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EUROPEAN PATENT APPLICATION

21 Application number: **79300735.2**

51 Int. Cl.³: **B 65 H 37/04**

22 Date of filing: **30.04.79**

43 Date of publication of application:
12.11.80 Bulletin 80/23

64 Designated Contracting States:
BE CH DE FR GB IT LU NL SE

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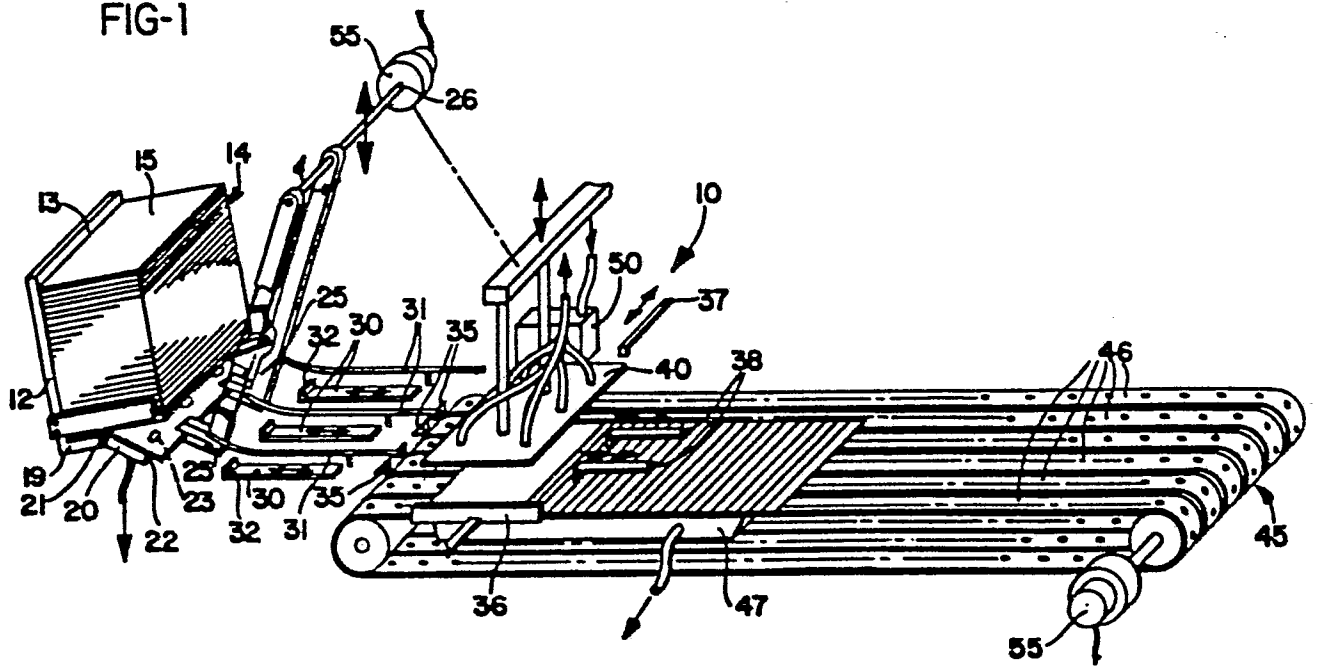
54 **Shingling apparatus.**

57 A shingling apparatus (10) prepares uniformly shingled sets of sheets (15) by transporting them from the bottom of a supply stack (14) to register stops (35,36) which define a pre-determined position from which the sheets are then transferred accurately onto a conveyor (45). The conveyor (45) is advanced intermittently to cause the sheets (15) to be shingled in a regular, partially overlapped relation thereon. Glue is applied by gluer (50) to each sheet as it is transferred onto the conveyor (45), to fasten the sheets (15) together. Application of the glue is periodically inhibited to divide the sheets (15) into shingled sets.

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FIG-1



SHINGLING APPARATUSBackground of the Invention

The present invention relates to machines for assembling and fastening shingled forms, and more particularly to a machine which is specially adapted for rapidly and continuously assembling and fastening stacked sheets into shingled sets of predetermined count, wherein it is not necessary to provide punched index holes in the sides of the sheets.

10 In prior art shingling machines, individual sheets (which could be discrete "web units" composed of several sheets or layers) are assembled into shingled, fastened assemblies, but there have been several undesirable limitations. For example, when the stack of sheets
15 (or web units) was exhausted in the machine, it was frequently necessary to stop the operation of the machine to replenish the supply, since the sheets or web units were withdrawn from the top of the supply stack. Another disadvantage was the necessity to provide index holes
20 punched in the sides of the sheet. That is, as the sheets were being assembled, indexing teeth engaged within the holes to advance and space the sheets. In some applications, the index holes were objectionable. Also, the spacing of the index holes and of the teeth necessarily determined the indexing or spacing of the sheets,
25 limiting the apparatus to the production of assemblies or sets with spacings corresponding only to the formats possible with the available teeth and punched hole spacings.

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Summary of the Invention

Briefly, the present invention overcomes the disadvantages of the prior art with an apparatus which feeds the sheets individually from the bottom of a supply
35 stack, indexes them for accurate positioning before they are placed on the conveyor, and then glues them to one

another on the conveyor, while incrementally advancing the conveyor to space the sheets so that they are shingled in a regular, partially overlapped relation thereon. The supply stack can be replenished as desired
5 from the top while the apparatus remains in continuous operation. The sheets do not need to be punched since the apparatus automatically positions and indexes them for proper and accurate formation of the shingle.

More specifically, the present invention
10 includes a holding means or feed hopper which holds a supply stack of the sheets, from which the sheets can be removed from the bottom one at a time. A transport means removes the sheets from the bottom of the stack and transports them to a predetermined position spaced
15 from the stack. A transfer means receives each sheet individually at the predetermined position and transfers the sheets accurately onto a conveyor which is adjacent thereto. The conveyor is then advanced at a predetermined rate to cause the sheets to be shingled in a regular,
20 partially overlapped relation thereon, as the sheets are fastened to one another in this shingled, overlapped relation. In the preferred embodiment, the sheets are fastened by gluing them to one another, and there is provision for periodically interrupting the gluing of
25 the sheets at predetermined intervals to divide the shingled sheets into sets of predetermined numbers.

The sheets are pulled and transported from the bottom of the stack, in part, by a support plate in the bottom of the supply hopper, part of which is stationary,
30 and part of which is hinged for upward and downward oscillating movement, especially on the edge opposite the hinge. The moving edge has vacuum ports therein which affirmatively pull the lowermost sheet downwardly from the bottom of the stack as the oscillating plate is
35 pivoted downwardly. The stationary plate supports the remainder of the stack in the hopper so only the lowermost sheet is released as it is pulled downwardly by the

vacuum openings in the oscillating plate.

Grippers then engage the downwardly pulled sheet, remove it from the plate, and place it on a reciprocating slide which advances it to register stops which define the predetermined position. Side and front joggers assure that the sheet will be properly positioned against the register stops, and as the slide is withdrawn and returned to the hopper to receive another sheet, a vacuum transfer plate engages the sheet at the register stops and lowers it for positively depositing it on the conveyor. The conveyor is formed of several parallel vacuum belts with perforations therethrough communicating with vacuum boxes on the sides of the belts opposite the sheets, so the sheets are held firmly on the conveyor. This assures regular, proper, and uniform development of the shingled sheet assemblies on the conveyor during the advancing thereof, without requiring mechanical coupling between the conveyor and the sheets thereon.

A gluer moves upwardly and downwardly with the vacuum transfer plate to apply glue to the individual sheets as they are deposited on the conveyor. The glue is applied to portions, usually edge portions, of the top surface of each sheet, and, as indicated above, is omitted when one set of sheets is to be separated from another. This periodic interruption of the gluer operation may be under the control, for example, of a suitable counting device.

It is therefore an object of the present invention to provide an improved apparatus for assembling and fastening stacked sheets into shingled sets; an apparatus which is capable of substantially continuous, uninterrupted operation for indefinite periods; in which the sheets can be replenished in a supply stack at any time, even during operation of the apparatus, by adding additional sheets to the top of the stack; in which the sheets are withdrawn from the bottom of the stack, accurately indexed to a predetermined position, and then transferred

onto a conveyor; in which the conveyor is advanced at a predetermined rate to cause the sheets to be shingled in a regular, partially overlapped relation thereon; in which the sheets are fastened to one another in the

5 shingled, overlapped relation; in which the fastening of the sheets may be interrupted at predetermined intervals for dividing the sheets into shingled sets; in which sheets of many different configurations, including multi-ply webs, folded webs, and webs which do not have

10 index holes in them, can be readily, quickly, and accurately assembled; in which the spacing or overlap of the sheets in the sets is readily and easily adjustable independently of the properties of the sheets themselves; and to accomplish the above objects and purposes in

15 an uncomplicated, versatile, and reliable configuration which is readily adapted to the convenient and rapid processing of a wide variety of sheets into shingled sets.

Other objects and advantages of the invention

20 will be apparent from the following description, the accompanying drawings and the appended claims.

Brief Description of the Drawings

Fig. 1 is a somewhat diagrammatic perspective view of the shingling apparatus showing the relationships

25 of the principle elements to one another;

Fig. 2 is a perspective view of the shingled stack of sheets;

Fig. 3a is a diagrammatic side view of the apparatus;

30 Fig. 3b is a view similar to Fig. 3a showing the grippers pulling a sheet from the bottom of the stack;

Fig. 3c is a view showing the operation of the apparatus at a subsequent stage in which the sheet is deposited in the slide;

35 Fig. 3d is a subsequent view showing the slide transporting the sheet to the vacuum transfer plate;

Fig. 3c is a still later view showing the slide returning, the vacuum transfer plate depositing the sheet on the conveyor, the gluer applying glue to the sheet, and the grippers engaging the next sheet
5 in the stack; and

Fig. 4 is a view similar to Fig. 3c showing inhibited operation of the gluer.

Description of the Preferred Embodiment

10 Fig. 1 shows a shingling apparatus 10 having a feed hopper 12 which is open at the top 13 thereof for receiving a supply stack 14 of sheets 15 which are to be formed into shingled sets. The term "sheets" is used in a broad sense, and is meant to refer to
15 discrete "web units" which could be single sheets, or could be formed of several layers, could be folded, bi-folded, and so on, as desired.

The bottom of hopper 12 is defined by a stationary plate 19 and an oscillating plate 20. Hopper
20 12 is slightly tilted, with the lowest portion thereof being defined by stationary plate 19, on which the sheets 15 in stack 14 are principally supported. Oscillating plate 20 is hinged at 21 to stationary plate 19, so that the edge 22 of oscillating plate 20 which is opposite
25 hinge 21 can be reciprocated upwardly and downwardly at the bottom of the feed hopper 12.

Edge 22 of plate 20 is at a location slightly inward from the edge of the sheet thereon, so that the sheet projects beyond edge 22. Edge 22 has openings 23
30 therein which are connected to a suitable source of vacuum. The vacuum openings 23 engage and affirmatively pull the lowermost sheet from the bottom of the stack 14 as plate 20 is oscillated downwardly on hinge 21. This separates the lowermost sheet from the remainder of the
35 sheets in stack 14, the remaining sheets being supported and remaining in position on the stationary plate 19.



The lowermost sheet itself is flexed or bent (but not creased) around hinge 21, to expose the sheet to several grippers 25. Grippers 25 are supported at 26 to swing on an axis toward and away from oscillating plate edge 22 when in its lower position as shown in Fig. 1. The grippers 25 engage the projecting edge of the sheet which has been pulled down from the bottom of stack 14, the vacuum in openings 23 is then released, and the grippers pull the sheet out from the stack onto a reciprocating slide 30. The sheet is guided onto slide 30 by fingers 31 thereabove, the grippers 25 pulling the sheet between the fingers and the slide. Slide 30 has a rear ledge 32 extending up therefrom. Grippers 25 pull the sheet past ledge 32 so that the ledge can engage the sheet to propel it forwardly. The grippers then release the sheet, hinge 26 is raised to space the grippers from the sheet, and the grippers return to hopper 12 to engage and pull another sheet from the bottom of the supply stack 14.

To assist in depositing the sheet 15 in slide 30, fingers 31 may include downwardly directed air jets, if desired. Once the sheet is resting on slide 30, the slide moves forwardly toward several register stops 35 which, in combination with a side registration plate 36, define a predetermined indexing or registered position spaced from stack 14. Slide 30 reciprocates back and forth between the position (Fig. 3c) in which grippers 25 deposit a sheet thereon, and the position (Fig. 3e) at register stops 35 where the sheet is removed from slide 30. The sheet is removed by first carrying it over the register stops 35 as slide 30 is advanced therepast (the rear ledge 32 thereof propelling the sheet over the stops 35). Stops 35 then prevent the sheet from returning with slide 30 as it is moved back toward the grippers 25.

To assure accurate indexing of each sheet, and thus accurate formation of the shingled sets, side

and front joggers 37 and 38 are momentarily pressed against the sheet as slide 30 begins to return to grippers 25 and hopper 12. The side and rear joggers 37 and 38 engage the edges of the sheet opposite the register stops 35 and side registration plate 36 to press the sheet firmly against stops 35 and plate 36 for accurate indexing thereof.

A vacuum transfer plate 40 then engages the sheet in the predetermined indexing position (Fig. 3e) and holds it there while slide 30 reciprocates back to grippers 25 and hopper 12. Plate 40 prevents the sheet from falling haphazardly when slide 30 is withdrawn and no longer supports the sheet. The vacuum transfer plate then cycles downwardly to transfer the sheet accurately into position on a conveyor 45 located therebeneath. When the sheet is properly positioned on conveyor 45, the vacuum in the vacuum transfer plate 40 is released, depositing the sheet on conveyor 45. Conveyor 45 consists of several belts 46 which are perforated and pass over vacuum boxes 47 to hold the shingled sheets firmly on the conveyor.

A gluer 50 is independently reciprocated with the vacuum transfer plate 40 to deposit spots of glue on the top edge of each sheet as it is lowered onto conveyor 45. This fastens the sheets directly to one another. Separation of the connected sheets into shingled sets is accomplished by intermittently inhibiting operation of gluer 50, such that predetermined ones of the sheets receive no glue, thus dividing the progressing sheets into predetermined shingled sets. In the preferred embodiment, operation of gluer 50 is inhibited simply by preventing it from reciprocating downwardly with vacuum transfer plate 40 (Fig. 4) when the particular sheet which is not to be glued is being deposited on conveyor 45.

A suitable drive 55 correlates the operation of the entire shingling apparatus 10. Thus, drive 55

operates the oscillating plate 20, grippers 25, and slide 30, which, together, form a transport means for individually transporting the sheets one at a time from the bottom of supply stack 14 to the predetermined position defined by the register stops 35 and side registration plate 36. Drive 55 also operates the transfer plate 40, fastening means or gluer 50, and conveyor 45, and regulates the timing of the vacuum to plate 20 and transfer plate 40.

More specifically, drive 55 advances conveyor 45 at a predetermined rate to cause the sheets to be shingled in a regular, partially overlapped relation thereon. In the preferred embodiment, conveyor 45 is advanced intermittently by drive 55 in predetermined increments, between the transfers of the sheets thereonto. The vacuum boxes 47 are extended to hold the sheets on conveyor 45 until the glue sets up. Mechanical coupling between the conveyor and the sheets is therefore not required, ^{incl} the shingled sets may be developed regularly and uniformly on the conveyor in any increments or spacings desired, strictly as a function of the rate at which the conveyor is advanced or incremented. Customized shingling of forms, at any spacings, can therefore be readily and inexpensively provided by the present apparatus without the need for special preparation of the forms themselves. It is not necessary to use prepunched sheets in order to prepare the shingled sets.

As may be seen, therefore, the present invention provides numerous advantages. It is versatile but inexpensive and uncomplicated in its design and operation. A wide variety of types and sizes of sheets, either single or multi-ply, can readily and quickly be assembled into fastened, shingled sets. The apparatus can readily and quickly be set up with minimum preparation time, so that maximum productivity is realized. The sheets are fed from the bottom of the stack 14, so that the

stack can be replenished while the apparatus 10 remains in operation. The shingled sets are automatically divided by inhibiting operation of the gluer at predetermined intervals, so that the sets can subsequently be
5 easily separated. The gluer itself can be located on either side of the apparatus 10, according to the type of shingle which is to be developed.

While the form of apparatus herein described constitutes a preferred embodiment of this invention, it
10 is to be understood that the invention is not limited thereto, and that changes may be made without departing from the scope of the invention.

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CLAIMS

1. Apparatus for assembling and fastening stacked sheets into shingled sets, characterised by:-
- a) holding means (12) for holding a supply stack (14) of the sheets (15),
 - 5 b) transport means (20,25,30) for individually transporting the sheets (15) one at a time from the bottom of the stack to a predetermined position spaced from the stack,
 - c) a conveyor (45) adjacent said predetermined position,
 - 10 d) transfer means (40) for receiving each sheet individually at said predetermined position and transferring each sheet accurately onto the conveyor,
 - e) advancing means (55) for advancing the
 - 15 conveyor at a predetermined rate to cause the sheets to be shingled in a regular, partially overlapped relation thereon, and
 - f) fastening means (50) for fastening the sheets in such shingled, overlapped relation.
- 20 2. Apparatus as claimed in claim 1, wherein the fastening means (50) further comprises means for periodically interrupting the fastening of the sheets at predetermined intervals to divide the shingled sheets into sets of predetermined numbers.
- 25 3. Apparatus as claimed in claim 1 or 2, wherein the fastening means (50) glues the sheets directly to one another.
4. Apparatus as claimed in claims 2 and 3, wherein the fastening means (50) moves with the transfer means
- 30 (40), whenever glue is to be applied to a sheet (15), and applies said glue to portions of the top surface of the sheet as the sheet is transferred onto the conveyor (45).
5. Apparatus as claimed in claim 4, wherein the
- 35 fastening means is inhibited from moving with the

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transfer means whenever a sheet is transferred which is not to be glued.

6. Apparatus as claimed in any one of the preceding claims, wherein the holding means (12) is a feed hopper
5 having an open top (13) for replenishing the stack (14) of sheets without disturbing the operation of the transport means (20,25,30).

7. Apparatus as claimed in any one of the preceding claims, wherein the transport means comprises:-

10 a) an oscillating plate (20) forming at least a portion of the bottom of the holding means (12) and mounted for moving one edge (22) thereof upwardly and downwardly,

b) pulling means (23) for pulling a single
15 sheet (15) downwardly from the bottom of the stack, with the plate (20), when said plate moves downwardly,

c) a reciprocating slide (30) movable back and forth between positions adjacent the holding means and said predetermined position,

20 d) gripper means (25) for engaging the downwardly pulled sheet, removing it from the plate (20), and placing it on the reciprocating slide (30),

e) register stop means (35,36) defining said predetermined position, and

25 f) means for moving the slide to position the sheets individually in said predetermined position in edge abutting relation with the register stop means, and for causing the register stop means to retain each sheet at said predetermined position upon return of the
30 slide to the holding means.

8. Apparatus as claimed in claim 7, wherein the pulling means (23) includes vacuum openings adjacent said one edge (22) of the oscillating plate (20) for pulling the lowermost sheet from the bottom of the
35 stack.

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9. Apparatus as claimed in claim 8, including a stationary plate (19) forming a portion of the bottom of the holding means (12) for supporting the supply stack therein and releasing only the lowermost sheet as it is pulled downwardly by the vacuum openings in the oscillating plate.

10. Apparatus as claimed in any one of the preceding claims, wherein the transfer means (40) is a vacuum transfer plate for engaging each sheet in said predetermined position and positively depositing it on the conveyor (45).

11. Apparatus as claimed in any one of the preceding claims, wherein the advancing means (55) advances the conveyor (45) intermittently in predetermined increments between the transfers of the sheets thereonto.

12. Apparatus as claimed in any one of the preceding claims, including vacuum means (46,47) in combination with the conveyor (45) for holding the shingled sheets on the conveyor during advance thereof, to develop said shingled sets regularly and uniformly on the conveyor without requiring mechanical coupling between the conveyor and the sheets thereon.

13. Apparatus as claimed in claim 12, wherein the conveyor and vacuum means comprises at least one perforated vacuum belt (46) and a vacuum box (47) on the side of said vacuum belt opposite the sheets assembled thereon.

14. Apparatus as claimed in any one of the preceding claims, including drive means for correlating the operation of the transport means (20,25,30), conveyor advancing means (55), transfer means (40), and fastening means (50) so as to overlap the sheets (15) in a regular pattern on the conveyor.

FIG-1

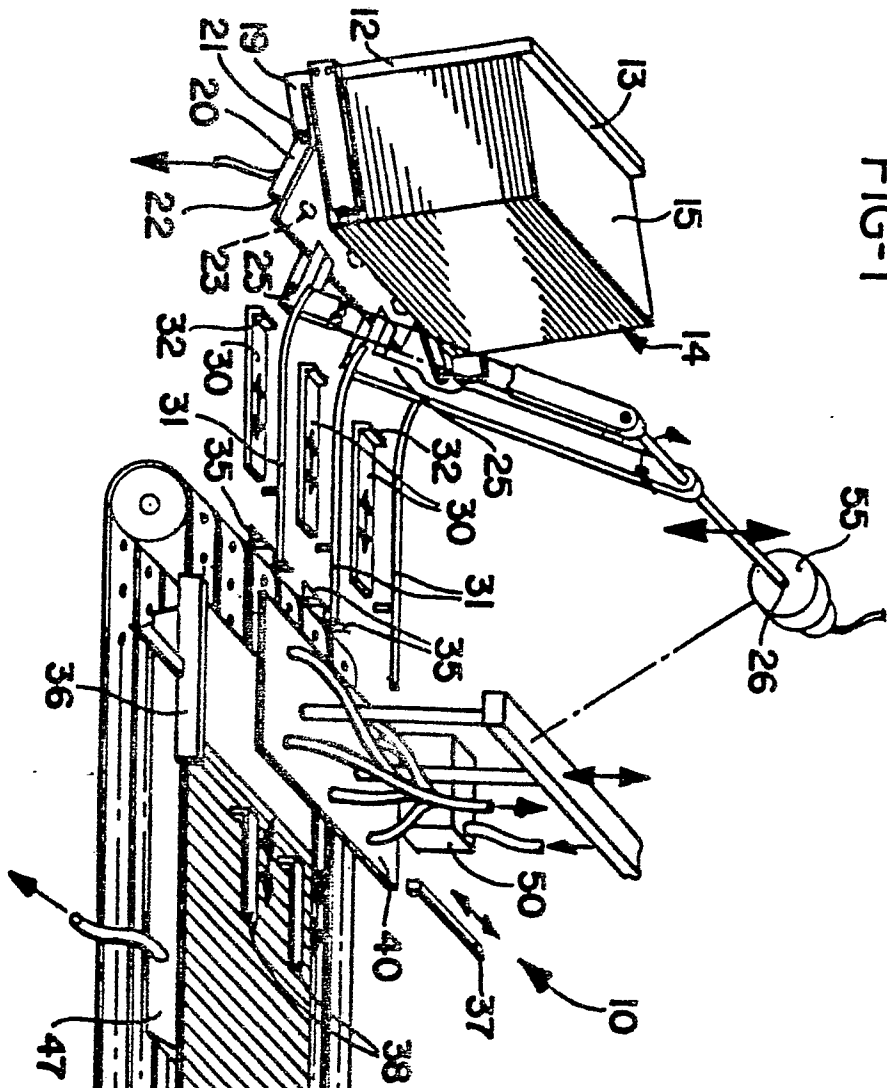


FIG-2

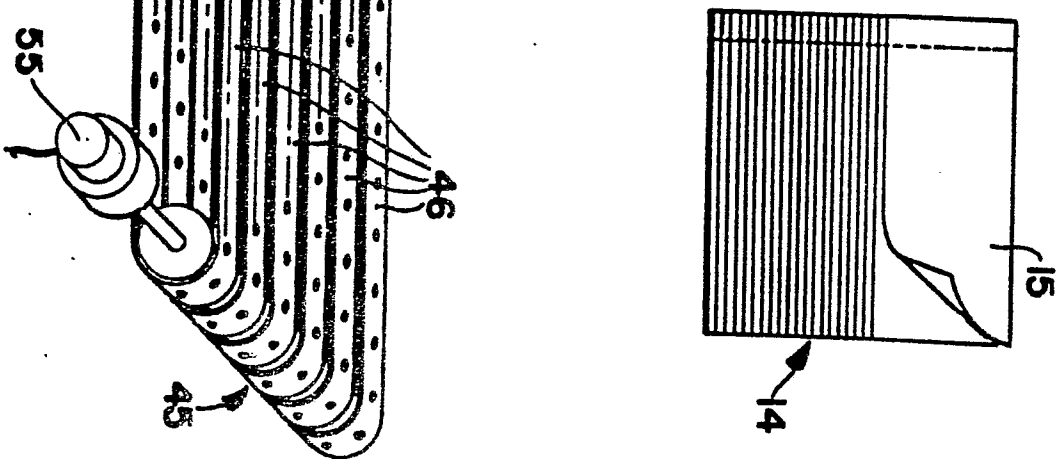


FIG-3a

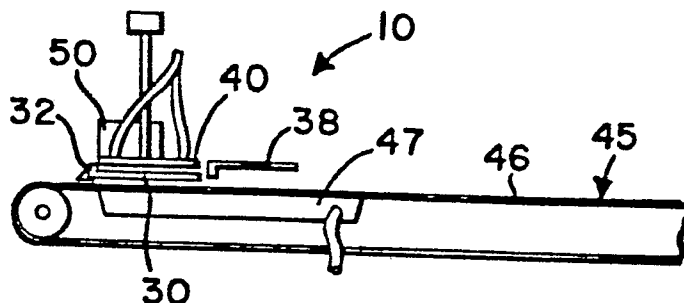
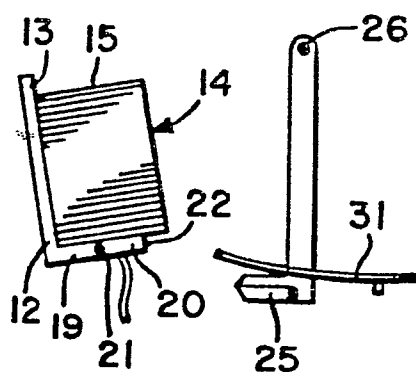


FIG-3b

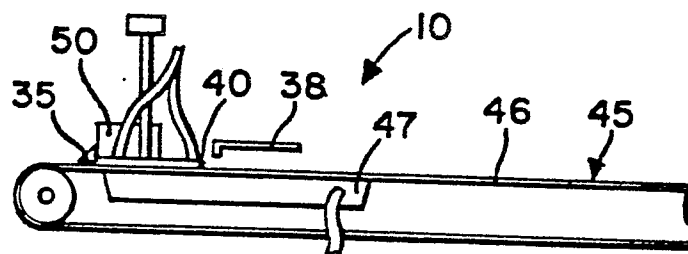
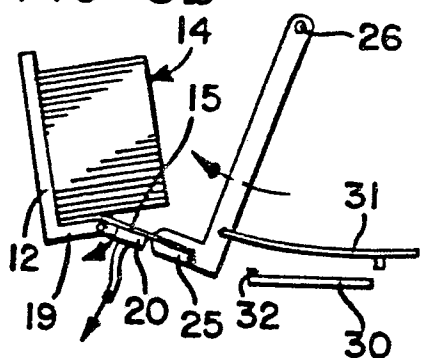


FIG-3c

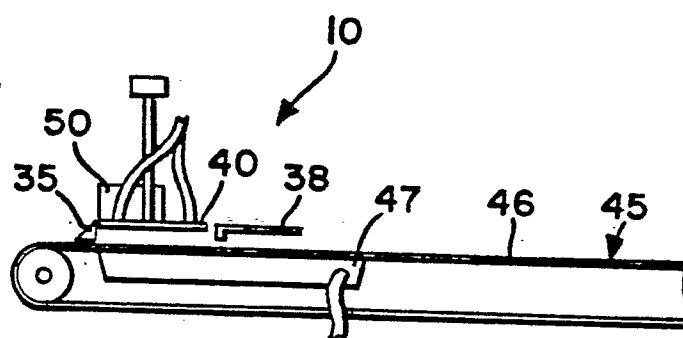
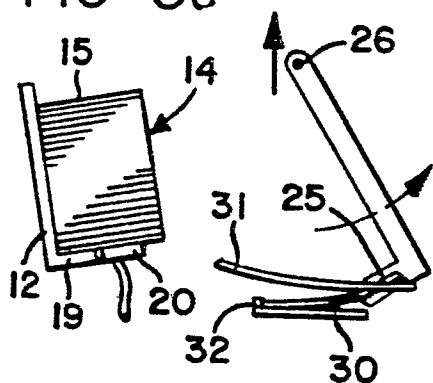


FIG-3d

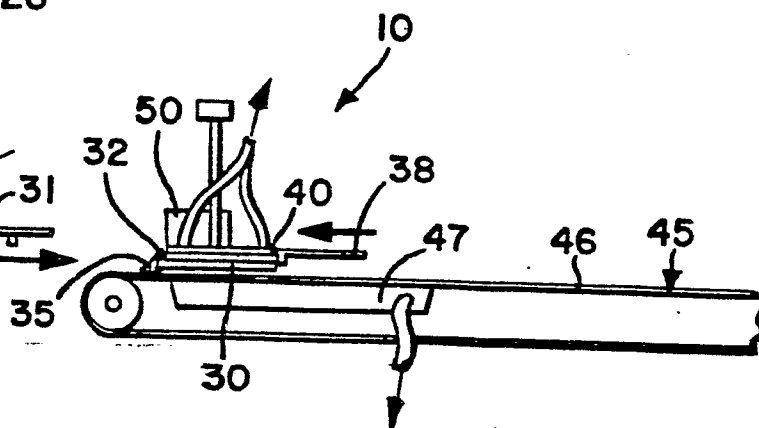
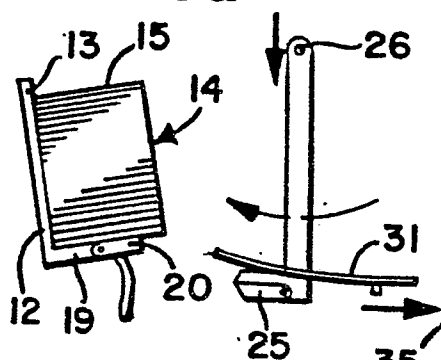


FIG-3e

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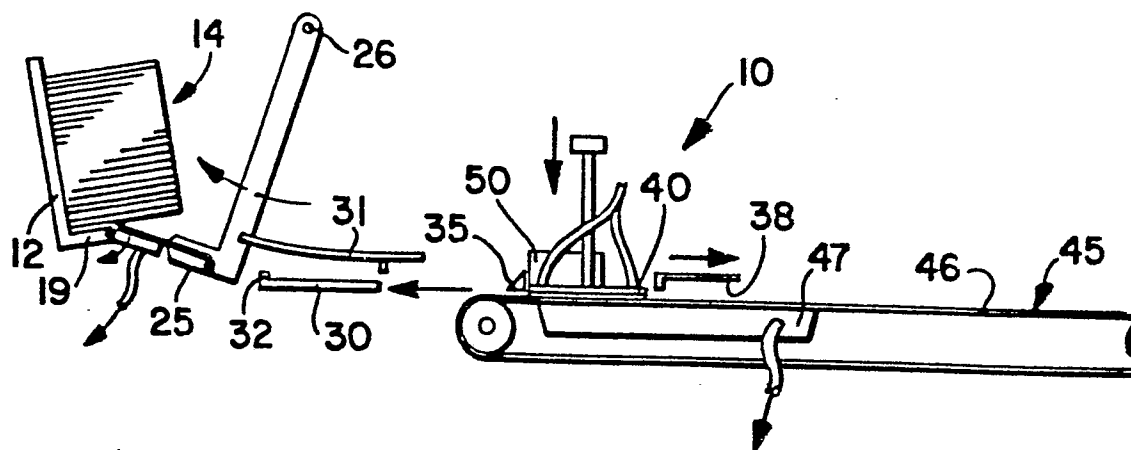
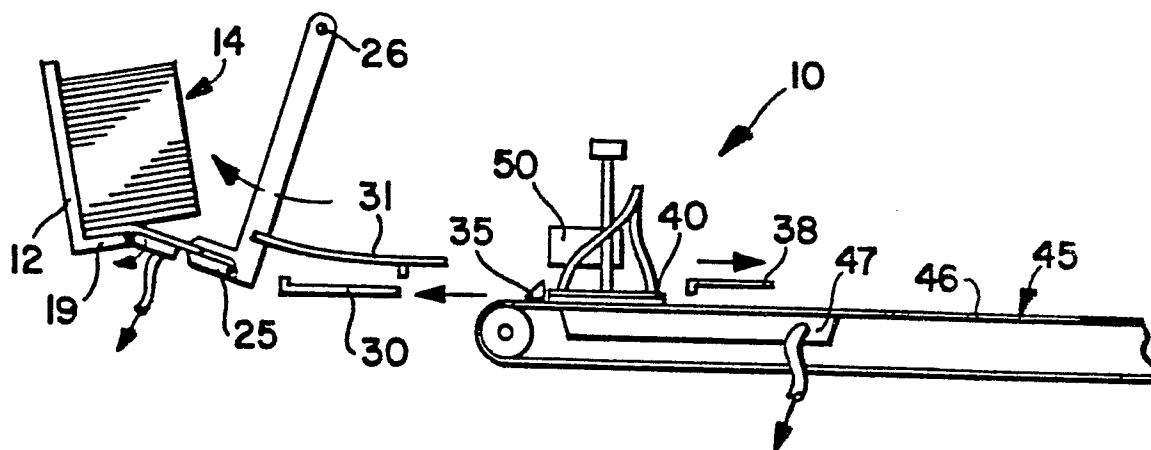


FIG-4





European Patent
Office

EUROPEAN SEARCH REPORT

Application number
EP 79 30 0735

0018451

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl. 7)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
	<u>US - A - 3 718 328 (LATTA)</u> * The complete description *	1,6	B 65 H 37/04
	-- <u>DE - A - 2 527 448 (HAUNI)</u> * Page 7, line 1 - page 8, line 9; figures 1,2 *	8	

			TECHNICAL FIELDS SEARCHED (Int.Cl. 3)
			B 42 C B 65 H
			CATEGORY OF CITED DOCUMENTS
			X: particularly relevant A: technological background O: non-written disclosure P: intermediate document T: theory or principle underlying the invention E: conflicting application D: document cited in the application L: citation for other reasons
			&: member of the same patent family, corresponding document
The present search report has been drawn up for all claims			
Place of search	Date of completion of the search	Examiner	
The Hague	30-11-1979	LONCKE	

