

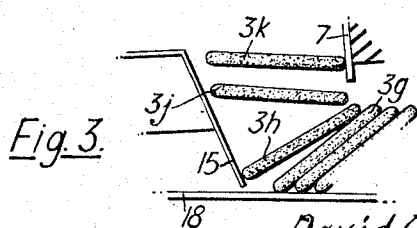
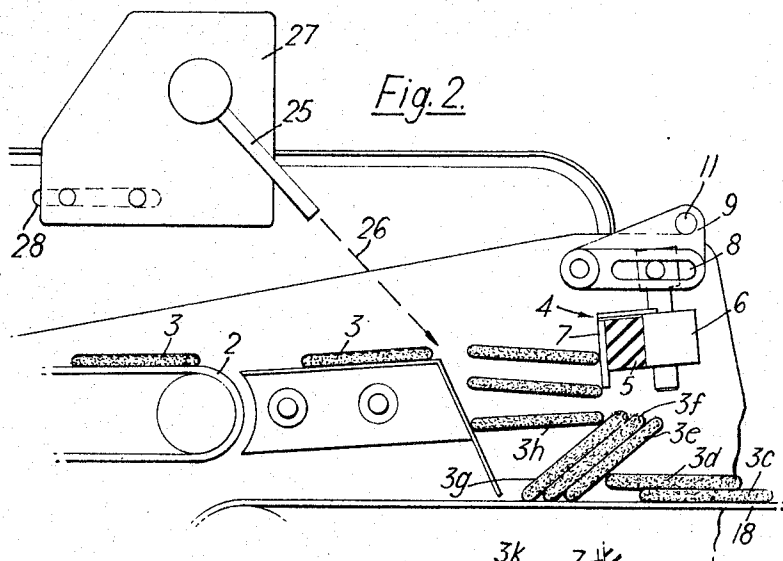
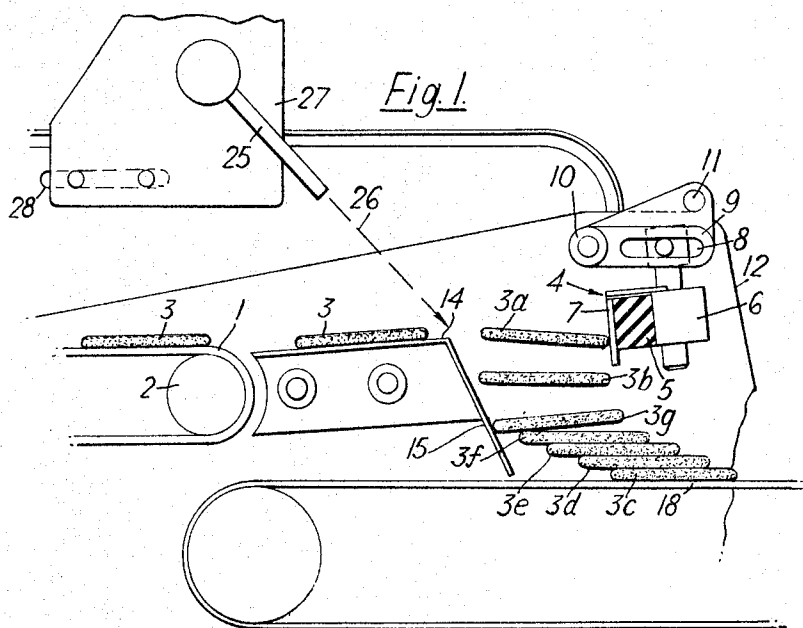
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METHOD AND APPARATUS FOR STACKING BISCUITS

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METHOD AND APPARATUS FOR STACKING BISCUITS

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After baking, biscuits normally emerge from the oven in a number of rows or lanes spaced across the width of a conveyor band. For subsequent handling purposes whether manual or automatic the biscuits are commonly stacked. It is generally more convenient if the number of rows of stacked biscuits is smaller than the number of rows emerging from the oven. The smaller the final number of rows the more biscuits there will be in each row and the faster the stacking mechanism needs to operate. Various types of stacking mechanisms can be used satisfactorily at relatively slow speeds. It is not unusual for the baking of biscuits to be at a rate of about 200 biscuits per minute in each row and if, for example, twelve rows are reduced to four the number of biscuits in each row is trebled so that a stacking mechanism operating at a speed of 600 biscuits per minute is required.

According to the present invention apparatus for stacking biscuits comprises a substantially horizontal conveyor, a stationary plate immediately following and approximately in line with the conveyor, a stop spaced away from the end of the stationary plate for arresting biscuits projected over the plate by the conveyor, a guide situated beneath the level of the plate for engaging successive biscuits on the opposite side to that engaged by the stop and a second conveyor for receiving biscuits from the guide and conveying away the stack thus formed. In operation each biscuit is projected from the end of the first conveyor against the stop, from which it falls in a substantially horizontal position until its leading edge engages the rear of the last biscuit in a stack on the second conveyor and its trailing edge engages the guide. Thereafter, as a result of the movement of the second conveyor, the biscuit pivots about its pivot of engagement with the preceding biscuit and its trailing edge slides down the guide until, when the bottom of the guide is reached, the biscuit assumes its position in the stack and the process is repeated with the next biscuit. It is found that apparatus operating in this way can run at high speeds both with round and rectangular biscuits and forms a substantially uniform stack.

As mentioned above the first conveyor needs to be substantially horizontal but the stationary plate is preferably inclined slightly upwardly, for example, at an angle of approximately $3\frac{1}{2}^\circ$. The provision of this stationary plate immediately following the conveyor serves as a launching platform for projecting biscuits against the stop. This plate also serves a further important function in that its friction tends to retard the forward velocity of each biscuit so as to lessen the impact of the biscuit against the stop and thus reduce the possibility of damage to the biscuit. In addition the impact may be cushioned by forming the stop with a rigid striking plate backed by a body of rubber or rubber-like material.

Since each biscuit must turn through an appreciable angle between leaving the stationary plate and taking up its position on the stack, it is found desirable, particularly when operating at high speeds to use a jet of air to depress the trailing edge of each biscuit once it has cleared the edge of the stationary plate. The air jet needs to be directed in the direction of movement of the biscuits (to avoid retardation) and in this way each biscuit is tilted while falling so that there is a correspondingly smaller angular movement necessary after it has engaged the preceding biscuit on the stack.

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A construction of apparatus in accordance with the invention will now be described by way of example with reference to the accompanying drawings in which:

FIGURES 1 and 2 are elevations showing the beginning of the formation of a stack; and,

FIGURE 3 is a view showing a later stage at which the stack is fully formed.

Turning first to FIGURE 1 the apparatus includes a feed conveyor 1 of which only the forward end is shown as it passes around a roller 2. Immediately following this and in line with the conveyor is a stationary plate 14 which is inclined at a small angle to the horizontal of approximately $3\frac{1}{2}^\circ$. Biscuits shown as 3 are fed or projected by the conveyor 1 over the surface of the plate 2 and into space along substantially linear path for engagement with a stop indicated generally as 4. This comprises a striking plate 7 of wear-resistant material such as steel or hard plastic backed by a body portion 5 of rubber which is sandwiched between the plate 7 and a mounting block 6. The stop as a whole is mounted on a rod 13 which is adjustable in a horizontal slot in a mounting plate 9 so as to space the plate 7 from the discharge end of the member 14 a distance at least as great as the length of the biscuit. The whole assembly can be turned upwardly about a pivot 10 and is held in the operative position shown in the drawing by the engagement of a step member 11 with the edge of a plate 12.

In operation each biscuit 3 is projected across the plate 14 and into space with sufficient velocity to strike the stop 4, the construction of which prevents any appreciable rebound. The biscuit in this position indicated as 3a is substantially horizontal but owing to the trajectory of the biscuit its leading edge is very slightly lower than its trailing edge. From there the biscuit drops vertically, its next position being shown as 3b. At the beginning of the stack there is nothing to hold the biscuits up and the first few biscuits lie flat on top of one another as shown as 3c, 3d, 3e and 3f each successive biscuit being slightly staggered to the left in relation to that preceding it owing to the movement of a lower conveyor 18 which is moving considerably slower than the conveyor 1.

The first three or four biscuits will form a stable pile as shown in FIGURE 1 but the arrival of the next biscuit shown as 3g upsets not only the biscuit preceding it, 3f but also the biscuit preceding that, 3e and all three biscuits together rock into the position shown in FIGURE 2 where they are supported by the biscuits 3c and 3d. Depending on the precise relative positions of the biscuits either two biscuits as illustrated or some times three will lie flat on the conveyor 18 to support the body of the stack. Successive biscuits thereafter will align themselves with the biscuits 3e, 3f and 3g in the position shown in FIGURE 2.

The next biscuit is shown in FIGURE 2 as 3h and it will be seen that in the position shown its leading edge has engaged the rear side of the biscuit 3g while its trailing edge is in engagement with a guide constituted by a flat plate 15 inclined at an angle of approximately 25° to the vertical. Owing to the movement of the conveyor 18 to the right the biscuit 3h is able to pivot about the point of engagement of its leading edge with the biscuit 3g so that its trailing edge slides down and is guided by the plate 15. The position of the biscuit 3h just before it joins the stack is illustrated by FIGURE 3 and the next biscuit 3j is just about to engage the biscuit 3h. The biscuit following that, 3k has just engaged the striking plate 7 and is starting its drop in the manner already described. Thereafter each successive biscuit takes up its position at the correct angle at the rear of the stack on the conveyor 18.

In order to obtain accurate stacking it is important that the biscuits on the conveyor 1 should be reasonably

spaced. If, however, there are several successive biscuits missing from this arrangement the apparatus will continue to function and although the angle of the stack will be temporarily disturbed the original angle will be rapidly resumed. This is because at any one time several biscuits will be passing between the conveyor 1 and the conveyor 18 and this "head" of biscuits provides the necessary continuity to allow stacking to be resumed. The next biscuit immediately after the gap will be inclined at a shallower angle to the rest of the stack but the angle illustrated in FIGURE 3 will rapidly be resumed.

Although the operation already described takes place quite satisfactorily at relatively low speeds, at higher speeds it is found desirable to provide a compressed air nozzle 25 providing an air jet shown in dotted lines as 26. The nozzle 25 projects from a housing 27 in which it is capable of angular adjustment in a horizontal direction by the provision of an elongated slots 28. The air jet 26 has a forward and downward component which serves to depress the trailing edge of each biscuit without retardation and thus assists each biscuit to turn through the necessary angle even in the very short time interval available at very high speeds.

Such high speeds may be used because the time interval between successive biscuits need only be that necessary for a biscuit striking the stop 4 to fall a distance slightly greater than the thickness of each biscuit. As will be seen from the drawing the stacking apparatus has no moving parts and it is a simple matter to construct the apparatus as part of a removable guide bar grid. Since during operation the biscuits are laid on top of one another rather than sliding on top of one another as in some other forms of apparatus the surface texture of the biscuits is not of importance.

I claim:

1. Apparatus for stacking biscuits comprising a substantially horizontal conveyor, a stationary plate immediately following and approximately in line with the conveyor, a stop spaced away from the end of the stationary plate for arresting biscuits projected over the plate by the conveyor, a guide situated beneath the level of the plate for engaging successive biscuits on the side opposite to that engaged by the stop, and a second conveyor for receiving biscuits from the guide and conveying away the stack thus formed.

2. Apparatus according to claim 1, in which the stationary plate is inclined to the horizontal at an angle of approximately $3\frac{1}{2}^\circ$.

3. Apparatus according to claim 1 including an air nozzle for directing a jet of air on to the trailing edge of each biscuit as it leaves the stationary plate, the direction of the jet having a forward and downward component to assist in depressing the trailing edge of each biscuit.

4. Apparatus according claim 1 in which the stop comprises a rigid striking plate backed by a body of rubber or rubber-like material.

5. A method of stacking biscuits or the like comprising projecting successive biscuits forwardly into space along

a substantially linear path; arresting the forward movement of successive biscuits; permitting successively arrested biscuits to fall downwardly; arresting the downward movement of successively falling biscuits; and moving the fallen biscuits along a path substantially parallel to the first mentioned path at a rate of speed to enable each successively falling biscuit partially to overlies its immediately preceding biscuit.

6. The method according to claim 5 including guiding each biscuit during its downward fall.

7. The method according to claim 5 including tilting each successive biscuit during its downward fall.

8. The method according to claim 5 including applying on each successive biscuit during its downward fall a force directed downwardly and forwardly.

9. The method according to claim 8 in which said force is applied on the trailing edge of each successive biscuit.

10. The method according to claim 5 in which the fallen biscuits are moved in the same direction as that in which the biscuits are projected.

11. Apparatus for stacking biscuits or the like comprising means for projecting successive biscuits forwardly into space along a substantially linear path; arresting means for engagement by the leading edge of successive biscuits; means mounting said arresting means in the path of projected biscuits and at such distance from said projecting means as to enable successively arrested biscuits to fall downwardly between said projecting means and said arresting means; and movable conveyor means mounted at a level below said projecting means in a position to receive and convey away along a second path successively fallen biscuits at a rate of speed less than the speed at which said biscuits are projected along the first mentioned path.

12. The apparatus according to claim 11 including guide means mounted between said projecting means and said conveyor means for engagement by successively falling biscuits.

13. The apparatus according to claim 11 including pressure fluid means mounted between said projecting means and said arresting means and operable to exert a tilting force on successively projected biscuits.

14. The apparatus set forth in claim 11 wherein said second path substantially parallels and extends in the same direction as said first mentioned path.

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