Jan. 19, 1965 C. H. PORTER ETAL 3,166,206

STACKING PRINTED PRODUCTS

Filed July 24, 1962 3 Sheets-Sheet 1

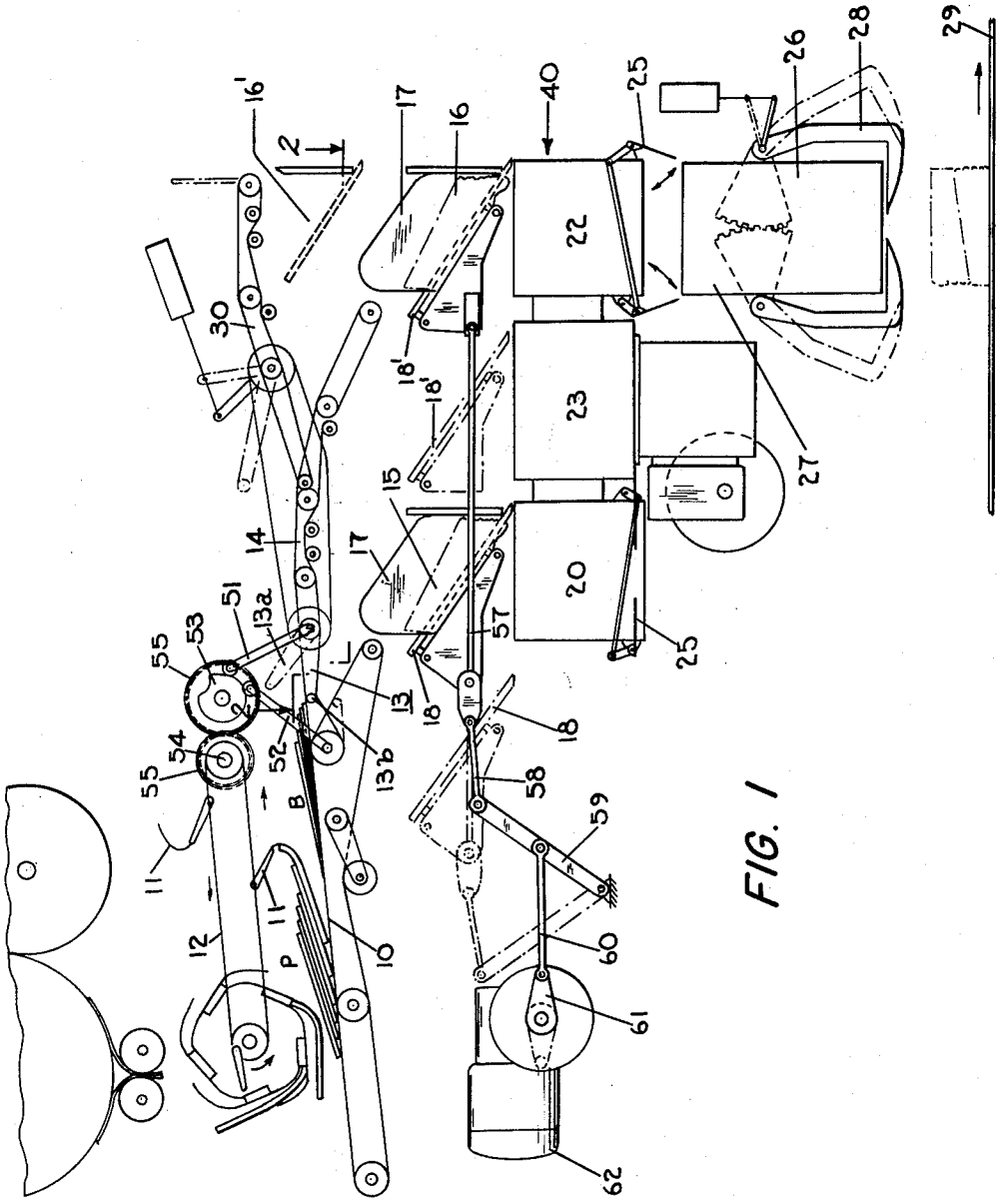

FIG. 1

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STACKING PRINTED PRODUCTS

Filed July 24, 1962 3 Sheets-Sheet 2

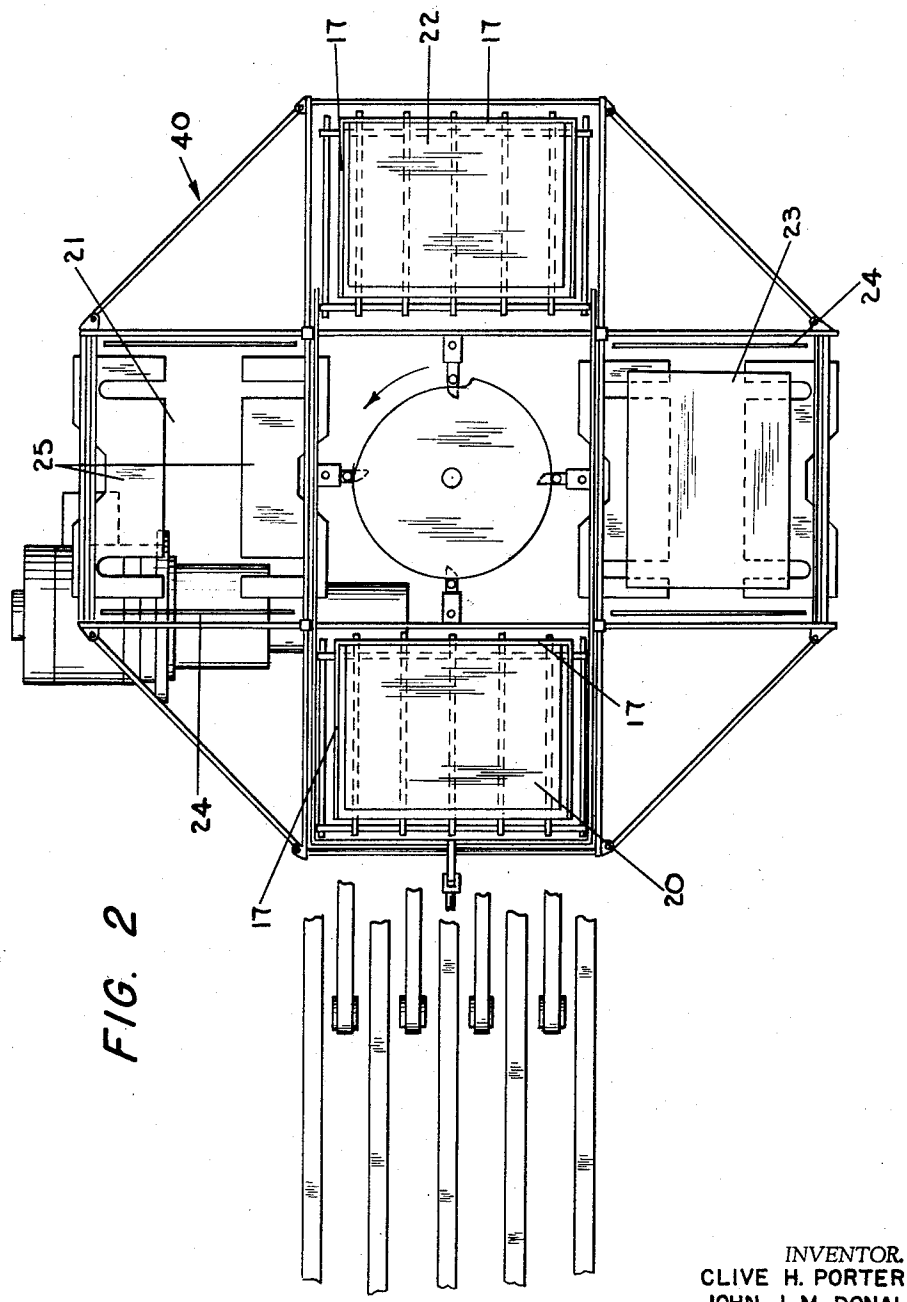

FIG. 2

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STACKING PRINTED PRODUCTS

Filed July 24, 1962 3 Sheets-Sheet 3

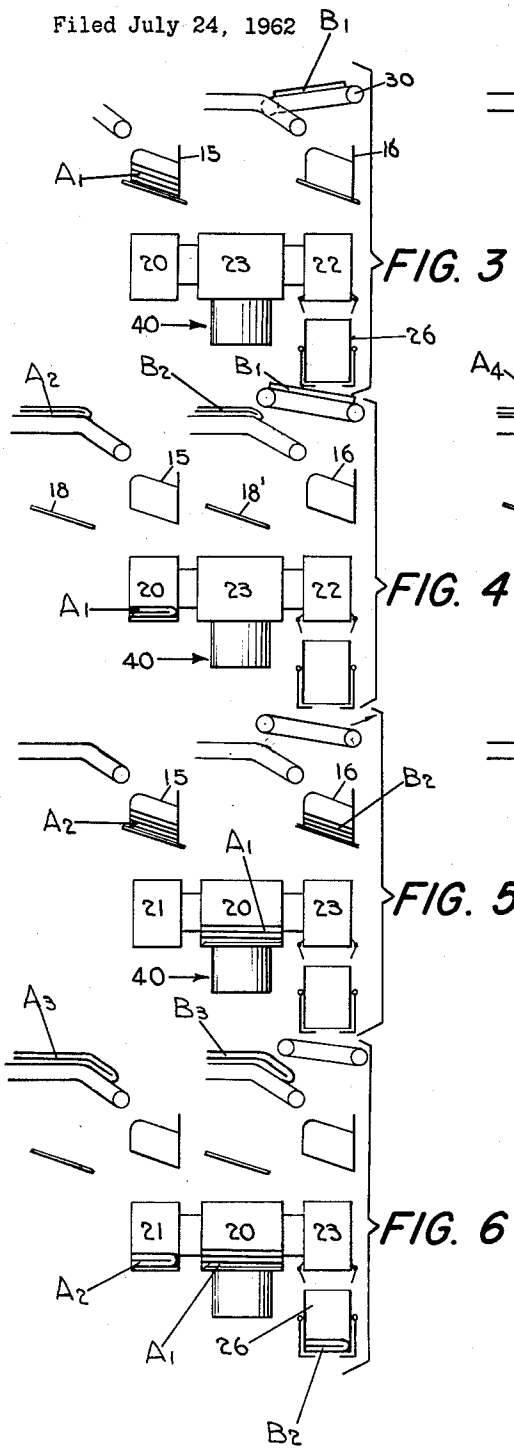

FIG. 3

FIG. 4

FIG. 5

FIG. 6

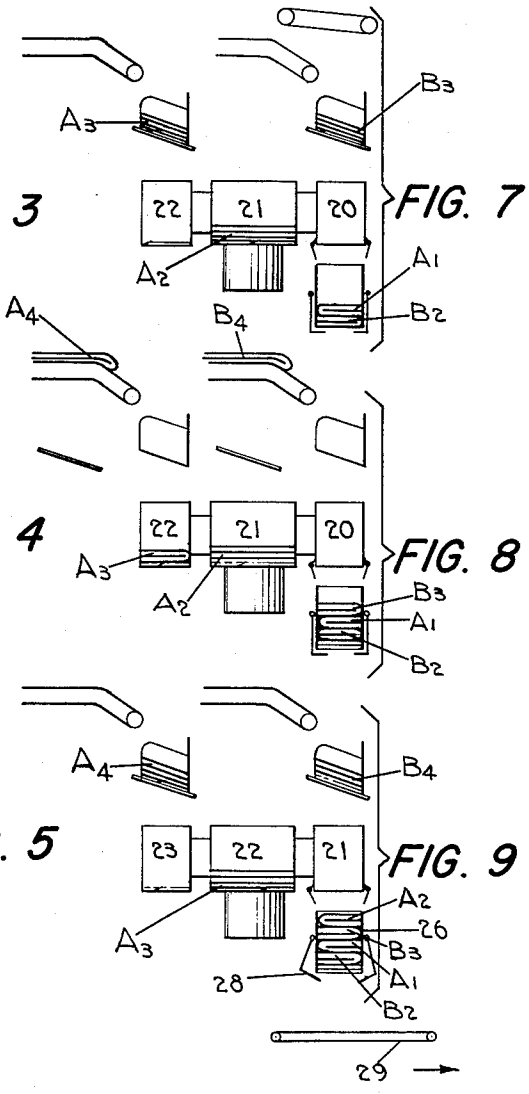

FIG. 7

FIG. 8

FIG. 9

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3,166,206

STACKING PRINTED PRODUCTS

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3 Claims. (Cl. 214—152)

The present invention relates to the stacking of printed products.

More particularly, the invention is concerned with the stacking of printed products in batches, the fold lines and cut edges of successive batches being reversed, so that the number of batches is immediately evident upon inspection of a stack and the stack is of the same height on all sides.

It is known prior practice in stacking printed products to turn alternate batches over, reversing the position of the transverse fold line and opposite cut edge, but this leaves any longitudinal fold lines in superposition along the same edge of the stack and, hence, is not an entirely satisfactory method.

It is also known practice to stack the batches in the same order in which produced, turning alternate batches in their own planes through 180° or one-half turn. This produces a satisfactory stack but is difficult to practice at high speeds. The difficulty involved will be evident by considering the requirements of a typical high speed printing operation, which may result in the production of up to 72,000 products per hour. If these products are divided into batches of ten (straight run, corresponding to five in a batch for a collect run), it is apparent that batches are produced and must be stacked at the rate of 7200 per hour or one batch per half-second. The turning of alternate batches through 180° in their own planes in this short space of time involves inertial effects which make such a method of stacking extremely difficult if not impossible, at speeds approaching the value mentioned. In any event, the various elements which cooperate in stacking the products are synchronized closely with each other, the speed at which each operation is performed being proportioned to the speed at which the copies are being produced, and it is found that stacking in this manner involves more or less unpredictable difficulties connected with the speed of the operation as a whole, so that it is not uncommon for a stacker which operates satisfactorily at a given high speed to operate unsatisfactorily at a somewhat lower speed.

It is also possible to produce a satisfactory stack by rotating the partially formed stack through a half turn as alternate batches are deposited. This, however, involves a rapid turning of a mass of considerable inertia, the inertia being variable according to the size of the stack.

It will be evident that the difficulties involved in the previous methods of stacking are such as to place severe limitations on the speed of operation. As the batches handled become large, more time is available for handling each batch, but the inertia correspondingly increases, as also the difficulty in maintaining vertical alignment of the products in the batch. In a limiting, but actual case, the stack may be composed of only two batches, each containing, say, as many as twenty-five or fifty products. In this case, however, in addition to the difficulties involved due to inertia effects, the stack is composed of two wedge-shaped batches, the dividing line between batches being a pronouncedly slanted plane, so that the stack itself lacks stability. With previous methods, the avoidance of such effects through handling small batches decreases the time available for handling each batch unduly and also rules out the turning of the partially formed stack as the time available for such turning movement decreases as the size of batch is decreased.

Previous stacking methods also present difficulty in permitting satisfactory inspection at high speeds. The removal and simultaneous replacement of the copy as hitherto practiced by the pressman is not satisfactory at high speeds so that the preservation of the count requires the removal and replacement of a complete batch. In doing this, it is desirable that the batch be comparatively small, but the difficulties above mentioned practically necessitate the handling of as large batches as possible, where previous stacking methods are used.

It is the general object of the invention to provide an improved method and apparatus for stacking products in batches with alternate batches turned in their own planes through a half turn.

Another object of the invention is to provide a method which permits the inspection of copies by diverting and replacing a batch of copies, thereby eliminating the difficulty of removing copies from a fast moving stream and also eliminating any interference with accurate count.

Another object is to provide a stacking method in which the essential movements of the products may be accomplished at a uniform high speed which is independent of the speed of production of copies, thus eliminating difficulty due to variation in operation with the speed of movement of the elements involved.

A further object is to provide a method in which the indexing movements of the stacking operation or steps may proceed at a slower rate, as, for example, one-half the rate of the batch production.

A method and apparatus for practicing the invention in a preferred form will now first be described with reference to the accompanying drawings, and the features forming the invention will then be pointed out in the appended claims.

In the drawing:

FIG. 1 is a schematic side view of the mechanism for practicing the invention in a preferred form;

FIG. 2 is a schematic plan view corresponding to FIG. 1;

FIGS. 3–9, inclusive, are schematics illustrating the steps involved in forming a stack according to the method of the invention.

Referring first to FIGS. 1 and 2, there is indicated therein a stream of products P advancing on tapes **10**, the products being retarded in their movement by stop elements **11**, which are moved along by a conveyor chain arrangement **12** at a somewhat slower speed than the tapes **10** so as to separate the products into batches B, as indicated. Past the patch forming point is a switch **13** comprising two groups of belt arms **13***a* and **13***b*, respectively, which in their solid line positions direct the batch to tapes **14** delivering to a temporary receiver **16** and in their dotted line positions permit tapes **10** to deliver a patch to another temporary receiver **15**. The two belt arms **13***a* and **13***b* are moved up and down, corresponding to the directing of the batches to the temporary receivers **15** and **16**, respectively, by lever arms **51** and **52**, respectively. The lever arm movements are controlled by a cam **53** which is designed for a full cycle of two successive batches and which is directly driven at a ratio of 1:4 by gears **55** and **56** by the upper sprocket shaft **54** of the conveyor chain **12**.

A linkage, composed of a rod **57**, a connecting link **58**, a lever **59**, rod **60** and crank **61** is arranged for moving the slanting bottoms **18**, **18**^{1} of the temporary receivers **15** and **16** back and forth. The crank **61** is driven by a gear motor **62**.

The receivers **15** and **16** may be of identical construc-

tion, embodying in each case walls 17 for guiding the batches and a slanting bottom 18, 18¹ for temporarily supporting and then releasing (broken line position) the batches. Below the temporary receivers 15 and 16 is positioned a rotatable carrier, denoted by the general numeral 40, equipped with four temporary receivers or pockets 20, 21, 22, 23, spaced at equal (90°) intervals around the carrier, the diametrally opposite pockets being spaced apart by the same distance as the temporary receivers 15, 16 and being adapted to receive batches dropped therefrom.

The pockets 20–23 are of similar construction, each having side guiding walls 24 for keeping a batch of products in vertical alignment and floor elements 25 for temporarily supporting a batch (full line position) and then dropping the same (dotted line position). Below temporary receiver 16 and below whichever of the pockets 20–23 may be in position underneath it, is a stack receiver 26 having side guide walls 27 and movable bottom elements 28 for temporarily supporting (full line position) and then dropping (dotted line position) its stack of batches onto subjacent delivery tapes 29 or into any further tieing or wrapping apparatus with which the stacker may be associated.

The novel method of the invention and the manner in which it is carried out by the indicated apparatus will be clear from the progressive diagrams contained in FIGS. 3–9, inclusive.

Switch 13 is synchronized with the production of products P and batches B, as, for example, by synchronizing in the usual manner with the tapes 10, directing successive batches alternately to the temporary receivers 15 and 16 as above mentioned. The indexing table makes one movement (90°) for each pair of batches B which is produced. The pockets 20–23 are closed at all times except when a pocket is over the receiver 26, in which location the floor elements of pockets 20–23 are dropped, being returned to upper or batch supporting position by the cam during 120° or so of movement. The receivers 15, 16 discharge products shortly after the indexing movement is completed.

For purposes of describing the operation below, the successive batches B are identified as A_1, B_1; A_2, B_2; A_3, B_3; etc. in order of production, the batches B_1, B_2, B_3, etc. being those placed on the stack without turning and the batches A_1, A_2, A_3, etc., being those which are turned through a half turn (in two steps) before placement in the stack. Batches A_1 and B_1 or A_2 and B_2, etc., are pairs of batches whose production time (for the pair) corresponds to one indexing movement of the turntable. At the start of a stacking operation, the first batch A_1 is delivered to temporary receiver 15 (FIG. 3). The next following batch B_1 is detoured to intercepting conveyor belts 30 which are normally in the inactive, dotted line position (FIG. 1) during the time the stacker is working, but are lowered to the full line position for detouring the batch B_1. While the following batch B_2 now is moving along on belts 14 toward the temporary receiver 16, the next batch A_2 is approaching the temporary receiver 15, directed by the cam-controlled movement of the switching belt arms 13*a* and 13*b*, respectively (FIG. 4). The bottoms 18 and 18¹ have been moved in order to let batch A_1 drop into the pocket 20. When the bottoms 18, 18¹ are returned, the rotatable carrier 40 with its pockets 20, 21, 22, 23 is counter-clockwise rotated through 90° (FIG. 5), so that pockets 21 and 23 now are positioned underneath the temporary receivers 15 and 16, respectively. Batches A_2 and B_2 drop simultaneously into pockets 21 and 23, but since the floor elements 25 of pocket 23 in the discharging position above stack receiver 26 are open, batch B_2 drops through into said stack receiver 26. With the rotatable carrier 40 now indexing, as described above, the bottoms 18, 18¹ reciprocating, the successively arriving pairs A_3B_3, A_4B_4 will drop into the temporary receivers 15, 16; eventually a stack of a predetermined height will be formed,

until upon a timed impulse the movable bottom elements 28 are opened so that the stack may drop onto the subjacent delivery tapes 29 for further handling.

As it is shown in FIG. 9, the final stack is composed of batches which are laid in the desired manner, so that the folded edges of the newspapers or the like folded signatures are arranged alternatingly opposite to one another.

If it is desired to inspect copies, the intercepter conveyor 30 is utilized for this purpose, diverting a batch which would otherwise have gone to temporary receiver 16. The originally discarded batch B_1 or other available copies may be used when the intercepter 30 is operated so as to fill the temporary receiver 16 and preserve the count. Thereafter, inspected copies may be kept available, ready to fill the temporary receiver 16 whenever another batch is diverted for inspection, and an auxiliary receiver 16', located above the receiver 16, may be utilized for so filling the receiver 16.

As is evident, the mechanism supplying products to the tapes 10 will ordinarily operate at a substantially fixed rate so that batches are formed and forwarded with a definite time interval between them, which time interval t may be of the order of one-half second. With conventional methods of stacking batches in the same order as produced, it is apparent that where alternate batches are reorientated through a half turn, the time available for doing this cannot materially exceed the time interval t (say, one-half second). In the method of the present invention, it will be noted that since the first (reorientated) batch A_1 is followed in the final stack not by batch B_1 but by batch B_3, the time for reorientating it is tripled ($3t$). Similar considerations apply to any later pair of batches. For example, batch A_3 (reorientated) is immediately followed by batch B_5, giving the same increase of time for reorientating the batch. It will also be noted that the carrier in which diametrally opposite pockets are active at each step does not require an indexing movement for each batch of products produced, but only for each pair of such products. The carrier, therefore, may have an operating cycle (opening and closing of receiver and pocket bottoms) related to the time interval $2t$, the added time t being available for the indexing movement of the carrier. In adapting the operation to production at different rates, the movement of all parts associated with the carrier in indexed position is at a fixed rate corresponding to the highest designed speed of production and only the time of initiation of an indexing movement is synchronized to the production of copies. This eliminates all difficulty due to variation in speed of the mechanism.

As will be evident, since the indexing movement occurs only for each pair of batches produced, a total time interval $2t$ is available for operating a batch through 90° and a time interval of $4t$ (two indexing movements) is available for operating it through two quarter turns, making up the necessary half turn. This contrasts very sharply with prior art methods using consecutive stacking and in which the time available for accomplishing the necessary operation, including the half turn, is only the interval t corresponding to the time of production of a batch.

What is claimed is:

1. Method of stacking printed products which comprises forming a moving stream of overlapped products, separating the said stream into a succession of batches, directing alternate batches of the said succession to a stack by one path and the remaining batches to the same stack by a second path, turning batches in the second path in their own planes successively through two quarter turns while delivering two batches from the first said path along with interspersed preceding batches from the second path to the stack and then delivering batches from the second said path to the stack in alternation with those of the first said path, whereby the batches from the second said path are retarded in the stack by relation to their position in the said succession of batches, each such batch

from the second path now following the batch which followed it in the said succession.

2. Method according to claim 1, which comprises maintaining a replacement batch of products in readiness for insertion in the first said path, removing a batch from the first said path for inspection and substituting the said replacement batch therefor to maintain the count.

3. Method according to claim 1, in which the first and second paths each comprise a location to which batches are delivered substantially simultaneously, the second path comprises a second location to which a batch is delivered

from the first said location in that path while a batch is delivered from the said location in the first said path to the stack and the second path comprising also two further successive locations, in which the batches are turned successively through two right angles in their own plane.

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