

printed product arrangement.

Brief Description of the Drawings

The invention will now be described in greater detail, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is a block diagram of a method of operating an arrangement according to the invention;

Figure 2 is an example of a simple arrangement with three roll or winding modules;

Figure 3 is an arrangement with three roll modules with in each case a rewinding device;

Figure 4 is another arrangement with two roll modules with in each case one winding device, as well as two roll modules with the possibility of rewinding or a 180° deflection of the printed products; and

Figure 5 is a block diagram of a method of operating an arrangement with two return means and a buffer timer.

Detailed Description

Although the invention is explained in greater detail hereinafter relative to examples from the field of printing technology, it can obviously also be used in conjunction with random other, flat articles, e.g. flexible plastic parts. It is also not a prerequisite that the products are supplied in a stream formation. Thus, e.g. by means of a clamp conveyor, products held in spaced manner with respect to one another can be wound on and off in the same way.

If e.g. printed products obtained with a high frequency are to be supplied to another process stage, which has a lower working capacity than would be necessary to be able to receive the continuously produced printed products, or if an interruption occurs during one working stage, then it is necessary to provide a corresponding buffer store. As was explained hereinbefore, known solutions either have a considerable mechanical expenditure, or limit the possibilities of the working process. The present invention on the one hand brings about a true offline buffer storage, i.e. the possible buffer capacity can be as large as necessary. On the other hand the buffer storage arrangement simultaneously provides the possibility of modifying in a flexible manner the different parameters associatable with the printed product supply.

Despite considerable mechanical expenditure, the hitherto known buffer storage means were only possible to fulfil one function, namely the storage of the supplied products. The inventive idea is to provide a multifunctional means, which is able to fulfil a number of functions with minimum expenditure. Use is made of the fact that the means necessary for buffer storage, such as e.g. additional winding stations are present, which bring about the mechanical requirements for further functions, particularly the modification of the input or inlet parameters, so that the total mechanical expenditure and effort is optimized in an overall system. Through the use of the apparatus according to the invention at only one point in an overall system, there can

be an overall optimisation of the latter, which is made more flexible. There is no longer any need for reciprocal matching of the working speeds of eg the printing press, the inserting and bundling means, etc, because the offline buffer store forms the necessary interface both with regards this point and as regards other parameters.

The method of operation is explained in greater detail hereinafter relative to the block diagram of Figure 1. It must be borne in mind that the latter in no way refers to the spatial arrangement of the individual elements and instead only shows the functional connections significant for the present principle. By means of a common inlet 2, the offline buffer storage means 1, which contains a suitable number of winding or roll modules 41-45, is supplied with printed products at a timing or clock frequency t_1 , an orientation o_1 , a phase p and a reciprocal position I_1 . The phase p or the phase relationship is understood to mean the reciprocal displacement of the printed products in the conveying direction. The orientation o is the spatial position of the printed products (eg bloom or cording in the conveying direction, top page at the top or bottom etc), whilst the reciprocal position I indicates whether the printed products are supplied in overshoot or undershoot manner at inlet 2. At an outlet 3, the printed products are discharged at a clock or timing frequency t_2 , a phase p , an orientation o_2 and a reciprocal position I_2 . At additional inlets 21-25, whose number is dependent on the number of roll stations in the offlying buffer store 1, empty or loaded rolls with printed products can be supplied to the buffer store 1. The printed products wound on to the roll hubs or cores can in the same way be characterised with parameters $I_{21}^{-1} \dots I_{25}^{-1}$, $o_{21}^{-1} \dots o_{25}^{-1}$, which describes the "frozen" state of the products, etc. Full, empty or partially wound rolls can be removed from the offline buffer store at outlets 31-35. Hereinafter, in general times inlet parameters are designated x_1 and outlet parameters y_1 .

The rolls supplied or removed via these inlets or outlets are loaded or charged with printed products in such a way that they preferably have the same phase p , but otherwise each roll can contain printed products with its own orientation o and reciprocal position I . At least one of the roll modules 41-45 of the offline buffer store 1 can modify the position I and orientation o of the printed products supplied to it via one of the inlets 2, 21-25. There can also be a direct connection 5 between inlet 2 and outlet 3. Each roll module 41-45 can contain a main and a buffer winding station or additional means for converting the parameters.

By means of interfaces 51-55, which have the functions of points or switches, inlet 2 is connected to the individual roll modules 41-45 and outlet 3. In a similar way, the outlets of the individual roll modules are connected via interfaces 56-60 to the outlet 3. Obviously inlet 2 can be supplied with products from different installations, i.e. a multiple inlet 2 can be provided. It can also be gathered from Fig. 1 that products can be supplied to the outlet 3 simultaneously and directly from the inlet and/or from one or more roll modules. These products can be spliced together to form unitary stream formations by suitable bringing together at the interfaces 56-60 or subsequently individual printed sheets or the like can be inserted therein. For this purpose it is possible to use buffer timers according to Swiss patent 610276 or US patent 4 072 228, as described in conjunction with Fig. 5.

Printed sheets printed on one side are supplied e.g. in undershot manner and with their ^{printed}side upwards to the inlet 2 at a timing frequency t_1 . If the printed products are to appear at the outlet with their underside upwards and with a lower timing frequency t_2 , then the inlet 2 is connected via a switch of switch group 51-55 to the roll module, at whose outlet the printed products can be removed with the desired orientation o_2 . It is clear that in this example the timing frequency can only be modified if part of the printed

articles is buffer stored. This is brought about in that e.g. one roll of a first roll module is filled. The inlet 2 is then automatically connected to the second roll module. Whilst the incoming printed products are now stored on the roll in the second roll module, it is possible to remove from the roll of the first roll module printed products with the desired timing frequency t_2 . The desired timing frequency t_2 is attained in that printed products are unwound from the corresponding second roll module at the desired speed and supplied to the outlet 3. It is obviously possible for the roll as a whole to be removed from said roll module via the corresponding outlet.

The following functions or their links or combinations are possible within a roll module:

Modification Of:

	Reciprocal Position	Orientation	Timing Frequency
Type 1	x		
Type 2		x	
Type 3			x
Type 4	x	x	
Type 5	x		x
Type 6		x	x
Type 7	x	x	x
Type 8	(None of the parameters changed)		

Obviously in the case of special process sequences, it may be necessary to modify further parameters and in certain circumstances also the phase p , so that this table only constitutes an example of the functions performable within a roll module. It is obviously possible by the cascade connection of at least two roll modules to interlink the functions, e.g. to obtain a roll module of type 6 by the cascade connection of two modules of types 2 and 3. For this purpose additional points or switches 71, 72 are provided within the buffer store 1, which in the represented arrangement

e.g. allow a cascade connection of the roll modules 41, 42 and 44.

As empty and full rolls can be supplied to and removed from the offline buffer by means of the outlets and inlets 21-25 and 31-35, it is possible to permanently supply thereto via inlet 2 printed products, even in the case of an empty outlet 3, i.e. if no printed products are removed therefrom. Through the intermediate storage of the full rolls from the offline store 1 in a separate store, it is possible to randomly enlarge the storage capacity of the offline store. As a function of the intended use, the offline store can contain 2 or preferably more roll modules 41-45. Conversely, from said store, inlets 21-25 can supply the offline store with full rolls and by unwinding in a suitable roll module 41-45 can be discharged at outlet 3 with desired outlet parameters y_i , without products occurring at inlet 2.

The present invention firstly makes it possible to receive the incoming printed products in the offline store and, if necessary, to intermediately store the same and can also be used as a functional arrangement for converting the parameters x_i associatable with the products. The outlet parameters y_i are in functional dependence on the inlet parameters x_i , the possible functions being given on the one hand by the types of the roll modules within the arrangement (cf. table) and on the other hand by the reciprocal, additional connections, e.g. 71, 72 in Fig. 1. The buffer storage arrangement can be randomly extended by coordination with an additional, separate store. In the described way, products wound on to a roll can be inserted via inlets 21-25, converted and wound directly within the arrangement on to a new roll (through the corresponding switching of points 71, 72) or can be removed for further processing at outlet 3.

The arrangement is controlled by a computer, which monitors the state of the individual roll modules and is responsible for the functional control of the installation. It is also possible to provide in the vicinity of the

conveyor systems sensors for monitoring purposes and which detect any faults or interruptions (eg an interruption of the stream). Preferably a central computer monitors and/or controls at least the supply and removal of the products via the inlets and outlets 2, 3, 21-25, 31-35, the winding processes of the individual roll modules 41-45, the position of the points 51-60, 71, 72 and the connections between the roll modules 41-45 and the inlets and outlets 2, 3, 21-25, 31-35 by means of eg optical sensors. It can be necessary in the case of complex roll modules to provide additional decentralised computer units.

Hereinafter is described an example of an arrangement with three winding or roll modules for performing the described method. Figure 2 shows the common feed belt 11, the common removal belt 12 and three roll modules 41, 42, 43. By means of a first group of points or switches 51, 52, 53 in each case one feed connection 61, 62, 63 leads to the corresponding roll modules 41-43 and supplies same with the printed products from below. The roll modules contain in each case one winding station 8 with winding mounts 46-48, which serve to wind on or off the rolls 10. The rolls 10 have a core or hub 9, which makes it possible to replace the rolls in the winding stations. A possible construction of the winding stations, the winding on and off and the way in which the rolls or roll cores are replaced can be gathered from Swiss patent application 00 860/87-5, 1 788/86-0 and 2 267/84-6. The roll modules are successively arranged in the feed direction in such a way that the winding planes, which are defined as the centre planes of the rolls at right angles to their winding axes (eg the axes of the individual winding stations 8), are vertical and in one plane. The feed belt passes linearly over the roll modules 41-43. In a similar manner the

removal belt 12 is located below the roll modules, parallel to the feed belt and the roll planes. Obviously it is possible to interchange the arrangement of the feed and removal belts, or to have a slight lateral displacement with respect to the roll modules. Thus it is possible for the individual winding stations to be slightly laterally displaced for special uses, the feed and removal means having corresponding points or connecting paths for overcoming the lateral displacement.

It is readily apparent that instead of having a feed or removal belt, the apparatus can have feed means of other types, e.g. a clamp conveyor, a belt conveyor, or a clamp chain system. Different feed means can be used for the connecting sections between the points 51, 52, 53 to the individual roll modules 41, 42, 43.

Thus, all the feed paths and roll modules are arranged parallel to a vertical plane. This arrangement of the roll modules or the conveyor belts has the important advantage that all the winding stations 41-43 or the rolls held on their roll mounts 46-48 can readily be reached from at least one side, so that the rolls or roll hubs can be moved backwards and forwards, gripped and interchanged by means of an industrial truck, which moves along the arrangement in a path parallel to said plane. This simple handling possibility makes it possible to use special, e.g. also inductively controlled handling means. Due to the interchangeability of the rolls, a randomly large number of printed products can be stored in space-saving and inexpensive manner in a separate store. As in the case of high working capacities a very frequent replacement of the rolls is necessary, there are generally at least three roll modules. As can be gathered from the drawings, in this embodiment coincidence exists between the inlets 21-25 and the outlets 31-35, i.e. the rolls are inserted and removed at the same point of the roll modules.

A second feed connection 66, 67, 68 with a 180° deflection leads from each roll module to the common removal belt 12.

As is readily visible, the products supplied by the feed belt 11 are reversed by winding on and off in a roll module, i.e. their orientation α is changed. In this embodiment all the roll modules 41-43 are the same and correspond to the aforementioned type 2. If the unwinding speed of the individual roll modules is controllable, it is also possible to achieve a desired timing frequency at outlet 3, in the case of a corresponding speed of the removal belt 12.

Fig. 3 shows another embodiment of the invention.

Once again there is a common feed belt 11, a common removal belt 12, points 51-53 and three roll modules 41-43. In this case, each roll module contains a winding station 8 and a rewinding device 7. The manner of the rewinding is e.g. described in Swiss patent 657 115. Points 74-76 on the one hand connect the main roll 8 to the feed belt 11 and on the other hand to the rewinding device 7. Through a second group of points 56-58, the rewound printed products can be brought from a rewinding device to the removal belt 12. As is readily apparent, between the inlet 2 and the outlet 3, the printed products retain their orientation and their reciprocal positioning. Thus, it is a roll module of type 3 or 8.

In order to be able to achieve a modification to the orientation of the printed products with said roll modules, it is e.g. possible to provide additional points at the winding station 8, which connects the latter directly to the removal belt 12 or, by means of points, there can be a direct connection from the feed belt 11 to the individual rewinding devices 7.

Fig. 4 shows an arrangement with two winding modules 41, 42 of type 2 or 6 and two winding modules 43, 44 of type 8. In addition to the rewinding device 7, winding modules 41, 42 have a rewinding device 79, which reverses the printed products by 180° , i.e. modifies their orientation α . By means of an associated point 78, either the rewinding device 7, or the rewinding device 79 of said winding stations can be activated. Thus, the printed products supplied via feed

connections 61, 62, as a function of the position of points 78, are supplied to the removal belt 12 in unchanged manner, or turned by 180°. If the products are to be supplied to outlet 3 in unchanged form, then they can be stored by any one of the roll modules 41-44 by setting the points 51-54. However, if the orientation of the printed products is to be changed, i.e. parameter α is converted, then preferably use is made of roll modules 41 and 42. It is naturally also possible to carry out buffer storage by means of the roll modules 43, 44 and to carry out conversion in a second operation by means of module 41 or 42.

In order to be able to control the rotation speed of the rolls during unwinding (modification of the timing frequency t_1 to t_2), the drive must be speed-variable and e.g. use is made of a reversible two-speed asynchronous motor.

The points 51-60, 71, 72, 79 etc. are adequately known from the prior art and can e.g. be in the form of short, pivotable conveyor belt sections.

Fig. 5 shows another possible use of the method according to the invention. The basic diagram and the reference numerals correspond to Fig. 1. In the vicinity of outlet 3 is provided a buffer storage timer 77, such as is e.g. known from Swiss patent 610 276. This makes it possible to simultaneously remove products by means of connection 5 and/or from different roll modules 41-45. By means of the timer 77 the corresponding product flows are "spliced together", i.e. joined to form a single stream and supplied to the outlet 3. In addition, there is at least one return mechanism 80 after outlet 3 to inlet 2. As stated, said return mechanism 80 can be provided after a first machine module 81, which represents one processing step for the products. It is also possible to provide a return mechanism 80' to inlet 2 after each further machine module. Thus, in the case of a failure of a random machine module, the products can be returned to inlet 2 and consequently it is only

necessary to provide a single buffer storage means 1 within an overall system. An apparatus for performing this method can be achieved in simple manner in that the return mechanisms, in much the same way as the feed paths 61-63 in Figure 2, are returned to the feed belt from above.

Reference is made to co-pending Application No 8901112.6 (Serial No 2216108), from which the present application has been divided and which relates to a method for operating an arrangement for buffer storage of flat products.

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CLAIMS

1. Arrangement for the buffer storage of flat articles, preferably printed products and preferably occurring in the form of a stream formation, comprising a buffer storage means with at least two roll modules, which are connected by means of switching points (51 - 55, 56 - 60) to a feed means and a removal means characterized

in that the winding planes as hereinbefore defined of all roll modules (41 - 45) are substantially parallel and approximately co-planar in a vertical plane,

in that the conveying directions of the feed means and of the removal means both run substantially parallel to said vertical plane,

in that the roll modules are arranged in succession between the feed means and the removal means,

and in that the roll modules are freely accessible from at least one side in the vicinity of their roll mounts.

2. Arrangement according to claim 1, characterized in that the feed and removal means are constructed as conveyor belts, and in that the feed belt (11) is located above the roll modules (41-45) and the removal belt (12) is located below them.

3. Arrangement according to claim 1, characterized in that the feed means is constituted by a clamp conveyor and in that the removal means is constituted by a conveyor belt or clamp conveyor.

4. Arrangement according to any one of the claims 1 to 3, characterized in that at least one roll module (41-45) contains a rewinding device (7) or a deflecting device (79).



5. Arrangement according to any one of the claims 1 to 4 characterized in that the feed and removal means (2, 3) are linked by a direct feed section (5).

6. Arrangement according to any one of the claims 1 to 5, characterized in that a group of switching points (56-60) is constructed as a buffer storage timer (77).

7. Arrangement according any to one of the claims 1 to 6, characterized in that at least two roll modules (41-46) are directly interconnected by means of additional points (71, 72).

8. Arrangement according to any one of the claims 1 to 7, characterized in that the drive for the roll modules (41-45) is a reversible two-speed asynchronous motor.

9. Arrangement for the buffer storage of flat articles substantially as herein described with reference to, and as shown in, the accompanying drawings.
