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(54) **Folding machine**

(57) Folding machine for sheets of paper material and the like comprising a first pair of cylinders (2, 10) and a second pair of cylinders (7, 8) capable of moving the

sheet that is to be folded, characterized in that the shafts of the cylinders (7, 8) of said second pair of cylinders (7, 8) are movable relative to the shafts of the cylinders (2, 10) of said first pair of cylinders (2, 10).

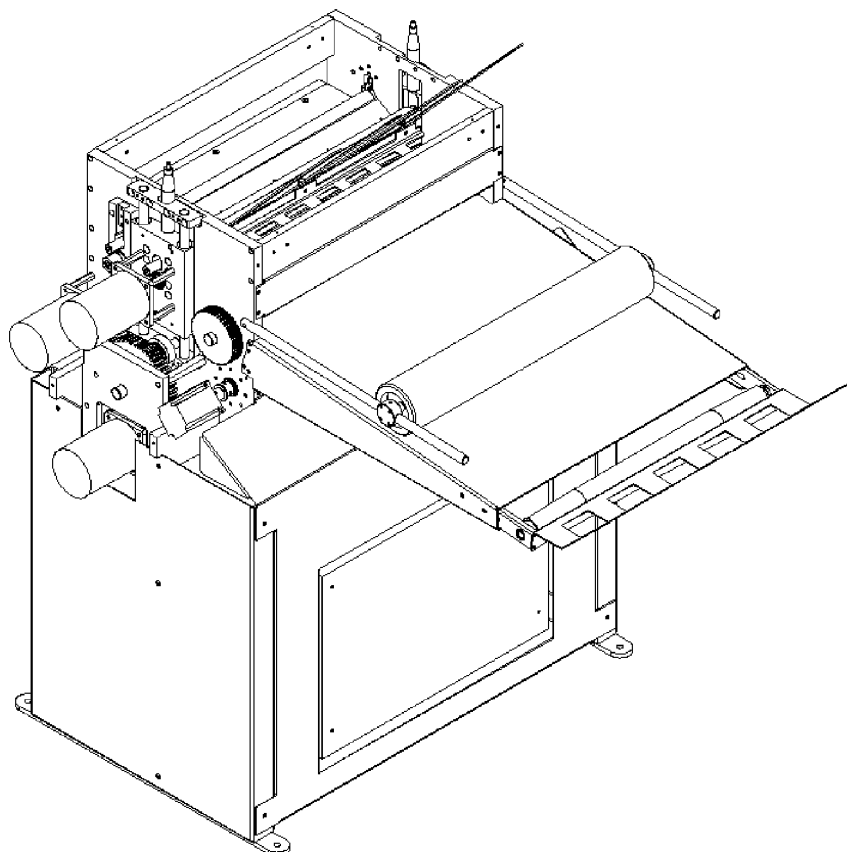


Fig. 2

Description

Field of the invention

[0001] The present invention relates to the technical field of folding machines, used for example in the typographic sector for the production of folders, covers and the like.

Prior art

[0002] Folding machines are used in typography and in bookbinding for the processing of sheets of cardboard and card that need to be folded to form folders, covers and other objects made from suitably folded card.

[0003] At present, folding takes place in various ways, using buckle folders, knife folders, "flying" knife folders, and helical folders.

[0004] Buckle folders are indicated for processing light cards. In these machines, the sheet, not necessarily creased beforehand, is introduced into a pocket, closed at the end, where hitting the stop at high speed causes a fold that allows the following rollers to pull the sheet out of said pocket.

[0005] In knife folders, in contrast, the sheet strikes a ledge and is pushed into the gap between two rollers by a blade, in fact called a knife, which is retracted as soon as the sheet is gripped by said rollers. Folders of this type are often used at the exit of a buckle folder, which makes parallel folds, to add a perpendicular fold to the sheet already folded.

[0006] In so-called "flying" knife folders the sheet is creased beforehand and then the knife comes into action at the moment that the paper goes past.

[0007] In helical folders, instead, the sheet of card is pulled by a series of belts until a part of it meets a helical element which provides closing of a door while said sheet advances. The main use is for cards of large thickness that cannot be folded with the other systems.

[0008] In each of the folders described above, except the helical folder, the sheet to be processed is wrapped, during the folding process, on suitable folding cylinders. Especially in the case of sheets of card of a certain thickness, this makes it impossible to process said sheet adequately or even causes it to be damaged. In fact, at the end of processing, the sheet will have a curvature imparted by the processing roller that actually makes it unusable. This is the reason for using helical folders, which succeed in folding the sheets without encountering the aforementioned problem. However, helical folders have the drawback that they are unwieldy and require long set-up times.

[0009] Another disadvantage, associated in particular with the buckle folders, is that the printed matter entering and leaving the pockets tends to be scratched and may be rendered unusable. In the case of printed matter produced by digital printers, and accordingly in a limited number of copies, the use of helical folders is clearly in-

advisable in view of the large number of copies required for setting up the machine.

[0010] The folding machine according to the present invention introduces a method of folding capable of overcoming the drawbacks enumerated above, connected with each folding machine of the prior art.

Brief description of the drawings

10 [0011]

Fig. 1 Sectional view of a detail of the machine according to the present invention.

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Fig. 2 Perspective view of the machine according to the present invention.

Summary of the invention

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[0012] Machine for making folds in sheets of paper material and the like comprising two pairs of cylinders for handling the sheet being processed and for effecting folding of the sheet.

Detailed description of the invention

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[0013] The folding machine according to the present invention introduces an additional control on sheet feed at the inlet, which can be of the creased type or not. The folding machine according to the present invention comprises at least one pair of rollers at the inlet, controlled so as to stop the feed of the sheet at the inlet without having to insert it until it meets the stop in the pocket.

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[0014] In more detail, the machine according to the present invention comprises a first pair of tension cylinders 2, 10, and a carriage 11 comprising a second pair of pressure and feed cylinders 7, 8, preferably motorized synchronously with said first pair of cylinders 2, 10, said carriage 11 being able to execute a preferably substantially vertical movement between two limit positions, a lower position that is assumed when it is necessary to make a fold, in the sheet being processed, from bottom to top and an upper position that is assumed when it is necessary to make a fold, in the sheet being processed, in the opposite direction, i.e. from top to bottom.

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[0015] The axial displacement of said carriage 11 means that the shafts of said second pair of cylinders 7, 8 are movable relative to the shafts of said first pair of cylinders 2, 10 and is such as to impress a partial fold in the sheet being processed corresponding to attainment of the middle position of said carriage 11 between said lower and upper limit positions. The subsequent rotation of said first pair of cylinders 2, 10 will drive the sheet being processed until its point of folding is below said second pair of cylinders 7, 8, which, rotating in synchronism with the cylinders of said first pair of cylinders 2, 10, will complete the folding, finally pushing the folded sheet onto the exit carpet 13.

[0016] The folding of the sheet being processed there-

fore takes place without the use of knives or of folding pockets and without the sheet being processed having to be wrapped on the cylinders during the folding process.

[0017] Referring to the appended Fig. 1, processing and folding of the sheet as carried out by the machine according to the present invention take place as follows: at the moment when the machine according to the present invention is switched on, based on the programming provided, carriage 11 is arranged corresponding to its lower position, if the fold to be executed is an upward fold, or corresponding to its upper position if the fold to be executed is a fold in the opposite direction i.e. downward.

[0018] Said carriage 11, in its axial movement along the appropriate guides 19, 20, also provides displacement of all the parts that are integral with said carriage 11, i.e.: said second pair of cylinders 7, 8; the plates 9, 12, the purpose of which is to guide the sheet being processed - introduced via the inlet tray 1 - after exit from the guide wedges 3, 4, providing said sheet being processed with a supporting surface that is inclined in relation to the fold that will be executed; the connecting crosspieces 15, 16 and the upper 17 and lower 18 exit plates that are intended to channel the sheet being processed, now already folded, towards the deflecting roller 14 positioned at the exit of the machine according to the present invention. The sheet, received for example from a creasing machine arranged upstream of the machine according to the present invention, is supported on the input tray 1, next it is picked up by the first pair of cylinders 2, 10 and is then fed into the guide wedges 3 and 4.

[0019] In the case when the fold to be executed faces upwards, carriage 11, already arranged in the lower position, allows the sheet to advance freely and come to rest gently on said plate 9 until it brings the preexisting crease, or the point of folding, in line with the fine adjustment plate 5. At this point carriage 11 moves to the middle position bringing back said second pair of cylinders 7, 8 to the same height as said first pair of cylinders 2, 10. In doing so, said second pair of cylinders 7, 8 has already, through its displacement, given the sheet a fold of approx. 90°.

[0020] In order to increase the fold to 180°, the sheet will be made to advance further in order to allow it to be taken up by the said second pair of cylinders 7, 8 which will squeeze it. Said second pair of cylinders 7 and 8 has a motion synchronous with said first pair of cylinders 2, 10 and can moreover be synchronized, for example, with the cylinders of the optional creasing machine arranged upstream of the folding machine according to the present invention.

[0021] For folding the sheet in the opposite direction, before the sheet arrives, carriage 11 moves to the upper position and then performs the same manoeuvres as described previously, but in the opposite direction.

[0022] After folding, the sheet is pushed onto an exit carpet 13 which, by means of a roller 14, provides transport thereof and a new squeezing.

[0023] The machine according to the present invention can be provided with additional folding stages - comprising at least one further carriage similar to said carriage 11 and a further pair of cylinders similar to said second pair of cylinders 7, 8 - arranged in cascade so that they can make two or more folds on the same sheet. The machine according to the present invention, as mentioned, is able to work in conjunction with a creasing machine arranged upstream. However, the machine according to the present invention can comprise a bridge connecting to a register table, so that folding of a sheet can be carried out while the creasing machine is already processing the next sheet, or can comprise a feeder or its own sheet feeder.

[0024] In cases when the machine according to the present invention is equipped with its own sheet feeder or with a bridge connecting to a register table, it will have to include a suitable control module capable of accurately determining the beginning of the sheet to be processed. Said control module could, for example, comprise a photocell arranged in order to sight the beginning of the sheet as it advances to the input of the machine according to the present invention.

[0025] The machine according to the present invention can be independent with regard to the layouts and the folds to be made, so that it can, instead, receive the layouts from the machine with which it is associated, for example the creasing machine arranged upstream of the machine according to the present invention of the preceding example.

[0026] The fold obtained in the sheet through the operation of the machine according to the present invention is executed without said sheet having to wrap around the rollers and without the need to use knives that characterize the similarly named folders, solving the technical problems described above, relative to the folding machines of the prior art.

Claims

1. Folding machine for sheets of paper material and the like comprising a first pair of cylinders (2, 10) and a second pair of cylinders (7, 8) capable of moving the sheet that is to be folded, **characterized in that** the shafts of the cylinders (7, 8) of said second pair of cylinders (7, 8) are movable relative to the shafts of the cylinders (2, 10) of said first pair of cylinders (2, 10).
2. Folding machine according to Claim 1 comprising a carriage (11), in its turn comprising said second pair of cylinders (7, 8), said carriage (11) being able to perform a substantially vertical movement between an upper limit position and a lower limit position.
3. Folding machine according to Claims 1-2 in which said first pair of cylinders (2, 10) and said second

pair of cylinders (7, 8) are motorized synchronously with one another.

pair of cylinders (2, 10).

4. Folding machine according to Claims 1-3 further comprising: an input tray (1); a pair of guide wedges (3, 4); a pair of guide plates (9, 12); a pair of connecting crosspieces (15, 16); a pair of fine adjustment plates (5, 6); an exit carpet (13); a pair of exit plates (17, 18); a squeezing roller (14); a pair of guides (19, 20) associated with said carriage (11). 5
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5. Folding machine according to Claims 1-4 associated with a creasing machine arranged upstream and able to supply the sheet to be folded to said folding machine. 15
6. Folding machine according to Claim 5 in which said first pair of cylinders (2, 10) and said second pair of cylinders (7, 8) are motorized synchronously with the cylinders of said creasing machine. 20
7. Folding machine according to Claims 1-6 comprising a bridge connecting to a register table.
8. Folding machine according to Claims 1-7 comprising a feeding unit or a sheet feeder. 25
9. Folding machine according to Claims 1-8 comprising a control module capable of accurately determining the beginning of the sheet to be processed. 30
10. Folding machine according to Claim 9 in which said control module comprises a photocell arranged in order to sight the beginning of the sheet as it advances to the input of said folding machine. 35
11. Folding machine according to Claims 1-10 comprising additional folding stages - comprising in their turn at least one further carriage similar to said carriage (11) and a further pair of cylinders similar to said second pair of cylinders (7, 8) - arranged in cascade so as to be able to make two or more folds in the same sheet. 40
12. Method for folding sheets of paper material and the like comprising the following steps: 45
 - a) supplying a first pair of tension cylinders (2, 10) and a second pair of pressure and feed cylinders (7, 8); 50
 - b) the cylinders of said first pair of tension cylinders (2, 10) grip the sheet being processed and cause it advance to said second pair of pressure and feed cylinders (7, 8);
 - c) the cylinders of said second pair of pressure and feed cylinders (7, 8) make a fold in the sheet being processed, translating their own shafts relative to the shafts of the cylinders of said first 55

13. Method according to Claim 12 carried out by the folding machine according to Claims 1-10.

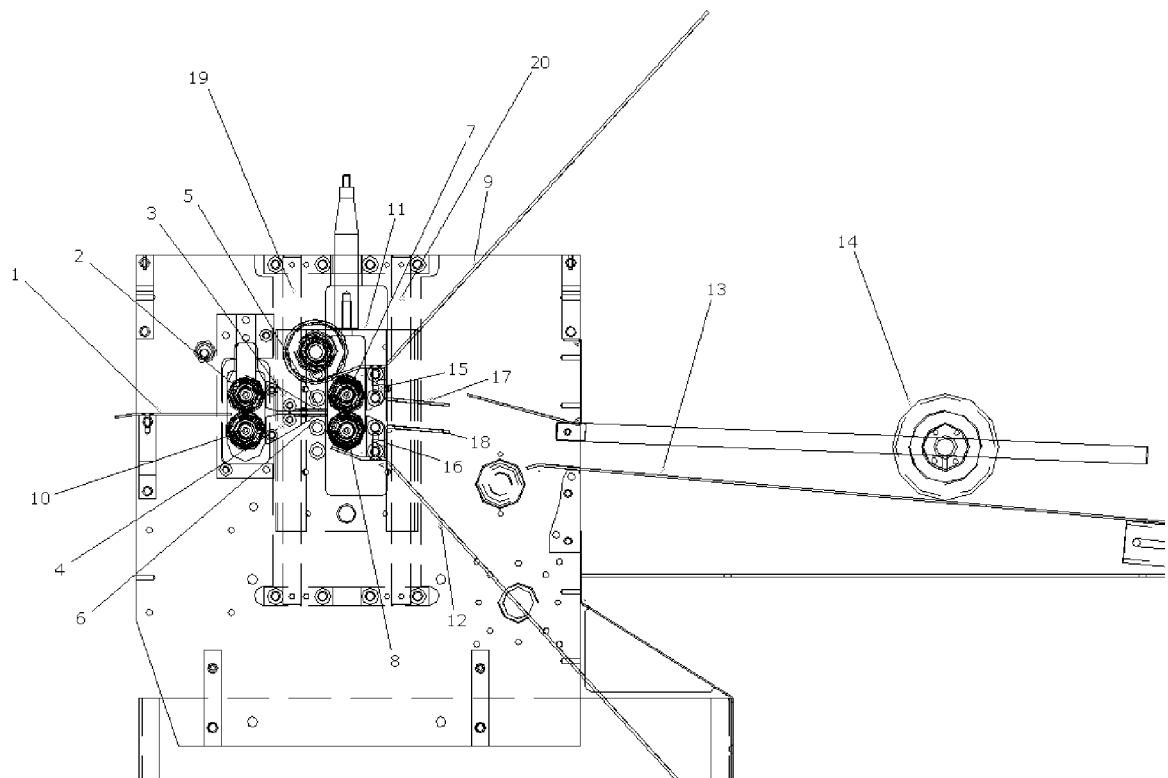


Fig. 1

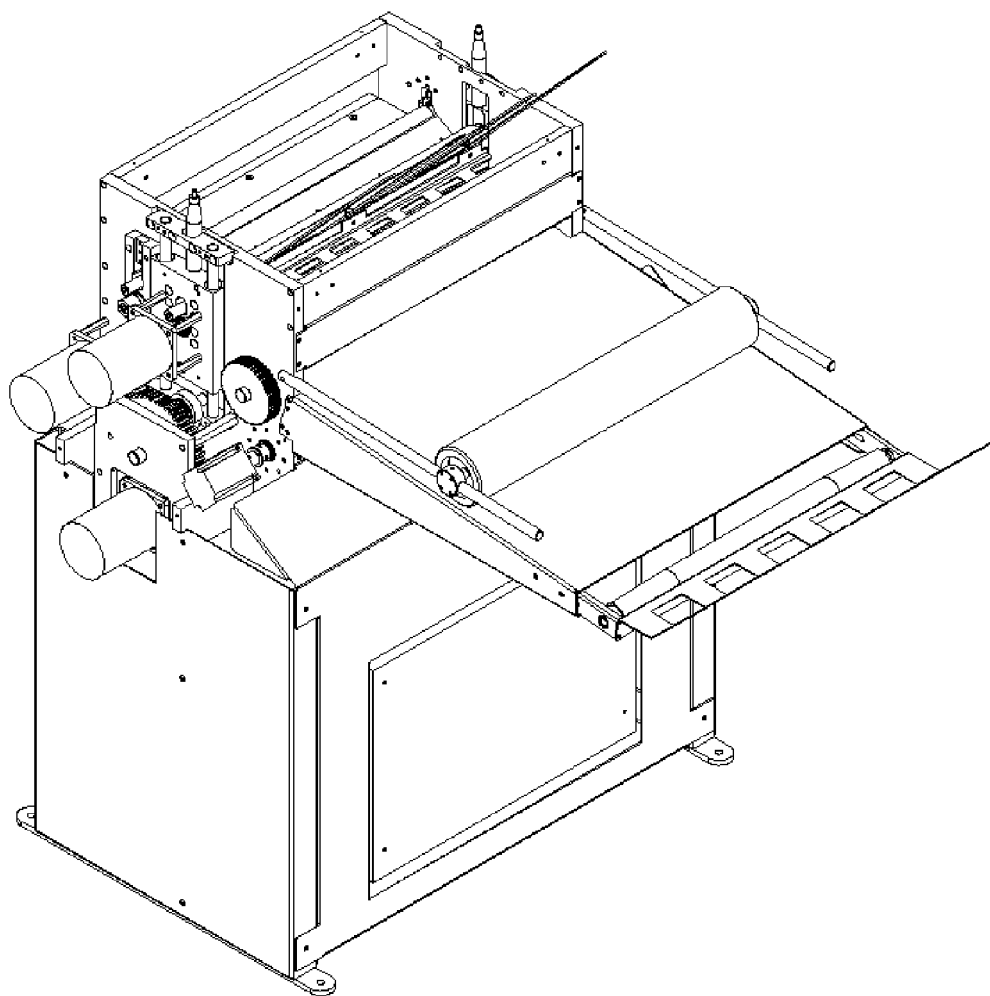


Fig. 2



EUROPEAN SEARCH REPORT

Application Number
EP 11 16 6322

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	US 5 425 696 A (HARA AKIHIKO [JP] ET AL) 20 June 1995 (1995-06-20) * abstract; figure 1 *	1,12	INV. B31F1/00 B65H45/14
A	DE 197 09 643 C1 (BOEWE SYSTEC AG [DE]) 16 July 1998 (1998-07-16) * abstract; figure 1 *	1,12	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC) B65H B31F
Place of search Munich		Date of completion of the search 21 July 2011	Examiner Farizon, Pascal
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 11 16 6322

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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21-07-2011

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