March 2, 1937. A. WORMSER 2,072,236

SHEET DETECTOR

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Fig. 1.

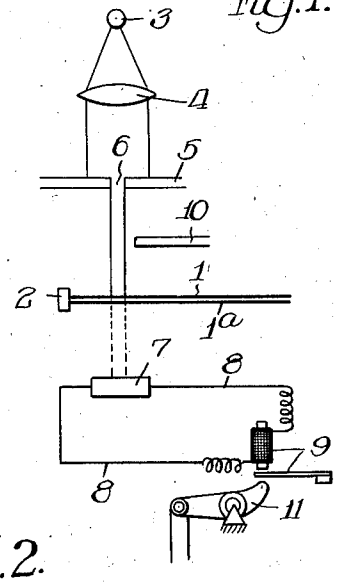
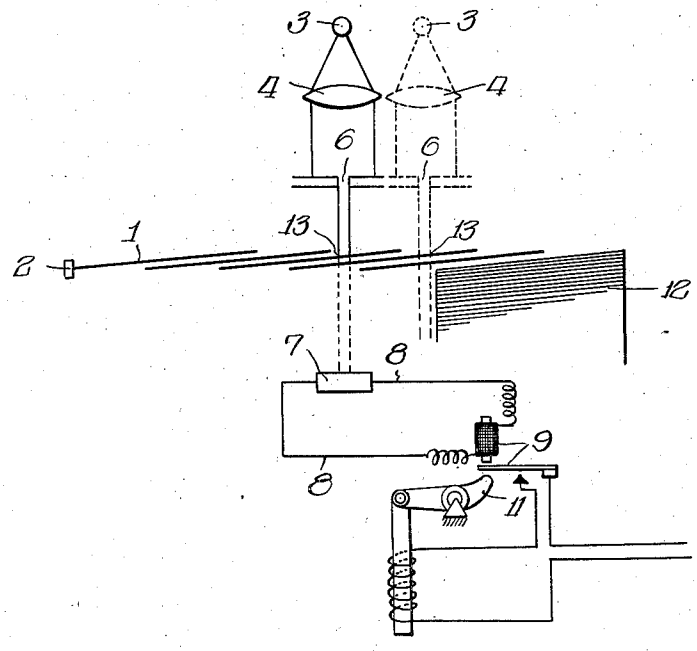


Fig. 2.



Inventor:
Arthur Wormser,
By Wilkinson, Huxley, Byron & Knight
attys.

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SHEET DETECTOR

Arthur Wormser, Offenbach, near Frankfort-on-the-Main, Germany

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7 Claims. (Cl. 271—57)

This invention relates to means which is adapted for use in connection with sheet feeding mechanism for the purpose of detecting any mispositioning of sheets occurring while being fed. The invention more specifically pertains to that class of sheet detecting means in which electric eyes, such as photo-electric cells, are being utilized, and one of the primary objects of my invention is to provide means whereby sheets, advanced erroneously together with the sheets to be fed, will be detected.

Another object is the provision of mechanism associated with the detecting means whereby the feeding of sheets will be interrupted in the event that more than a predetermined sheet thickness is being fed towards sheet registering means or the like.

A further object of the invention is to provide simple and effective apparatus adapted for use in connection with any conventional type of sheet feeding mechanism and whereby disturbances in the feeding of sheets will be reduced to a minimum.

Still further objects of the invention will be apparent from the following description and appended claims.

Sheet feeding apparatus, even of the most reliable type, used heretofore on printing presses, folding machines or the like, are subject to occasional interruptions for reasons, such as the presence of more than one sheet, or of defective sheets, or sheets becoming mispositioned during their travel. It becomes necessary therefore to provide sheet detecting means associated with suitable mechanism whereby conditions such as pointed out above will be prevented, or whereby the operation of the sheet handling machine itself will be interrupted. It is desirable to arrange sheet detecting devices at stations where it can be ascertained whether or not excess sheets are being advanced erroneously together with the sheets to be registered.

In sheet feeding mechanism it has been common practice heretofore to detect the position of sheets by means of mechanical or electric contact appliances. Such devices, however, are not entirely reliable and therefore they do not assure the desired results.

Some preferred arrangements for carrying my invention into effect are illustrated in the accompanying drawing, in which:

Figure 1 is a diagrammatic illustration of means specifically adapted for detecting plural sheets which have not reached the registering guides in proper position; and

Figure 2 illustrates means similar to that shown in Figure 1 but applied in connection with sheet feeding mechanism whereby sheets are being advanced to the registering guides in superimposed relation, that is to say in the form of a seriated bank of sheets.

The arrangement illustrated in Figure 1 is intended to detect whether or not more than one sheet is fed simultaneously to the registering guides 2. I have shown in addition to the top sheet 1, an excess sheet 1a which has been erroneously fed towards the registering guides and the leading edges of both sheets are shown adjacent said guides. It will be seen that the beam of light and all of the parts associated with it are located preferably somewhat in advance of the front guides 2. The arrangement of the cooperating parts is such that the tripping takes effect when the relay fails to be energized and said armature moves down. Accordingly, a device must be provided which will prevent the tripping of sheet handling mechanism during the greater part of the cycle of operation of such mechanism, while the photo-electric cell 7 is not energized due to the extinguishment of the electric light, the closing of the slit 6, or the covering of such slit by the shutter 10. This can be accomplished by means of cams or the like elements associated with the tripping mechanism so that the latter will become effective during a predetermined period only, namely during a predetermined portion of the operating cycle of the sheet handling mechanism or machine.

In Figure 1 a preferred means whereby this may be accomplished for example is shown directly associated with the armature of the relay 9. I provide a finger 11 which is intended to continually hold the armature of the relay 9 in its upper position and said finger is lowered only during that predetermined moment during which the detecting means may become effective.

The photo-electric cell 7 is of such character that the light rays passing through a single sheet will be of sufficient intensity to energize said cell for the purpose of attracting the armature of the relay 9 and maintain it in the position shown in Figure 1 without the aid of the finger 11.

However, when a plurality of sheets in superimposed relation are accidentally fed towards the guides 2, then the volume of light passing through such plurality of sheets will not be sufficient to energize the relay 9, and consequently the armature, as it recedes from the relay 9, will cause the tripping mechanism to operate.

My invention has proven of particular advan-

tage when applied in connection with mechanism where superimposed sheets i. e. a seriated bank of sheets are being fed towards the registering guides. Such an arrangement is indicated in Figure 2.

It will be seen that according to this modification, the sheets are advanced in continuous superimposed relation.

When feeding sheets in this manner, it is evident that if the detecting means were mounted so as to act in close proximity to the front registering guides, then any misfeeding of sheets occurring intermediate said guides and the pile 12 from which they are being separated and fed, would not be detected. Therefore, any sheets that become mispositioned during their removal from the pile 12, or immediately after they have passed said pile, would continue to travel towards the front registering guides and obstruct the path of other oncoming sheets with obvious consequences.

For this reason it is highly desirable to mount sheet detecting means in close proximity to the front edge of the pile of sheets and to trip the feeding mechanism before any misfed sheets will reach the registering guides.

I have found that when feeding sheets in superimposed relation, it is exceedingly difficult to provide mechanical detecting devices that can be relied upon to function satisfactorily, particularly so when arranged near the pile where the number of superimposed sheets is usually a maximum. Mechanical detecting devices which are intended to act on two or more superimposed sheets are very delicate. Such devices become more intricate as the number of superimposed sheets increase.

Because of the fact that light sensitive apparatus, such as photo-electric cells, are adapted to energize relays only above an accurately adjusted limit of light penetration, such devices are particularly well suited for use as detecting means in machines where sheets in superimposed relation are fed.

It is evident of course that in such events the rays of light would be caused to impinge at such point or points at which normally the minimum number of sheets are superimposed. In Figure 2, I have illustrated one preferred form of such an arrangement, one of the detector devices and associated mechanism being shown in full lines and in a position intermediate the front guides 2 and the pile 12, whereas another position of such device is shown in broken lines and located in close proximity to the leading edge of said pile. The arrangement of parts and operation thereof being shown preferably as identical to that described in connection with Figure 1.

In feeding superimposed sheets it frequently occurs that upon separation of the sheets from the pile, disturbances occur, because misfed or misseparated sheets may become displaced so that their lateral margins extend beyond the normal path of the sheets. By providing a source of light on each side of said normal path and in close proximity to its limits, an arrangement such as is illustrated in Figure 1 could very readily be used for stopping the sheet handling machine or the sheet conveying apparatus in the event of such displacement of sheets. In such case the cooperating parts would be so arranged that the beam of light rays passing through the shutter 5 would prevent tripping of the machine or apparatus by maintaining the relay 9 energized whenever the finger 11 is lowered and providing that said beam is not interrupted by a sheet. On the other hand, however, the armature of the relay 9 would move down and actuate the tripping means in the event that the beam of light rays passing between the slit 6 and the photo-electric cell 7 would become interrupted by a misfed sheet.

It will be readily understood that it would be possible to arrange a number of the disclosed detecting means and to cause the various relays to actuate a single tripping device. It is also possible to provide some detecting devices of a mechanical or electrical type and to associate them with one or more detecting means of a light sensitive type in such a manner that they would actuate a single tripping mechanism. Other modifications may be adopted without departing from the principle of the invention and I therefore desire to cover any such modification that will come within the scope of the appended claims.

I claim:

1. Sheet detecting means, having in combination a source of light arranged to direct a beam of rays through one or more sheets of material, a light sensitive element adapted to be energized by rays of light penetrating through a predetermined plurality of sheets for the purpose of interrupting the advance of sheets in the event that more than said predetermined plurality of sheets pass said beam of rays simultaneously.

2. Sheet detecting means, having in combination a source of light arranged to direct a beam of rays through one or more sheets of material while in motion, a light sensitive element adapted to be energized by rays of light penetrating through a predetermined plurality of sheets for the purpose of interrupting the advance of sheets in the event that more than said predetermined plurality of sheets pass said beam of rays simultaneously.

3. Sheet detecting means, having in combination a source of light arranged to direct a beam of rays through one or more sheets of material, a light sensitive element adapted to be energized by rays of light penetrating through a predetermined plurality of sheets, an electric relay associated with said element for the purpose of interrupting the advance of sheets in the event that more than said predetermined plurality of sheets pass said beam of rays simultaneously.

4. Sheet detecting means, having in combination a source of light arranged to direct a beam of rays through one or more sheets of material, a light sensitive element adapted to be energized by rays of light penetrating through a predetermined plurality of sheets, an electric relay associated with said element and adapted to be energized when more than a predetermined plurality of sheets present themselves to said beam of rays for the purpose of actuating tripping means whereby the operation of the sheet handling mechanism will be interrupted.

5. In a sheet-detecting means, the combination of a source of light arranged to direct a beam of light through a thickness of one or more overlying sheets of material, and a light-sensitive element arranged to be influenced by said light-beam after it has penetrated through said sheet thickness and, in the event more than said sheet-thickness is interposed between said source of light and said element, as by an additional sheet, to modify the effect of the beam on said element sufficiently to be availed of to preclude feeding of said added sheet.

6. Sheet-detecting means, having in combination a source of light arranged to direct a beam of rays through one or more sheets of material, means for feeding sheets, a light-sensitive element adapted to be energized by the rays of light penetrating through a predetermined sheet thickness, and means for precluding the feeding of sheets, said latter means becoming effective when said beam of rays becomes diminished through feeding of excessive sheets.

7. Sheet-detecting means, having in combination a source of light arranged to direct a beam of rays through a predetermined sheet thickness, a light-senstive element adapted to be energized by the rays of light penetrating through said sheet thickness, means for feeding and interposing sheets between said beam of rays and said element, and means for precluding the feeding of sheets, said latter means becoming effective when more than said predetermined sheet thickness is interposed between said beam of rays and said element.

ARTHUR WORMSER.