

SHEET PROCESSING APPARATUS

5 This invention relates to a sheet-processing apparatus comprising a feed table to which (in use) paper sheets, or other sheets comparable in respect of flexibility with paper, are fed, and also comprising a device which (in use) makes thickness sensing tests on the sheets fed to the feed
10 table; the said device comprising a roller carrier disposed above that position, on the feed table, to which the leading end portions of the sheets are fed, and incorporating a pivotally mounted lever; and a roller, which (in use) makes contact with the surface of a fed sheet, being mounted at
15 one end of the lever.

 In industries which entail working with paper, and especially in the printing industry, it is desirable to be able to test the thickness of the sheets which are to be worked on, so as to derive information therefrom as to the
20 required machine setting values. Since sheets can have different thickness values, it is necessary to test each sheet individually, after it has been taken from its stack and has arrived in a sheet alignment area.

 In certain known devices, e.g. those known from the
25 German Patent Application No.3221379, there is a pivotal lever arm positioned above the sheet alignment table and out of the operative range of the side pull guide, with a roller being provided at the end of said lever arm and touching the paper surface. A change in sheet thickness causes a
30 vertical movement of the lever arm, which is sensed by a device directly connected to the lever arm.

 It is a disadvantage of this method that a further direct contact with the sheet to be

tested must be made. With this further direct contact, there does arise an additional possibility of damage to the paper surface. In general, it is advisable to aim at avoiding as much as possible any mechanical action on the
5 sheet which is to be printed.

Therefore, it is an object of the present invention to provide a device of the kind defined above in the opening paragraph of this description, wherein the possibility of damage to the sheet surface is diminished.

10 According to the present invention, there is provided a sheet-processing apparatus comprising a feed table to which (in use) paper sheets, or other sheets comparable in respect of flexibility with paper, are fed, and also comprising a device which (in use) makes thickness sensing
15 tests on the paper or other flexible sheets fed to the feed table; the said device comprising a roller carrier disposed above that position, on the feed table, to which the leading end portions of the sheets are fed, and incorporating a pivotally mounted lever; and a roller, which (in use) makes
20 contact with the surface of a fed sheet, being mounted at one end of the lever; wherein the roller carrier is provided with a distance sensor which senses sheet-feed-related vertical displacements of the lever; wherein means are provided whereby the values determined by means of the
25 distance sensor are transmitted to an electronic evaluation apparatus; and wherein a stop pin is provided at the extremity of that end portion of the lever on which the said roller is mounted, this stop pin being so positioned and dimensioned as to enable it to perform (in use) the function
30 of aligning the fed sheet.

It is an advantage of the device of this invention that the thickness sensing means is integrated in the roller carrier. Thus the roller, besides performing its basic function of pressing down the sheet, has an additional function, namely that of the raising or lowering of the pivotally mounted lever, which is utilised for the sensing of the sheet thickness. Therefore the ordinary devices for sensing the sheet thickness which have been used up to now and which function independently of the roller carrier can be

entirely discarded. Besides saving materials and assembly costs, the possibility of damage to the sheet surface can be eliminated. Furthermore, the pivotally mounted lever permits the testing of the thicknesses of the most diverse printing materials, since the lever which through the roller contacts the surface of the sheet adjusts itself automatically to the thicknesses of the various printing materials.

In a preferred embodiment of the invention, the lever is a two-arm lever, and, on the arm opposite the roller, is provided with a tongue lying substantially parallel to the feed table, an inductive distance sensor being mounted in the roller carrier above the tongue, and the operative portion of this sensor being directed towards the tongue.

This embodiment of the invention permits the use of an inductive distance sensor with which particularly good resolution within the range of thicknesses tested is attainable.

In a further preferred embodiment of the invention, the position of the lever in the absence of any sheets is utilised as a reference-value-determining starting position for subsequent tests. Thus at the start of a run, and before the first sheet has arrived for thickness sensing, the lever position is treated as the starting position for the sensing of the sheet thicknesses. A manual adjustment of the lever to suit different sheet thicknesses can thereby be eliminated. When a predetermined acceptable range of sheet thickness is departed from, e.g. with the arrival of a double or multiple sheet, the electronic evaluation apparatus can give a warning or other signal so that an appropriate response can be made.

Double or multiple sheets can be instantly recognized and indicated by the electronic evaluation apparatus on account of the sensing of a multiple of the statistically expected sheet thickness.

The invention is illustrated in the accompanying diagrammatic drawing, wherein

Figure 1 is a fragmentary side view of an apparatus according to the invention, and

Figure 2 is a fragmentary top view of the apparatus of Figure 1.

The apparatus of Figures 1 and 2 comprises a basic body 4 which is displaceably mounted on a traverse 3 extending above a feed table 1. For the purpose of fastening the body 4 on the traverse 3, there is provided a locking screw 5. On the side facing the feed table 1, the body 4 carries a pivot bearing 8 which serves to receive a two-arm lever 9 extending roughly parallel to the traverse 3. One arm of the two-arm lever 9 extends away from the body 4, and is bent towards the feed table 1, in the region of the pivot bearing 8. Near its end, this arm of the two-arm lever 9 carries a roller 7, which makes contact with the surface of a sheet 2 that has been fed to the feed table 1. At the very end of this arm of the two-arm lever 9, there is provided a stop pin 6, which aligns the fed sheet 2. The other arm of the two-arm lever 9, i.e. that which extends towards the body 4, is provided at its end with a tongue 11, which serves as a level-measuring surface; as may be seen from Figure 1, the tongue 11 lies substantially parallel to the surface of the feed table 1, and substantially parallel to the under surface of the body 4. At a right angle to the tongue 11, there is mounted a distance sensor 10,

which is inserted into the body 4 in such a way that the operative portion of the distance sensor 10, which is afforded by that end of it which is shown at 13, is directed towards the tongue 11. Between the tongue 11 and the end 13 of the distance sensor 10, which affords the operative portion of it, there is a narrow slit 12.

A sheet 2 fed to the feed table 1 is given side alignment. In order not to impair this side alignment of the sheet 2, that arm of the two-arm lever 9 which carries the roller 7 is raised during the side alignment, by being turned about the axis of the pivot bearing 8. This turning movement about the axis of the pivot bearing 8 entails a simultaneous lowering of that arm of the two-arm lever 9 which is provided with the tongue 11. The distance sensor 10 inserted in the body 4, which is an inductive distance sensor, senses the degree of lowering of the tongue 11, i.e. the degree of widening of the slit 12 that lies between the tongue 11 and the operative portion of the distance sensor 10. The value sensed by the distance sensor 10 is transmitted to a microcomputer (not illustrated) for evaluation. If this value is not within a predetermined acceptable range, feeding is stopped and/or a warning signal is given.

Before a first sheet 2 arrives, the position of the lever 9 is sensed by means of the distance sensor 10, and the relevant value is transmitted to the microcomputer. The value transmitted is utilised in the microcomputer as a reference value for use in connection with subsequent tests. In the event of the simultaneous arrival of a plurality of sheets 2, the slit 12 is widened, in proportion to the thickness represented by that

plurality of sheets 2, and in this event the microcomputer causes a signal to be given for the recognition of the arrival of more than one sheet.

It will be understood that the invention has been described above purely way of example, and that various modifications of detail can be made within the ambit of the invention.

LIST OF PARTS

- 1 feed table
- 2 sheet
- 3 traverse
- 4 basic body
- 5 locking screw
- 6 stop pin
- 7 roller
- 8 pivot bearing
- 9 lever
- 10 distance sensor
- 11 tongue
- 12 slit
- 13 distance indicator end



CLAIMS

1. A sheet-processing apparatus comprising a feed table to which (in use) paper sheets, or other sheets comparable in
5 respect of flexibility with paper, are fed, and also comprising a device which (in use) makes thickness sensing tests on the sheets fed to the feed table; the said device comprising a roller carrier disposed above that position, on the feed table, to which the leading end portions of the
10 sheets are fed, and incorporating a pivotally mounted lever; and a roller, which (in use) makes contact with the surface of a fed sheet, being mounted at one end of the lever; wherein the roller carrier is provided with a distance sensor which senses sheet-feed-related vertical
15 displacements of the lever; wherein means are provided whereby the values determined by means of the distance sensor are transmitted to an electronic evaluation apparatus; and wherein a stop pin is provided at the extremity of that end portion of the lever on which the said
20 roller is mounted, this stop pin being so positioned and dimensioned as to enable it to perform (in use) the function of aligning the fed sheet.

2. An apparatus according to claim 1, wherein the lever is
25 a two-arm lever and, on the arm opposite the roller, is provided with a tongue lying substantially parallel to the feed table, an inductive distance sensor being mounted in the roller carrier above the tongue, and the operative portion of this sensor being directed towards the tongue.

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3. A method for making thickness sensing tests on paper sheets, or other sheets comparable in respect of flexibility with paper, employing an apparatus as defined in claim 1 or
35 2, wherein the said sheets are fed to the feed table of this apparatus in such a manner as to reach a position under the roller specified, whereupon values are determined and transmitted as specified in claim 1, the position of the lever in the absence of any sheets being utilised as a



reference-value-determining starting position for subsequent sensing tests.

4. A method for making thickness sensing tests on paper sheets, or other sheets comparable in respect of flexibility with paper, employing an apparatus as defined in claim 1 or 2, wherein the said sheets are fed to the feed table of this apparatus in such a manner as to reach a position under the roller specified, whereupon values are determined and transmitted as specified in claim 1, a warning signal being given and/or feeding being stopped in the event of a departure from a predetermined acceptable range of sheet thickness.

5. A method for making thickness sensing tests on paper sheets, or other sheets comparable in respect of flexibility with paper, employing an apparatus as defined in claim 1 or 2, wherein the said sheets are fed to the feed table of this apparatus in such a manner as to reach a position under the roller specified, whereupon values are determined and transmitted as specified in claim 1, any sheet thickness sensing tests indicating the presence of an integral multiplicity of sheets causing a multiple-sheet warning to be given and/or causing feeding to be stopped.

6. An apparatus according to claim 1, substantially as described with reference to the accompanying drawings.