July 28, 1970 C. F. H. CRATHERN III 3,522,129

REGISTRATION APPARATUS

Filed Sept. 13, 1967 5 Sheets-Sheet 1

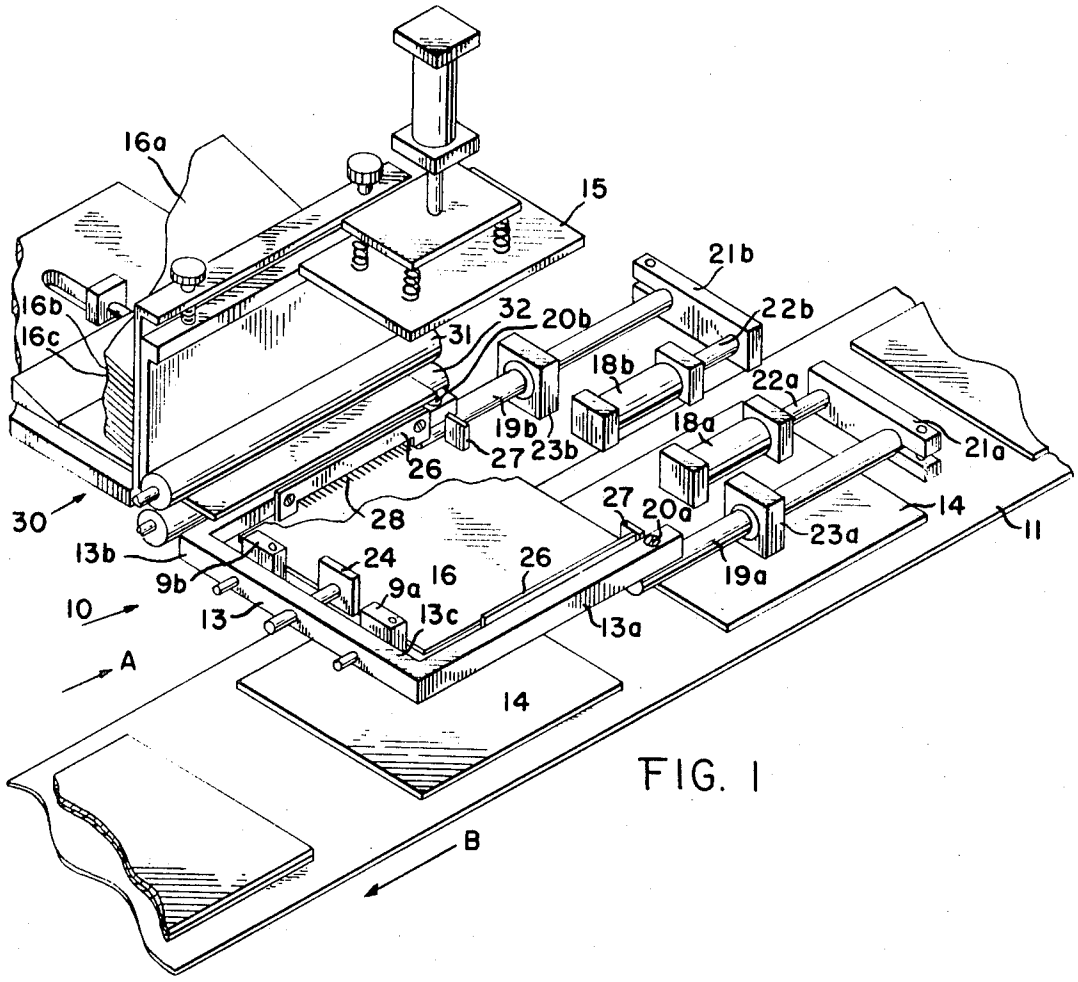


FIG. 1

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REGISTRATION APPARATUS

Filed Sept. 13, 1967 5 Sheets-Sheet 2

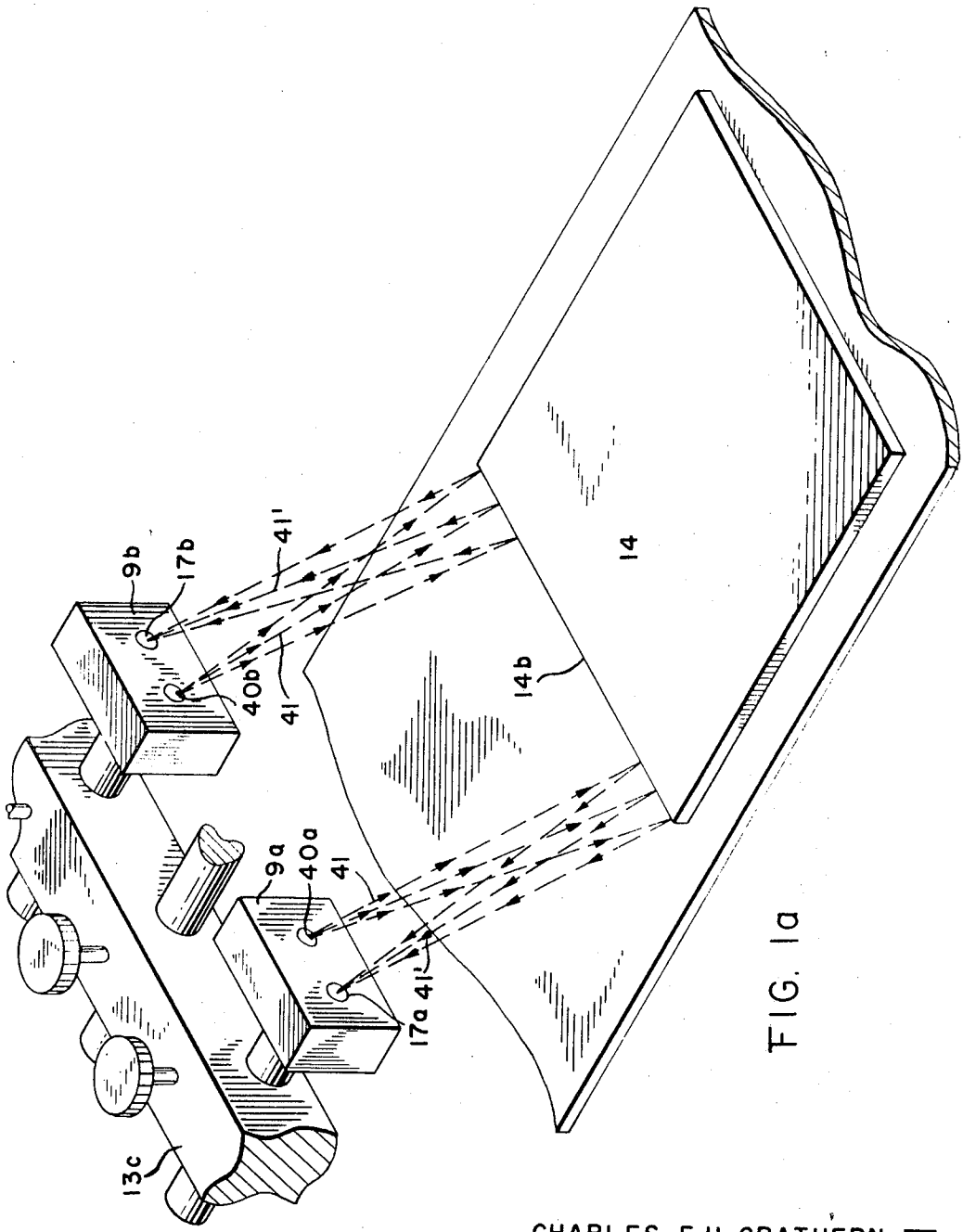


FIG. 1a

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REGISTRATION APPARATUS

Filed Sept. 13, 1967 5 Sheets-Sheet 3

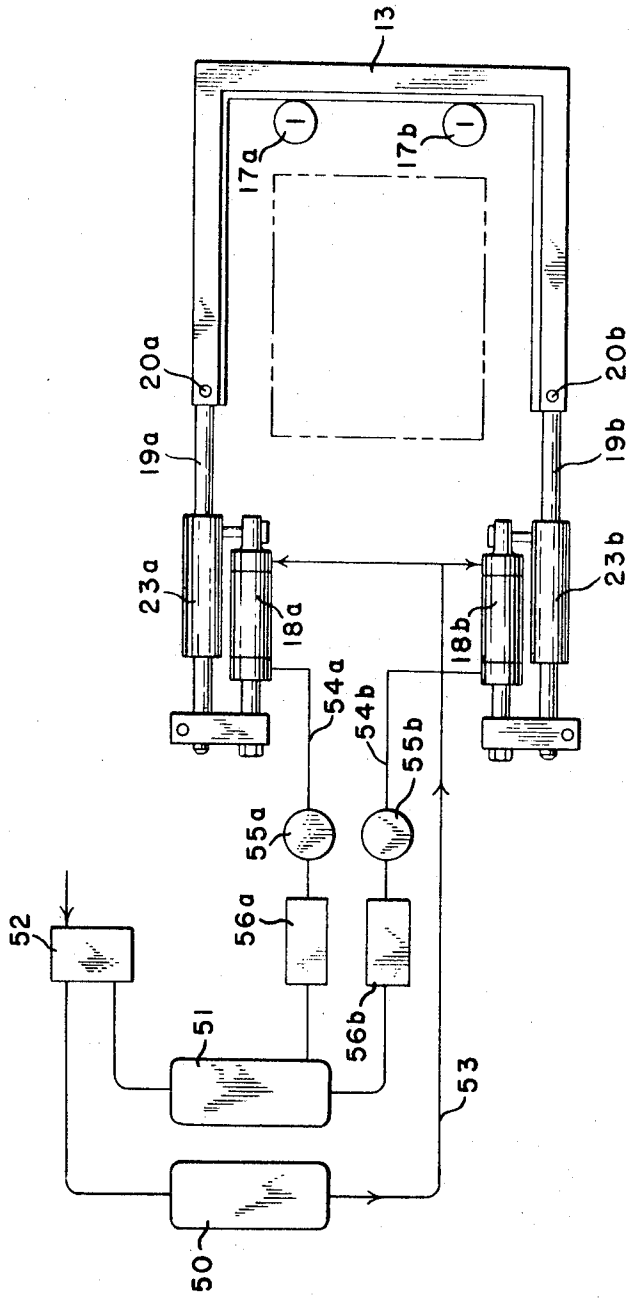


FIGURE 2

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REGISTRATION APPARATUS

Filed Sept. 13, 1967 5 Sheets-Sheet 4

FIG. 3.

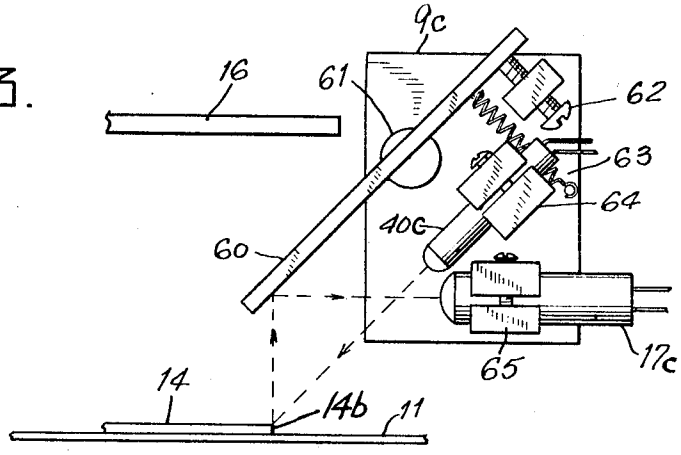
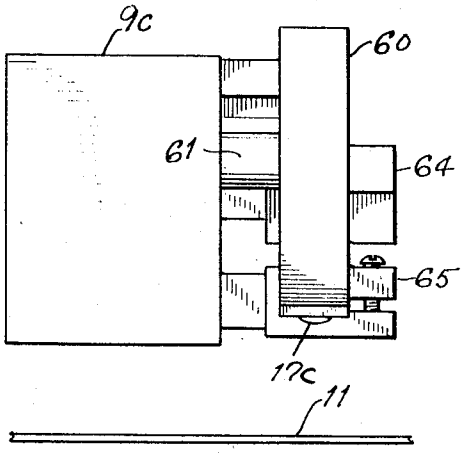


FIG. 3a.



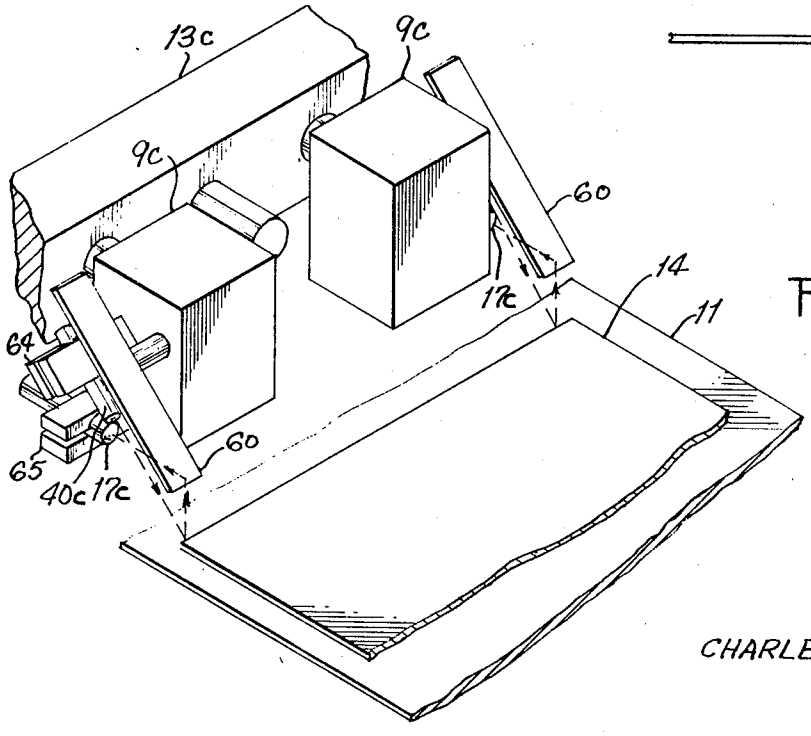


FIG. 3b.

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REGISTRATION APPARATUS

Filed Sept. 13, 1967 5 Sheets-Sheet 5

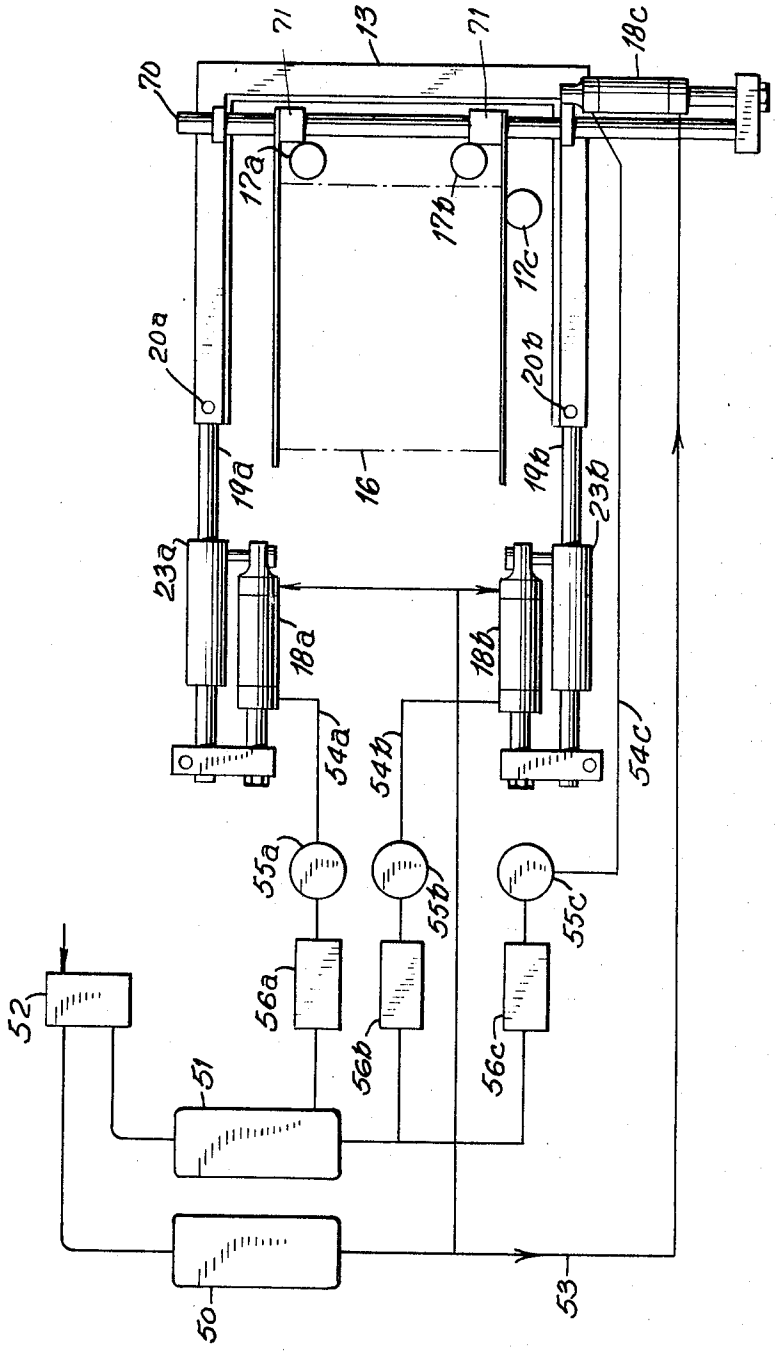


FIG. 4.

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United States Patent Office 3,522,129 Patented July 28, 1970

3,522,129

REGISTRATION APPARATUS

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Continuation-in-part of application Ser. No. 387,440, Aug. 4, 1964. This application Sept. 13, 1967, Ser. No. 667,524

Int. Cl. B32b *31/00*; B65h *43/00*

U.S. Cl. 156—364 4 Claims

ABSTRACT OF THE DISCLOSURE

This invention relates to registration apparatus employed in the vertical aligning and laminating of sheet material, as for example wrapping printed sheets on blank record jackets. The disclosed apparatus provides an articulated support means carrying cardboard or other support material and is positioned above a conveyor system carrying adhesive coated facing sheets. Means are provided for aligning the support material over the coated facing sheet and employing a plunger on the cardboard to forcibly bring it into contact with the facing sheet material in edge aligned relation.

This application is a continuation-in-part of my copending application, Ser. No. 387,440 filed Aug. 4, 1964 now Pat. No. 3,400,031.

This invention relates to registration apparatus and more particularly to registration apparatus employed in the laminating of a sheet material (or "wrap") to a corresponding supporting surface and which requires accurate positioning of one with respect to the other before being brounght into contact. The supporting surface may be plane, as for example another sheet materila, or may be in the nature of a box or cylindrical container.

In the field of adhesively applying a cover sheet to a supporting surface in face-to-face relation, there is, in many instances, a requirement that the sheet be pre-positioned with respect to the other surface before they are brought into adhesive contact. Such sheet lamination is generally performed on a continuous basis by having an intermittently operated conveyor belt carry a series of adhesively faced cover sheets or wraps in spaced relation, and passing them consecutively under stack-fed pieces of supporting material, one by one, where they are brounght into contact with each other. Though as indicated above, this supporting surface comprehends such items as the outer surfaces of boxes and cylindrical containers along with other sheet material, for convenience of description, this disclosure will refer to all such supporting surfaces merely as sheet material.

In those instances where accurate alignment of the two sheets is important preparatory to being brought together, various forms of registration apparatus have been developed. Such apparatus has, in most instances, been of the type which orients the entire conveyor belt or attempts to accurately control the positioning of the cover sheet material on the conveyor so as to give reasonably close register with respect to the mating sheet material subsequently brought into contact therewith. Although such prior art devices have served their purpose, they have not generally proven to be adaptable to existing conveyor and sheet laminating systems. Accordingly, those segments of industry having a requirement for accurate alignment of sheet material in preparation for laminating them together have not been able to convert existing systems to accomplish accurate registration, but had, for the most part, to satisfy their needs by purchasing new equipment having built-in registration features. Such a capital expenditure is often times prohibitive in nature and, accordingly, much of industry's efforts to achieve an accurate registration of a sheet to a supporting surface is therefore done manually, particularly in the manufacture of such items as phonograph record jackets.

In this industry, these jackets are generally comprised of a pre-printed cover sheet laminated to a stiff cardboard member. In many instances, the pre-printed cover sheets carry the name of the record on the face thereof in such a location that when assembled with the cardboard stiffener, the record name appears on the edge of the jacket which facilitates identifications when these jackets containing their records are stacked in storage. Even in those instances, however, where there is no resultant edge printing on the completed record jacket, the requirement for accurate alignment of the pre-printed cover on the supporting cardboard stiffeners is still present.

Since substantially all registrations or positioning of the pre-printed cover sheets on the cardboard stiffeners in the manufacture of phonograph record jackets is now done manually, item by item, those concerned with the development of such sheet registration apparatus have long recognized the need for automated equipment exhibiting the ability to precisely align the sheet components preparatory to laminating them together. A need has particularly existed for equipment of an accessory nature which can be adapted to existing conveyor systems. This invention fulfills this need by introducing novel structural features of alignment apparatus heretofore not available in the prior art.

In general, this invention provides an apparatus comprised of a selectively traversable articulated support means, mountable in conjunction with a conventional belt-type conveyor and adapted to receive and carry a piece of cardboard or other supporting surface in spaced relation above the piece or pieces of pre-printed cover sheets carried by the conveyor, and aligning the cardboard sheet (by virtue of the traversable support) with respect to the conveyor carried sheet, and then bringing these sheets into adhesive contact under pressure.

Though these concepts have a wide variety of applications which will become obvious in light of the hereinafter disclosures, I have, for purposes of description and illustration, selected the field of manufacturing phonograph record jackets as typical of these areas of application.

It is accordingly among the objects of this invention to provide an alignment apparatus for accurately bringing into pre-determined register initially unaligned sheet material carried in spaced apart parallel relation with respect to each other.

Another object of this invention is to provide a sensitively controlled pneumatic-hydraulic system for use with this apparatus for aligning into pre-determined register parallely disposed sheet material.

Yet another object of this invention is to provide a registration apparatus of an accessory nature which may be easily adapted to any conventional sheet conveying system to provide such existing systems with a capability of accurately aligning parallely disposed sheet material preparatory to bringing them into adhesive contact with each other.

It is a still further object of this invention to provide a registration apparatus which acts in spaced relation from a conventional belt-type conveyor and orients the sheet material or other supporting surface received by it with respect to the corresponding pre-printed sheet material carried by the conveyor belt even though such sheet material may lie in any askewed horizontal position.

Still another object is to provide a registration apparatus of the type hereinafter described which exhibits features of economy of production and ease of main-

tenance and which substantially eliminates the need for frequent adjustment and readjustment.

With these and other objects in view, as will hereinafter more fully appear and which will be more particularly pointed out in the appended claims, reference is now made to the following description taken in connection with the accompanying drawings in which:

FIGS. 1 and 1*a* illustrate a perspective schematic view of the registration apparatus in conjunction with a ram press and conveyor system;

FIG. 2 depicts a schematic representation of the registration apparatus and associated power control;

FIGS. 3, 3*a* and 3*b* depict schematic illustrations of a second embodiment of the photo-cell sensing unit; and

FIG. 4 illustrates a schematic illustration of a second embodiment of the registration apparatus and associated power control.

Referring generally now to the drawings, there is depicted in FIG. 1 the registration apparatus **10** mounted over a conventional conveyor **11** of the type generally employed in the paper box industry. Conventional glue applicators (not shown) deliver adhesively faced pre-cut sheets of paper **14** to conveyor **11** which carries them in the direction of arrow B in spaced relation thereon underneath alignment frame **13** in an intermittently timed stop-and-go motion. Each sheet of glued paper **14** comes to a complete stop somewhere under alignment frame **13** which carries a cardboard sheet **16**. The cardboard sheets **16** are delivered one by one to the frame **13** from a conventional stack-feeder **30** by means of driven rollers **31, 32**. Hydraulic cylinders **18***a*, **18***b*, in cooperation, respectively, with photo-electric sensing means **17***a*, **17***b* (FIG. 2), actuate and move alignment frame **13** in the direction of arrow A so as to vertically align cardboard **16** with glued sheet **14**. Plunger **15** then descends transferring and momentarily compressing cardboard **16** to the glued surface of sheet **14**.

It should be noted at this point that photo-electric sensing means **17***a*, **17***b*, carried on frame **13** are each independently connected to an operable with hydraulic cylinders **18***a*, **18***b*, respectively.

Referring to the details of the drawings with greater particularly, the registration apparatus **10** is comprised of an alignment frame **13** whose side portions **13***a* and **13***b* are fixedly attached to cross member **13***c*. Side portions **13***a*, **13***b* are respectively connected in pivotal relation to one end of rods **19***a* and **19***b* by pivot pins **20***a* and **20***b*. Members **23***a*, **23***b* are bearings for slidably supporting each rod **19***a*, **19***b*. The other end of each of rods **19** is attached respectively to block members **21***a* and **21***b* which are each then respectively attached to a hydraulic piston **22***a* and **22***b* that operate independently of one another from hydraulic cylinders **18***a*, **18***b*.

Cross member **13***c* of the alignment frame carries an axially adjustably mounted end stop member **24** and a pair of axially adjustable support blocks **9***a*, **9***b* which carry photo-electric cells **17***a*, **17***b* and light sources **40***a*, **40***b*. The inner opposed surfaces of alignment frame members **13***a* and **13***b* each carry a side guide **26**. Mounted on each guide, in substantially coplanar relation with each other, are elongated brush means **28** adapted to carry and support cardboard sheet **16**. Cardboard sheet **16** is fed onto brush supports **28** by the rollers **31, 32** of a conventional feed mechanism **30** from a stacked supply of cardboard sheet members **16***a*, **16***b*, **16***c*, etc. Though the disclosed embodiment describes the cardboard support as brush means **28**, these means may be of any suitable resilient construction which can support the cardboard or other material and yet allow it to pass vertically downward onto conveyor **11** when forcibly acted on by plunger **15** at the appropriate time.

As driven rolls **31, 32** deliver cardboard **16** on to the brush means **28**, back stops **27** in conjunction with end stop **24** and side guides **26** serve to limit transverse movement of cardboard sheet **16** with respect to alignment frame **13** and thereby fix and hold its position relative to the frame.

The operation of photo-cell **17***a* and its associated light source **40***a* depicted in FIG. 1*a*, is as follows: The light beam **41** is angularly directed toward conveyor belt **11**. As alignment frame **13** moves in the direction of arrow A by virtue of pressurization of hydraulic cylinder **18***a*, light beam **41** falling on conveyor **11** also moves toward sheet **14**. When this light beam reaches the edge **14***b* of sheet **14**, a portion of it is reflected back as beam **41** to the sensing unit **17***a* generating a signal which is conventionally amplified to initiate the power means for halting the advancement of hydraulic piston **22***a* in a manner hereinafter described. Block **9***b* continues to advance along with its portion of frame **13** pivoting about pivot **20***a* until light beam **41** from source **40***b* intersects with edge **14***b* so as to function with its similar arrangement of parts operating in conjunction with sensing unit **17***b*, for stopping the further movement of piston **18***b*.

It should be observed that (1) the spatial relation of sheet member **16** relative to photo-cells **17***a*, **17***b* as determined by stop elements **24** and **27**, and (2) the angular orientation of the projected light beams **41** with respect to conveyor belt **11** can be predetermined in any given system. Thus by proper selection and adjustment of the stop elements an angular orientation of light sources **40***a*, **40***b*, along with suitable adjustment of photo-cells **17***a*, **17***b*, cardboard **16** may be placed over any selected area of sheet **14**.

In operation, the device functions in sequence as follows: a cardboard blank **16** is fed into alignment frame **13** from a conventional feeding mechanism **30** and rests on a pair of resilient supports as, for example, the two elongated brush means **28**. Each brush means **28**, disposed between end stop **24** and back stop **27** is rigidly attached to a side guide **26**. During this time interval the conveyor **11** advances glued sheet **14** to a stop position somewhere under frame **13**, but not beyond the point where light beam **41** intersects the conveyor belt.

Hydraulic cylinders **18***a* and **18***b* are then pressurized by suitable power means hereinafter described, thereby causing the frame **13** carrying light sources **40***a*, **40***b* photo-cells **17***a*, **17***b* and cardboard **16** to advance in the direction of arrow A. This advancement continues at a regulated speed by virtue of flow control valves **56***a*, **56***b* until each photo-cell **17***a*, **17***b* senses a light intensity reflected from the edge **14***b* of glued sheet **14** whereupon its respective solenoid valve **55***a*, **55***b* closes to stop the flow of hydraulic fluid in conduits **54***a*, **54***b* thereby stopping the further movement of pistons **18***a*, **18***b* and frame **13**. At this time a positive pressure however is still maintained on the up-stream side of the hydraulic piston, that is in conduit **53**, and this therefore has the effect of locking the piston and, in turn, the frame **13**, in place. Cardboard blank **16** is now aligned with glued sheet **14** on conveyor **11**. At this time, plunger **15** forcibly descends against cardboard blank **16** pushing it through the resilient supporting brushes **28** and into pressured contact with the glued surface of sheet **14**. As plunger **15** retracts, pistons **18***a*, **18***b* also retract so as to reposition frame **13**, whereupon a new cardboard blank is fed to the frame. At this time conveyor **11** advances another stop thereby placing a new sheet **14** in some proximate location under frame **13** to repeat the cycle.

It should be noted that each of photo-cells **17***a*, **17***b* independently controls its respective hydraulic cylinder **18***a*, **18***b* and corresponding frame element **13***a*, **13***b* pivotally connected to rods **19***a*, **19***b*. Notwithstanding that the sheet **14** may be in an askewed position on the conveyor at the end of its travel, alignment frame **13** and cardboard **16** will be correspondingly aligned with such a sheet at the end of the alignment cycle. The independent cooperation of each photo-cell **17***a*, **17***b* with its respective hydraulic cylinder **18***a*, **18***b* and the articulated connection of frame **13** to rods **19** will permit the

frame 13 to advance in the direction of arrow A by a combination traversing and rotation as required about pivots 22*a* or 22*b* to orient itself with respect to sheet 14 on conveyor 11.

OPERATION OF POWER MEANS

The hydraulic-pneumatic-electric circuits, depicted schematically in FIG. 2, consists of two "air over oil" tanks 50, 51 that are partially filled with hydraulic oil. These tanks are alternately pressurized with compressed air (depending on whether hydraulic pistons 22*a*, 22*b* are to be extended or retracted) by means of the four-way solenoid valve 52, from a conventional high pressure source (not shown) thus generating a predetermined hydraulic pressure in each of cylinders 18*a*, 18*b*.

When conveyor 11 stops (as hereinabove described), four-way valve 52 is actuated to permit pressurized air flow into tank 50 while tank 51 is vented to the atmosphere. This permits hydraulic oil to flow through conduit 53 to hydraulic cylinders 18*a*, 18*b* causing each cylinder piston to extend and thereby move frame 13 and its appended photo-cells 17*a*, 17*b* in the direction of arrow A.

While pressurized oil is being delivered to the inlet side of cylinders 18*a*, 18*b*, conduits 54*a*, 54*b* carry the oil displaced by pistons 22*a*, 22*b* away through flow valves 56*a*, 56*b* respectively, into vented tank 51. Frame 13 continues moving in the direction of A, and when, for example, photo-cell 17*a* detects the edge 14*b* of glued sheet 14 on conveyor 11 by virtue of the reflected light intensity hereinbefore described, an electric signal is generated and amplified which causes solenoid valve 55*a* to close, thereby stopping the flow of oil in conduit 54*a* which in turn prevents further extension of hydraulic piston 22*a* halting further linear movement of frame element 13*a*. It should be noted at this point that a positive pressure is still maintained at the inlet side of the cylinder 18*a*, thus effectively locking the position of this piston and the cooperating elements connecting it to frame member 13*a*. Frame element 13*b* continues its movement causing frame 13 to now rotate about pivot 20*a* and when photo-cell 17*b* detects the edge 14*b* of sheet 14, an electric signal is generated and amplified which causes solenoid valve 55*b* to close thereby preventing further extension of hydraulic cylinder 22*b* in the same manner described for frame element 13*a*.

The cardboard 16 in frame 13 is now vertically aligned in predetermined relation with the sheet 14 on conveyor 11. Each of the photo-cell units 17*a*, 17*b* are connected in series to the plunger 15 so that when the last photo-cell unit is energized, it not only stops the further advancement of frame 13, but also closes the electrical circuit which causes plunger 15 to descend and push cardboard 16 past the resilient brush support 28 and into contact with the adhesive surface of sheet 14. At the conclusion of this operation, valve 52, activated by the motion of plunger 15, repositions itself so as to vent tank 50 and pressurize tank 51 causing a reversal of flow of hydraulic oil into cylinders 18*a*, 18*b* thereby retracting pistons 22*a*, 22*b* and returning frame 13 to its original position ready for the next cycle.

Though the hereinabove description discloses a preferred embodiment, it is to be expressly understood that the apparatus set forth is merely illustrative of the broad invention itself, namely, an automated device for accurately registering a plurality of non-aligned pieces of sheet material into predetermined relation with one another.

Various modifications of the equipment may be made, for example, the brush means 28 may be replaced with any suitable resilient support which will carry the cardboard or other sheet material and permit the plunger 15 to push this sheet past such support without experiencing any damage. Similarly, the described four-way solenoid valve 52 could be replaced by a hydraulic pump and a four-way valve combination. Also, pivots 20*a*, 20*b* may be located closer to photo-cells 17*a*, 17*b* to achieve greater flexibility in the aligning of frame 13 with respect to the sheet material carried on conveyor 11. These changes are merely illustrative and are not intended to be exhaustive.

A different photoelectric sensing means arrangement is schematically illustrated in FIG. 3, 3*a*, and 3*b*, wherein are shown respectively a side elevation, a front elevation, and a perspective view. Very often, the conveyor system which carries sheet members 14 tends to introduce vertical dispositions of the datum edge 14*b* caused by "puckering" in the paper itself, or caused by the uneveness of the conveyor system thereby producing random directional paths of reflected light which may not be correctly sensed, hence affecting registration accuracy. Referring now to the schematic illustrations of FIG. 3, 3*a*, and 3*b* support block 9*c* corresponds in its function to either of support blocks 9*a* or 9*b* shown in FIG. 1*a*, and hence only one such structure need be described in detail, since its relation with the remaining apparatus remains the same as that previously disclosed. Support block 9*c* carries rigidly mounted thereon a light source 40*c* held by support 64, and a photo-electric cell 17*c*, held by support 65. Pivotally mounted on block 9*c* is a mirror 60 oriented with respect to photo-cell 17*c* so that light reflected from the mirror will be coincident against photo-cell 17*c*. Mirror 60 is resiliently biased against adjustable stop-member 62 by spring member 63. In operation, the device, would perform as follows: Alignment frame 13 begins its scanning advancement until light sources 40*c* intersects the edge 14*b* of sheet member 14. A portion of this light is reflected, as illustrated in FIGS. 3 and 3*b* to mirror 60, thence reflected again onto photo-cell 17*c* where the signal is conventionally amplified and transmitted so as to stop the advancement of frame 13 in the manner hereinbefore explained. The leading edge of cardboard member 16 is illustrated as being considerably beyond the corresponding leading edge 14*b* of sheet member 14, a feature not heretofore possible with my previous embodiment because of interference from frame structure. Such an accurately measured marginal overlap as I have now disclosed is highly desirable depending on subsequent operations to the sheet lamination. Accordingly, cardboard member 16, supported as previously disclosed is, transferred by plunger 15, or other means, causing mirror 60 to pivot on its shaft 61 permitting cardboard 16 to pass by and come into adhesive contact with sheet 14 in a manner whereby an edge portion of the cardboard lies outside the marginal edge of the sheet.

A further embodiment of this invention is directed to the alignment frame to which a third light-source and photo-cell combination have been added so as to effect, in addition to the orientation of the leading edges of the cardboard 16 and sheet 14, an orientation or alignment of one pair of longitudinal sides between these two sheet members. The operation of this system is similar to that previously described with the two photo-cell scanning arrangement. When alignment frame 13 is positioned as a result of the performance of photo-cells 17*a* and 17*b*, photo-cell arrangement 17*c* comes into play as follows: Referring to the schematic illustration of FIG. 4, valve 55*c* opens, allowing fluid to flow out of hydraulic cylinder 18*c* due to fluid pressure on the opposite side of its piston. Shaft 70, supported by guides 71, is moved by cylinder 18*c* and moves the cardboard blank 16 in a direction which is now parallel to the lead edge 14*b* of the paper. This movement continues at a controlled rate until photo-cell 17*c* detects the light intensity reflected from the side edge of the paper 14 on the conveyor whereupon its respective solenoid valve 55*c* closes to stop the flow of fluid out of cylinder 18*c* and thereby stopping further movement of shaft 70. The cardboard

blank **16** is now aligned with glued sheet **14** both on the lead edge and the side. At this time, plunger **15** transfers the cardboard to the paper as hereinbefore described.

I claim:

1. An apparatus for aligning and laminating sheet material, comprising in combination:

(a) means for carrying an adhesively faced first sheet member;

(b) an articulated frame in spaced relation to said means for carrying said first sheet member;

(c) (a second sheet member carried by said frame;) means on said frame for carrying a second sheet member;

(d) a first and second independently operable power means pivotally connected to said frame for vertically aligning the leading edge of said second sheet member with the corresponding leading edge of said first sheet;

(e) a third power means for translating said second sheet member in a direction parallel to its leading edge to align another corresponding set of first and second sheet member edges;

(f) plunger means for transferring said second sheet member from said frame into face-to-face relation with said first sheet member.

2. An apparatus for aligning and laminating sheet material, comprising in combination:

(a) a conveyor for carrying an adhesively faced first sheet;

(b) an articulated peripheral frame member in spaced relation over said conveyor;

(c) selectively operable power means connected to said frame member for moving it at a controlled rate;

(d) a yieldable support means movably carried within said peripheral frame for carrying a second sheet;

(e) sensing means coacting with said power means for aligning two adjacent edges of said second sheet with two corresponding edges of said first sheet; and

(f) means for transferring said second sheet from the support means into adhesive face-to-face relation with said first sheet.

3. The apparatus of claim **2** wherein the sensing means comprises: at least three photo-electric cell means carried by said frame each responsive to certain light energy reflected from an edge of the first sheet member.

4. Apparatus for aligning a frame member in predetermined relation to sheet material spaced therefrom comprising in combination:

(a) means for carrying an adhesively coated facing sheet;

(b) an articulated alignment frame vertically disposed in spaced relation to the facing sheet;

(c) independently operable power means pivotally connected to said frame for traversing and rotating said frame at a regulated speed;

(d) mirror means carried by the frame with one end thereof juxtaposed an edge of the facing sheet;

(e) photo-cell means carried by the frame and operably coacting with the aforementioned power means;

(f) said mirror means positioned so as to optically align an edge portion of the facing sheet with the photo-cell means; and

(g) a light source directed at the aforementioned edge portion of the facing sheet whereby to reflect light energy therefrom against the mirror.

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U.S. Cl. X.R.

29—407; 156—366, 566; 270—59