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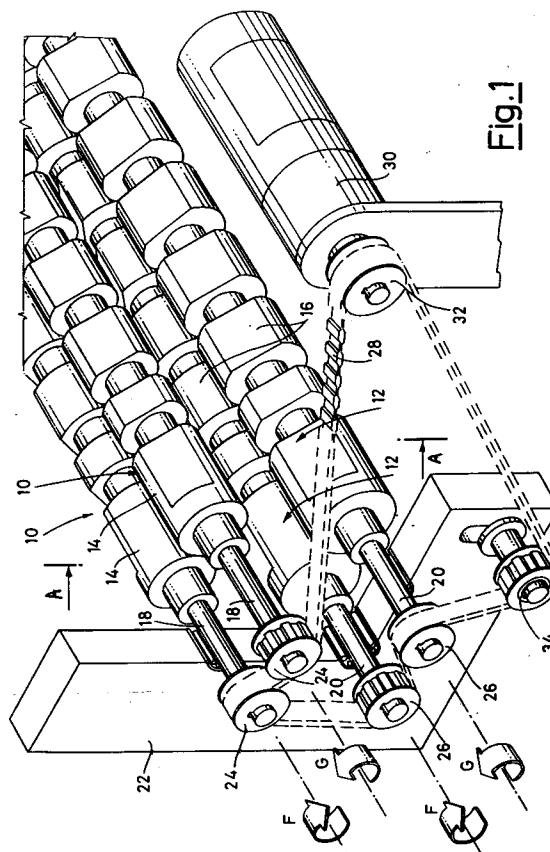
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**AT BE CH DE DK ES FR GB GR IT LI LU NL SE**(71) Applicant: **Industria Grafica Meschi S.r.l.**  
**Via Pian di Rota, 2**  
**I-57100 Livorno(IT)**(72) Inventor: **Meschi, Luciano****Corso Amedeo, 73**  
**I-57100 Livorno(IT)**(74) Representative: **Michelotti, Giuliano**  
**c/o SAIC BREVETTI S.r.l. Viale Bianca Maria**  
**15**  
**I-20122 Milano(IT)**(54) **Device for providing tear in a paper sheet, or the like, along a substantially transversal pre-punched straight line.**

(57) A device for effecting the tearing of a paper sheet (40), or the like, along a pre-punched straight line or area (46) substantially transversal with respect to the sheet is disclosed.

The tearing device comprises two roll pairs (10, 12) having opposed cylinders (14, 16) in which the cylinders are so shaped to have two opposed planar faces (36, 38) for delimitating a free passage for the sheet (40) while the remaining faces (42, 44) are of substantially convex shape, so that, when the rolls (10, 12) rotate, said convex faces (42, 44) get each other in touch, grasping the sheet (40).

The angular speed of both roll pairs (10, 12) is the same but, according to the invention, the cross-section of the cylinders (16) of the rolls (12) located downstream of the pre-punched area (46) is larger than that of the cylinders (14) of the rolls (10) located upstream of the area so that the peripheral speed of the first ones is higher than that of the second ones, that causing the development of a tensile action on the sheet (40) during the contact time of the sheet itself with the convex faces (42, 44) of the above mentioned cylinders (14, 16) and the tearing of the pre-punched area (46).

**Fig.1**

The subject matter of the present invention is a device for effecting the tearing of a paper sheet, or the like, along a pre-punched substantially transversal straight line or area.

The invention relates to a device of the kind forming the subject matter of EP-A-0370578, filed on November 20, 1989 at the name of the present applicant and also, more specifically, a device reminding in some of its essential features, that forming part of the subject matter of the European Patent Application No. 91202571.5 filed on October 2, 1991 at the name of the present applicant. It has been realized that both the devices forming the subject matter of the above mentioned patent applications allowed to advantageously solve the problem of effecting a paper sheet tearing along a substantially transversal pre-punched line. It has been devised and is the subject matter of the present invention a device of the above kind which, while showing the same reliability and safety features, is an advantageous simplification thereof and, obviously, provides to enhance the advantages of the devices disclosed in the above mentioned patent applications. One of the most noticeable advantages of the device according to the present invention consists in using just one motor for driving the means providing to tear the paper sheet along the above mentioned pre-punched line.

A further advantage consists in that the sheet to be teared is firmly held along two lines substantially parallel to the transversal pre-punched line, being said two lines upstream and downstream with respect to said pre-punched line, and a strong tensional strain surely sufficient to provide the tear severing thereof, is thereon provided.

The features as well as the advantages of the device according to the present invention will appear more clearly from the following detailed description of an exemplary, not limiting embodiment made with reference to the enclosed figures, in which:

figure 1 is a perspective, schematic partial view of a tear severing device according to the invention;

figure 2 is a schematic view of the severing device taken along the A-A line of figure 1 in at rest condition;

figure 3 is a schematic view of the severing device, along the A-A line, at the beginning of the sheet tightening, and

figure 4 is a schematic view of the severing device, along the A-A line, depicting the tear step.

Having particular reference to figure 1, the apparatus according to the present invention comprises two roller pairs 10, 12 counterrotating in the way indicated by the arrows F and G anyone of which consists of a plurality of each other opposed

cylinders 14, 16, arranged or shaped on or from shafts 18, 20 turnable on a fixed supporting frame 22.

At the ends of the shafts 18, 20 are fastened gears 24, 26 which are rotated by a toothed belt 28 which is connected to just one control motor 30 by engaging a gear 32 fastened to the shaft thereof. The numeral 34 indicates an idle gear which is fastened in a settable position on the frame 22 for maintaining properly tensioned the toothed belt 28.

As the diameter of the gears 24 and 26 is equal, the angular speed of the shafts 18, 20 will be the same.

Referring now also to figures 2 to 4, both cylinders 14 and 16 have two planar substantially parallel faces 36, 38 which, when are opposed in the rest condition of the apparatus depicted in figure 2, define a passage for the paper sheet 40 advancing in accordance with the direction of the arrow H. The advancement is driven by well known means (not depicted).

The paper sheet 40 is provided with preset constantly spaced transversal pre-punched lines which will allow the paper tear therealong, when one of them is between the roller pairs 10, 12 and the cylinders 14, 16 are each other engaged by rotation, so that they get frictionally in touch with the paper sheet 40. The areas of the cylinders 14, 16 friction engaging the paper sheet 40 contain a convex portion 42, 44 comprised between the planar faces 36, 38 of the cylinders 14, 16.

As it is seen in detail in figures 2 to 4, in accordance with the main feature of the apparatus according to the invention, the downstream cylinders 16 with respect to the advancing direction of the paper sheet 40 have a transversal cross section larger than that of the upstream cylinders 14 with respect to the same direction. As the angular speed of the shafts 18, 20 is the same, the peripheral speed of the convex regions 44 of the cylinders 16 will be higher than that of the convex portions 42 of the cylinders 14. In such a way, when the control motor 30 is actuated for driving the rotation of the cylinders 14, 16 in order to bring them subsequently in the positions of the figures 3 and 4, the portion of the paper sheet 40 between the above mentioned cylinders undergoes such a tensile action to cause a tear of the paper sheet 40 along the transversal pre-punched line 46, as schematically depicted in figure 4.

Once effected the above mentioned tear, the cylinders 14, 16 still rotating in accordance with the arrows F and G, will return in the position of figure 2 in order to allow a new advancing of the paper sheet 40 till the subsequent pre-punched line 46 will be located between the above cylinders. These last will be rotated again to provide another tear in said paper sheet 40. The just disclosed cycle is

repeated for every pre-punched line 46 of the paper sheet.

The advantages of the device according to the present invention will be apparent and can be summarized as follows.

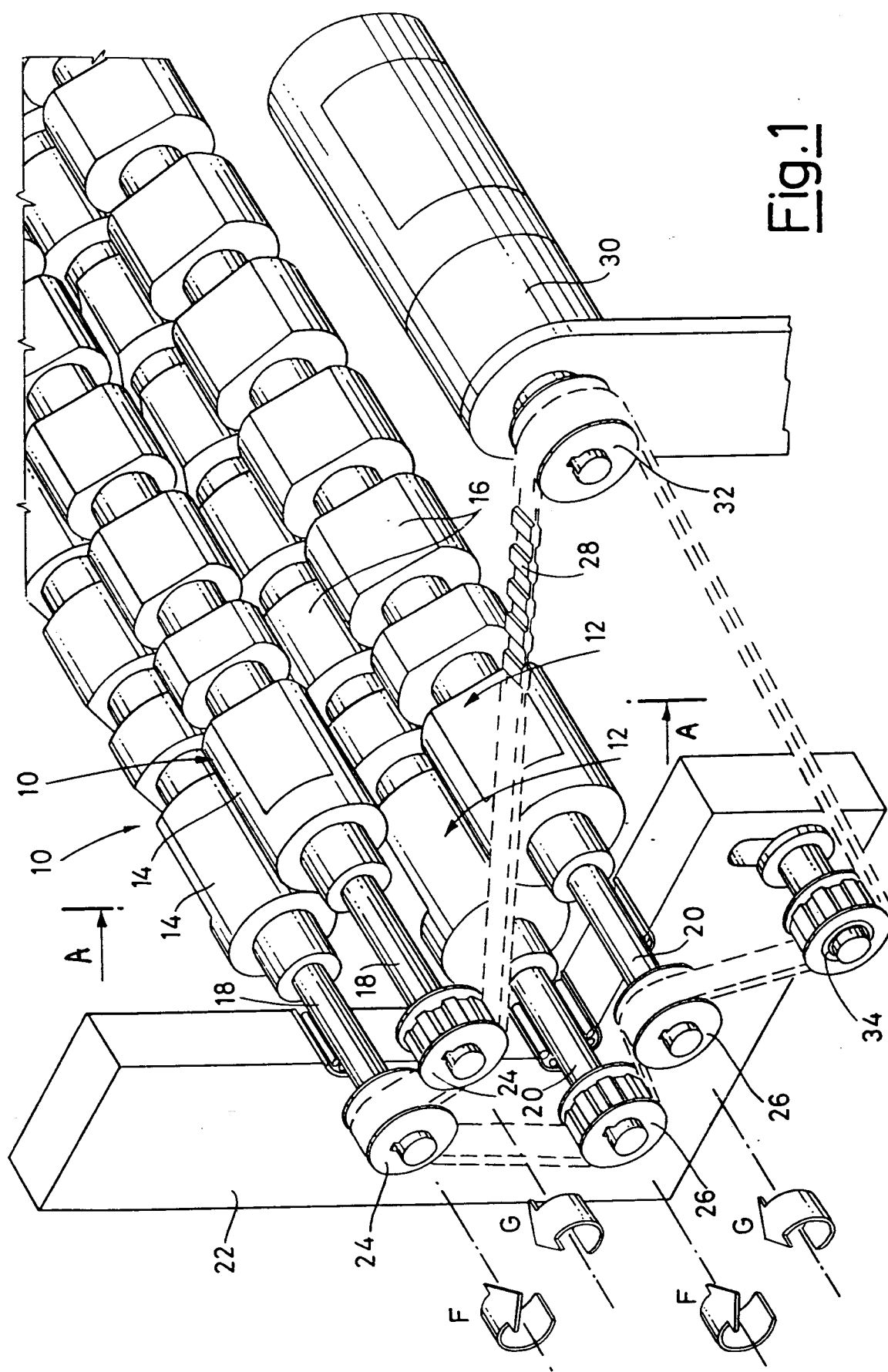
Manufacturing and operating simplicity of the device because the motor is just one in number and do not have to be provided driving means or units to coordinate the actuation of many motors. It will be sufficient just one detector detecting and signalling to the motor 30 the presence of a pre-punched line 46 between the cylinders 14 and 16 in order to have it actuated as hereabove disclosed.

Clogging impossibility of the apparatus because the rollers 10, 12 are rotated by the same and unic belt 28 assuring the simultaneous and synchronous rotation of the cylinders 14, 16.

It is clear and apparent the variations and/or changements can be made to the device according to the invention without coming out of the scope as defined by the appended claims.

## Claims

1. Device for providing tear in a paper sheet (40), or the like, along a substantially transversal pre-punched line, comprising two roller pairs (10, 12) counterrotating with respect to cylinders (14, 16) series arranged along the feed direction of the paper sheet (40) in which the cylinders (14, 16) appear with at least a planar portion (36) which, when faced against the corresponding planar portion (38) of a cylinder of the other roll, defines a passage for the paper sheet, at least a convex portion to engage the paper sheet together with a corresponding convex portion of a cylinder of the other roll, characterized in that the cylinders (16) of the rolls (12) downstream arranged according to the feed direction of the paper sheet (40) appear with a cross-section larger than the cylinders (14) of the rolls (10) upstream arranged according to the feed direction itself.
2. Device, according to claim 1, characterized in that the two roll pairs (10,12) are provided with the same angular speed, so that the peripheral speed of the convex portions (44) of the cylinders (16) of the downstream arranged rolls (12) is higher than that of the cylinders (14) of the upstream rolls (10).
3. Device, according to claim 1, characterized in that the position of the rolls (10) upstream with respect to that of the downstream rolls (12) is so arranged that the relating cylinders (14, 16) get simultaneously in touch, through their convex portions (42, 44), with the paper sheet (40), occurring the tearing thereof along a pre-punched line (46) because of a difference in peripheral speed of the cylinders (16) of the downstream rolls (12) with respect to that of the upstream rolls (10).
4. Device, according to claim 1, characterized in that the cylinders (14) of the upstream rolls (10) and those of the downstream rolls (12) appear with at least two planar substantially parallel and each other 180° arranged portions (36, 38), as well as with at least two convex portions (42, 44) symmetrical with respect to said planar portions (36, 38) and also each other 180° arranged.
5. Device, according to claim 1, characterized in that the two roll pairs (10, 12) are actuated by just one control motor (30).



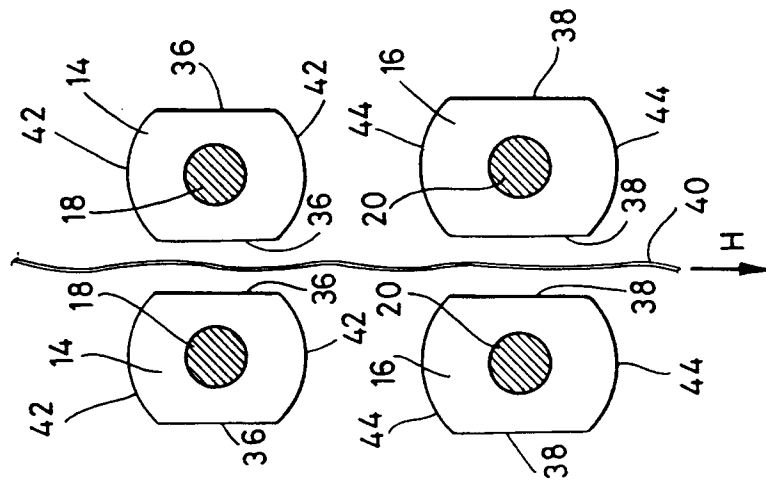


Fig. 2

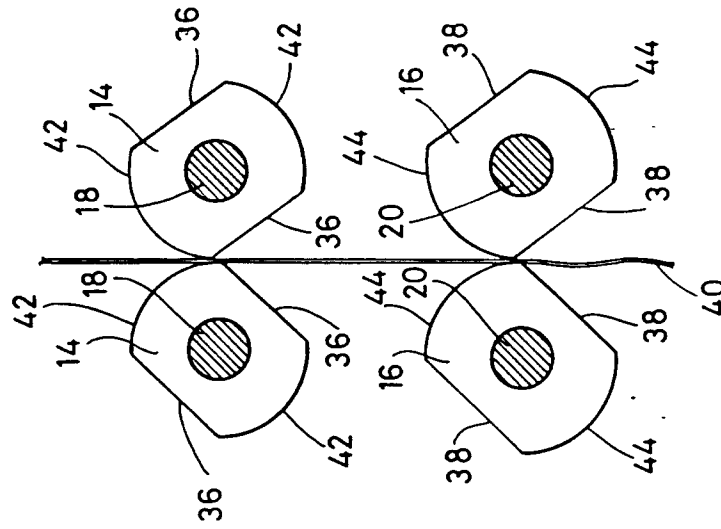


Fig. 3

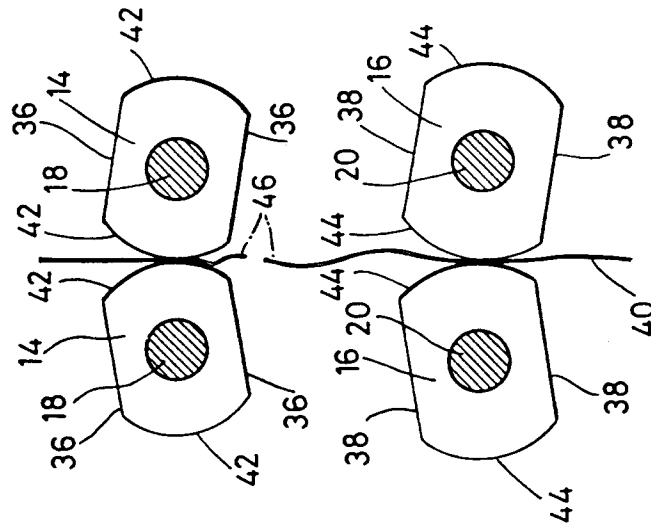


Fig. 4



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## EUROPEAN SEARCH REPORT

Application Number

EP 92 20 0824

| DOCUMENTS CONSIDERED TO BE RELEVANT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                       |                                                  |                                               |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|--------------------------------------------------|-----------------------------------------------|
| Category                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Citation of document with indication, where appropriate, of relevant passages         | Relevant to claim                                | CLASSIFICATION OF THE APPLICATION (Int. Cl.5) |
| X                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | DE-A-3 205 801 (BÖWE MASCHINENFABRIK)<br>* the whole document *<br>---                | 1-5                                              | B65H35/10                                     |
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| D,A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | EP-A-0 370 578 (INDUSTRIA GRAFICA MESCHI S. R. L.)<br>* the whole document *<br>----- | 1-5                                              |                                               |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                       |                                                  | TECHNICAL FIELDS<br>SEARCHED (Int. Cl.5)      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                       |                                                  | B65H                                          |
| The present search report has been drawn up for all claims                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                       |                                                  |                                               |
| Place of search<br>THE HAGUE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                       | Date of completion of the search<br>12 JUNE 1992 | Examiner<br>MEULEMANS J. P.                   |
| <b>CATEGORY OF CITED DOCUMENTS</b><br>X : particularly relevant if taken alone<br>Y : particularly relevant if combined with another document of the same category<br>A : technological background<br>O : non-written disclosure<br>P : intermediate document<br>T : theory or principle underlying the invention<br>E : earlier patent document, but published on, or after the filing date<br>D : document cited in the application<br>L : document cited for other reasons<br>-----<br>& : member of the same patent family, corresponding document |                                                                                       |                                                  |                                               |