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(11) Publication number:

0 489 471 A1

(12)

EUROPEAN PATENT APPLICATION(21) Application number: **91203136.6**(51) Int. Cl.⁵: **G06M 9/00**(22) Date of filing: **02.12.91**(30) Priority: **04.12.90 NL 9002654**(43) Date of publication of application:
10.06.92 Bulletin 92/24(84) Designated Contracting States:
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NL-9718 EA Groningen(NL)(54) **Device for counting a number of flat objects, such as letters, forming a stack.**

(57) Device for counting essentially flat objects, such as letters, in the stacked state. The object edges in a side plane of the stack form, when illuminated, a pattern of light and dark bars which can be detected with the aid of bar code reader 30 known per se. The device comprises a stack bed 20 formed by two mutually perpendicular support plates 23 and 24 which are open upwards for receiving a stack 21 of letters 22. The letters 22 are all placed in the base with one letter edge against the supporting face 23, so that said bar pattern is visible in a strip-type opening 27. The bar code reader 30, mounted in a holder 29 can be moved with its scanning head 31 along the letter edges visible in the strip-type opening 27 over the entire length of the stack by means of a guide rod 28. A signal corresponding to the bar code is presented via a connection line 32 to analysis means and the number of letters in the stack derived therefrom is displayed on a number display 34. Reset means, which can be operated by means of a reset button 35, offer the possibility of counting stacks separately or cumulatively.

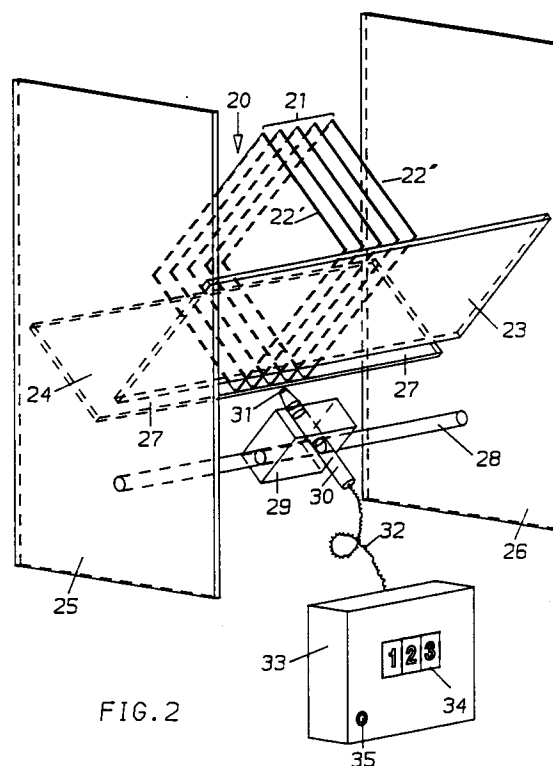


FIG. 2

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A. Background of the invention

1. Field of the invention

The invention is in the field of counting objects. More particularly, the invention relates to a device for counting essentially flat objects, such as letters, in the stacked state.

2. Prior art

Senders of items of mail have the facility of presenting large numbers of items of mail in large batches to the postal service. It is usual for special rates to apply to such batch mail. On presentation, the presenter should state the numbers and the weight classes of the batch mail presented. Since carrying out counts is very labour-intensive, the stated numbers and weight classes have until now been monitored only by random tests. A more intensive check has, however, been found to be necessary.

Batch mail can in general be divided into two groups, viz. a first group consisting of items of mail having essentially the same weight and the same dimensions, and a second group consisting of items of mail of differing weight and/or differing dimensions. Batch post of the first group can in general be quantified fairly simply and with sufficient accuracy in terms of number by means of weighing. The determination of the number of items of mail in a batch of the second group can be carried out with sufficient accuracy only by counting. Such counting has until now been carried out by hand and is consequently very time-consuming. There is therefore a need for a new device with which such counting can be carried out much more simply and rapidly while retaining a sufficient degree of accuracy. Such batch mail is usually delivered in reasonably ordered bundled stacks. The letters of the second group differ quite a lot in relation to dimensions but are, however, generally reasonably flat objects having at least one straight side. Such letters can be ordered in a stack so that said straight sides of all the letters lie essentially in one flat plane. In addition, such letters do not have a rectangular cross section at said straight side but a cross section usually tapering to a point, so that, at the side of said flat plane, the stack has an essentially serrated or ribbed cross section, each rib or serration representing a letter. If such a stack is then illuminated at the side of said flat plane, a pattern of alternating light and dark bars becomes visible. By counting, for example, the number of light bars in the said pattern, the number of letters in the stack can then be determined. Such a counting principle for counting the number of objects in a stack of usually uniform sheet-type objects is

known per se, for example, from references [1], [2] and [3] mentioned under C. (See below). Since the applications described in said publications are fairly specific, even if it were commercially obtainable as such, the equipment with which the counting technique can be carried out has the drawback that it could nevertheless only be used for the counting problem described above after the necessary adaptations and extensive tests.

B. Summary of the invention

The invention meets the abovementioned requirement. For this purpose, it provides a novel device for counting a number of essentially flat objects, such as letters, forming a stack, in which use is made of the counting principle known from the technology cited above. For this purpose, the device according to the invention has the characteristic according to Claim 1. The object of the invention is, in addition, to provide such a device in a preferred embodiment which does not have the drawback mentioned. In practice, it has in fact been found that the bar-type pattern indicated above, which is visible on illuminating the stack of letters at the side of said plane can be treated as a bar code, which is currently used in all kinds of forms, for example for identifying articles for sale, and for which all kinds of scanners are now commercially available in order to be able to read such codes. Said preferred embodiment therefore has the characteristic according to Claim 2.

In particular, if a scanner with a fixed scanning beam is used, the invention offers a simple and cheap device with which the number of objects in the stack can be counted rapidly and with low labour intensity.

C. References

- [1] US-A-3 964 041 (HINDS);
- [2] US-A-3 835 306 (BILLS et al.);
- [3] US-A-3 422 274 (COAN);
- [4] Solid State Scan Modules, Specifications Part No. 1188 DQ, Symbol Technologies Inc. 1987;
- [5] LP 1500 Series Hand-held contact-scanning wands, Specifications Part No. 887 GA, Symbol Technologies Inc. 1987.
- [6] F30 Fixed Position Bar Code Reader, DATALOGIC S.p.A., Bologna, Italy, Febr. 1989, (BC-041 81100019).

D. Brief description of the drawing

The invention will be explained in greater detail by means of a description of an exemplary embodiment, reference being made to a drawing,

wherein:

- Figure 1: shows an outline diagram of a device according to the invention;
 Figure 2: shows a view of a preferred embodiment of the device according to the invention.

E. Description of an exemplary embodiment

The principle of the invention can be applied to any type of essentially flat objects which can be positioned in a stack in such a way that at least some of their object edges form a common, essentially flat side plane of the stack. However, for the sake of convenience, the description will be limited below to letters which have the usual, essentially rectangular appearance but which may vary, however, in dimensions such as thickness. In order not to complicate the drawing unnecessarily, however, the letters in the figures have in fact been shown with uniform dimensions.

Figure 1 shows an outline diagram of a device for counting a number of letters in the stacked state. In this figure, a part of a stack 1 of letters 2 has been drawn in cross section. The stack comprises N letters starting from a foremost letter 2' up to and including the rearmost letter 2". In the stacked position, the N letters 2 each form, with one of their letter edges 3, an essentially flat side plane 4 (broken dotted line) of the stack over the entire length of the stack, that is to say starting from the foremost letter 2' up to and including the rearmost letter 2". A scanner 5 scans the stack 1 in the side plane 4 at least over the entire length by means of a scanning beam 6, for example laser light, and picks up a reflection signal 7 therefrom. Said reflection signal will in general fluctuate in light intensity, the maxima being the consequence of strong reflection at the letter edges 3 essentially in the side plane 4, while the minima are caused by absorption and large lateral scattering in the space between the consecutive letter edges 3. The scanner 5 converts the reflection signal 7 into a corresponding electrical signal which is then presented to a signal processor 8. The signal processor 8 processes the reflection signal to a form suitable for further analysis, for example a digital form, and presents it to a signal analyser 9. Said analyser determines, for example by counting the number of maxima in the processed reflection signal, the number N of letters in the stack 1. Said number N is then transmitted to, for example, a number display 10 for visually showing the number N.

In principle, any type of pick-up having an associated light source and which picks up a reflection signal from the side plane 4 of the stack which is then processed and analysed can be

chosen instead of said scanner 5 (with associated signal processor 8). Thus, the pick-up may be a video camera which, for example, picks up an image of the entire side plane 4 of the stack 1 from which a part is separated by an associated video signal processor and is processed in such a way that it is comparable with the abovementioned processed reflection signal. This would, however, be an expensive design of the invention.

Specifically, it has been found experimentally that a side plane 4 of a stack in which the letters are positioned as described above can be regarded as a bar code pattern which can be scanned with the standard, commercially available scanning equipment. Such scanning equipment comprises in fact the functions of the scanner 5 and the processor 8 taken together or embodied in a scanning part and a processing part. A bar code scanned by the scanning part is usually delivered by the processor part as a digital signal for further processing. The number, for example, of light bars in a pattern can therefore simply be counted by counting all the 'zero'/'one' junctions or all the 'one'/'zero' junctions in the digital signal. A micro-processor can easily be programmed for this purpose. There are two types of scanning apparatuses available commercially; one having a movable scanning beam and one having a fixed scanning beam. A scanner having a movable scanning beam is known, for example, from reference [4] mentioned under C. Said known scanner has a horizontal 90° beam sweep, with which, in theory a stack of letters having a length of up to 20 cm could be scanned starting from a fixed position, for example at a distance of 10 cm. However, it has been found that only stacks containing approximately 20 letters can be counted with sufficient accuracy. This is the consequence of the fact that more to the side, viewed from the centre of the sweeping beam, the scanning signal is always scattered more at the letter edges, so that the maxima are increasingly difficult to distinguish from the minima in the reflection signal received therefrom. This limitation can be eliminated by using a scanner having a fixed scanning beam and setting it in relative movement along the side plane 4 of the stack 1 during the scanning. This embodiment is explained in greater detail below with reference to Figure 2. Scanners having a fixed scanning beam are known, for example, from references [5] and [6].

Figure 2 shows a view of a device according to a preferred embodiment. A stacking base 20 for receiving a stack 21 of letters 22 consists of two supporting plates 23 and 24 which are supported on either side by two vertical stands 25 and 26. The stacking plates 23 and 24 have an essentially orthogonal position with respect to each other and in the upward direction leave a space free which

has a right-angled cross section for receiving the stack 21. In the stack 21, each letter 22 is arranged as much as possible in accordance with such a right-angled cross section, so that the letter edges of the letter touch the supporting plates 23 and 24 in doing so. In the downward direction, the supporting plates leave a narrow strip 27 free, at least in the plane of one of the supporting plates, in this case supporting plate 23, through which a fraction of the letter edges of the letters 22 in the stack 21 is visible. The stands 25 and 26 also support a guide rod 28 which is fitted so as to run parallel to the narrow strip 27 under the stacking base 20. Fitted on said guide rod 28 is a holder 29 which can be moved along the guide rod at an otherwise fixed spatial orientation. A pen-type scanner 30 is incorporated so as to be adjustable in its longitudinal direction in the holder 29. The scanner has a scanning head 31 which is adjusted at a fixed distance from the letter edges of the letters 22 visible in the strip 27. The scanner 30 has a flexible connecting line 32 for supply and signal transmission to a small box 33 in which a microprocessor (not shown) and a visual number display 34, for example, having three figures as shown. The small box 33 may furthermore be provided with a reset button 35 with which the display can be set to zero. The signal connection line 32 has at least a length which makes it possible for the holder 29 with the scanner 30 to be displaceable over the entire length of the guide rod between the two stands 25 and 26. A stack placed in the stacking base 21 can be supported on either side by means of displaceable side supports (not shown).

The device is used as follows. A stack 21 of letters 22 is placed, for example by hand, in the stacking base 20, as shown in Figure 2. The stack is, if necessary, shaken a little by hand in order to ensure that the letter edges of the letters 22 rest as well as possible against the supporting face 23 at the side where the scanner 30 is situated. The holder 29 with the scanner 30 is set to a starting position if this has not already been assumed. A starting position for the scanner is any position in which the scanner 30 is situated either between the plane of the stand 25 and the foremost letter 22' in the stack or between the last letter 22'' in the stack and the plane of the stand 26. The holder 29 is then displaced from a starting position along the guide rod 28 from one side of the stack, past the stack to a final position at the other side of the stack, in which process the scanner 30 scans the letter edges of the stack in the strip 27 during the displacement and picks up a reflection signal and processes it to a digital signal that is then delivered via the connection line 32 to the microprocessor in the small box 33. The microprocessor is programmed in such a way that, for example, all the

'zero'/'one' junctions in the digital signal are counted and then this number is presented by the display 34, after which said number can be read off by operating staff. The counted stack can then be replaced by a new stack which is again scanned in the manner described. The microprocessor may, moreover, be so programmed that, if the display 34 is not reset with the reset button 35 when an already counted stack is replaced by a fresh stack still to be counted, the number of counted letters in the new stack is added to the number of letters counted until that time in one or more consecutive, already counted stacks. This has the advantage that the number of letters can be determined in a simple way in stacks which are too extensive to be counted in one go.

Obviously, the displacement of the holder 29 along the guide rod 28 can also be brought about with the aid of electromechanical drive means known per se.

Claims

1. Device for counting a number of essentially flat objects, such as letters, forming a stack, comprising:
 - a stack base provided with a flat section in which an at least strip-type opening is cut out which extends over the entire length of the stack base, in which stack base the objects can each be positioned with an object side essentially resting against said flat section,
 - pick-up means for picking up a reflection signal from the stack over the entire length in said opening,
 - analysis means for analysing the reflection signal and deriving therefrom the number of objects in the stack,
 - presentation means for presenting the number derived by the analysis means.
2. Device according to Claim 1, characterised in that, moreover, illumination means are provided for illuminating the stack in said opening.
3. Device according to Claim 2, characterised in that the illumination means and the pick-up means are together formed by bar code scanning means known per se.
4. Device according to Claim 3, characterised in that the scanning means consist of a scanner having a fixed scanning beam which can be passed along the stack in said opening.
5. Device according to Claim 4, characterised in that, moreover, guide means are provided

along which the scanner can be moved along the stack from a preset position.

6. Device according to Claim 3, characterised in that the scanning means consist of a scanner 5 having a sweeping scanning beam which is positioned at a fixed preset distance from the said opening.

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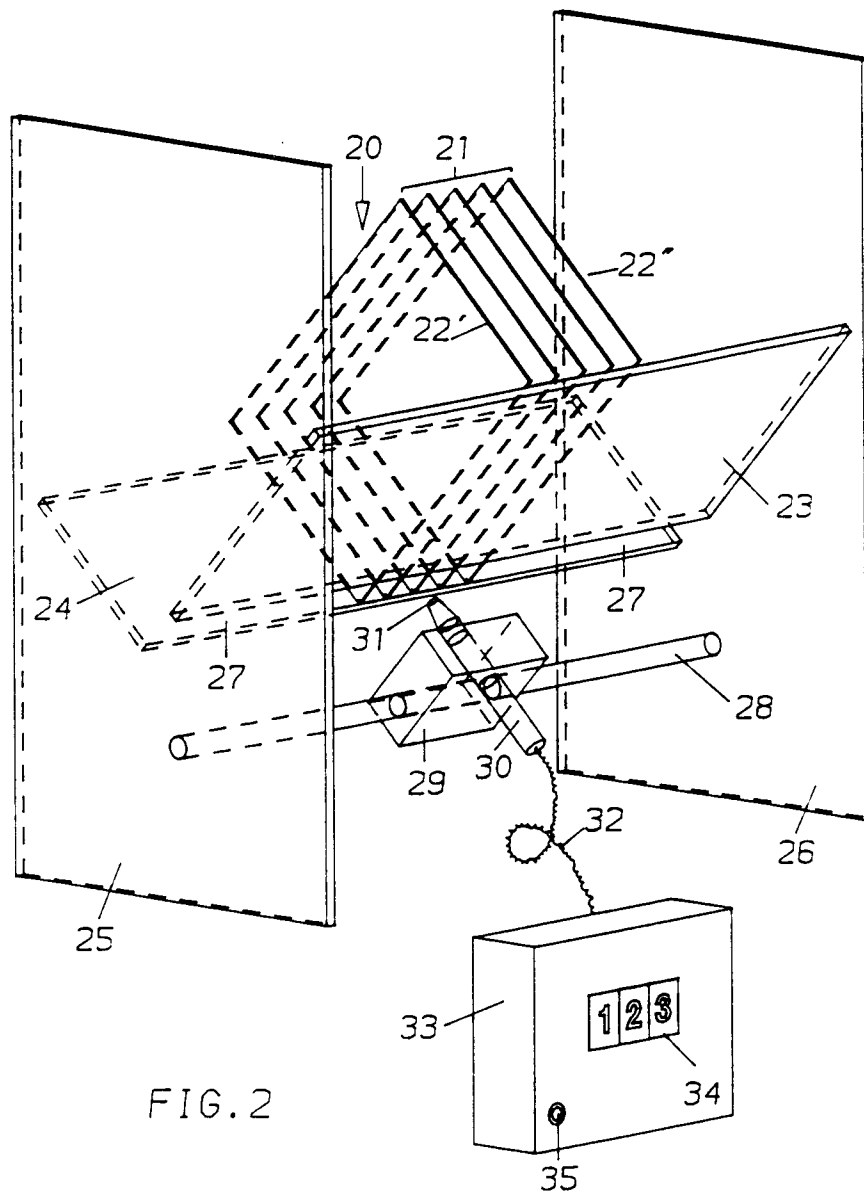
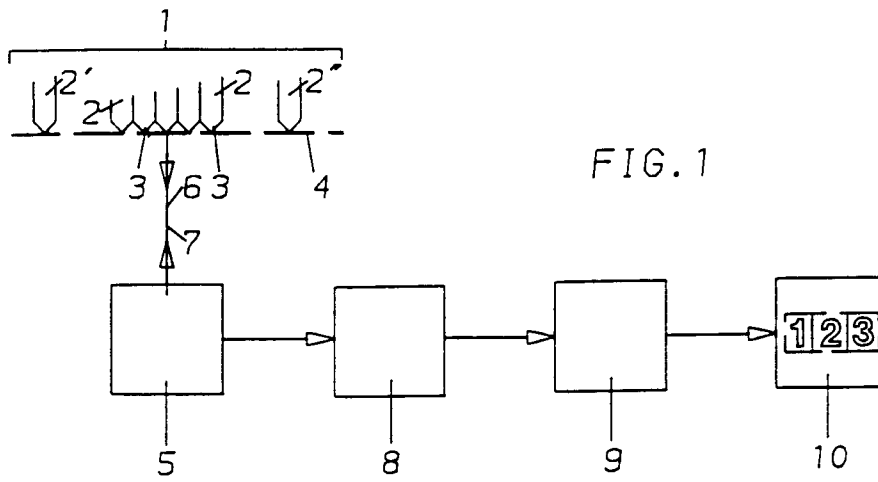
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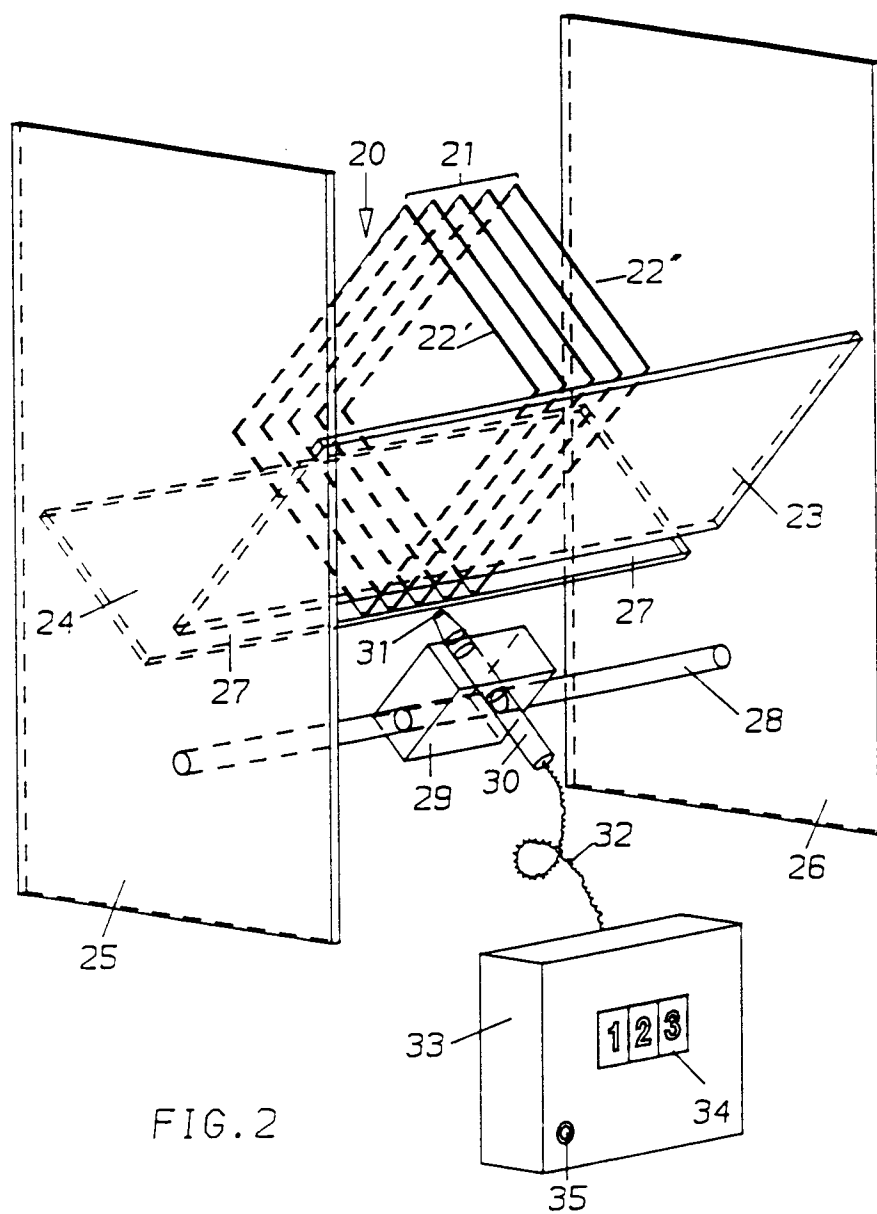
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EUROPEAN SEARCH REPORT

Application Number

EP 91 20 3136

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)
D,A	US-A-3 964 041 (HINDS) * abstract * * column 2, line 44 - column 3, line 68 * ---	1-5	G06M9/00
D,A	US-A-3 422 274 (COAN) * claims; figures 1,2 * ---	1	
A	US-A-3 813 523 (MOHAN ET AL.) -----		
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			G06M
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 03 MARCH 1992	Examiner GELEBART Y. C. M.
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			