United States Patent [19]

Parker et al.

[11] **3,744,788**

[45] **July 10, 1973**

[54] **RECORD FEEDING APPARATUS**

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[73] Assignee: **Masson Scott Thrissell Engineering Limited**

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[21] Appl. No.: **140,509**

[52] **U.S. Cl.** **271/1**, 271/62

[51] **Int. Cl.** **B65h 1/00**, B65h 5/00

[58] **Field of Search** 271/1, 11-12, 271/26, 30-31

[56] **References Cited**

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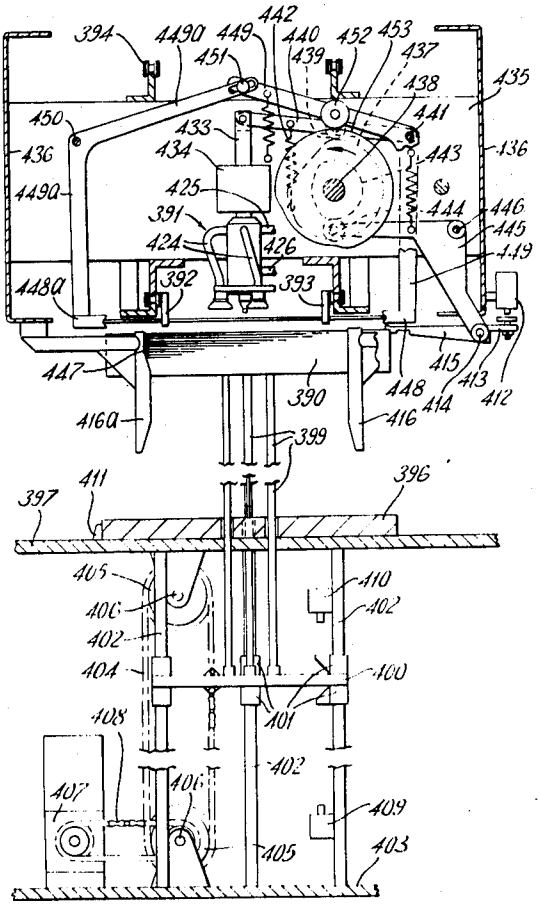
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[57] **ABSTRACT**

Apparatus for feeding records successively from a stack comprises a finger for displacing the uppermost record out of alignment with the stack and into vertical alignment with a suction device positioned above the record. The suction device is lowered and a projection slidably carried in the suction device locates in the central hole of the record and rests on the next lower record in the stack. The suction device is also brought into engagement with the uppermost record, suction is applied and the suction device is raised, the projection remaining and being held in contact with the next lower record to assist in separation of the uppermost record from the next lower record, the projection then being raised with the suction device.

13 Claims, 10 Drawing Figures



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SHEET 1 OF 6

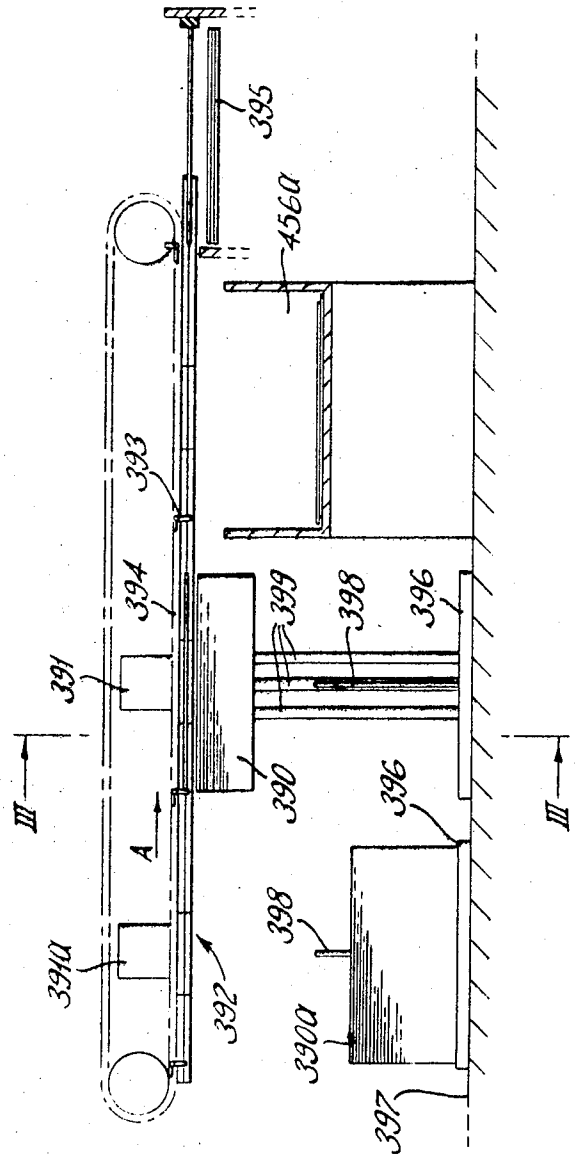


FIG. 1.

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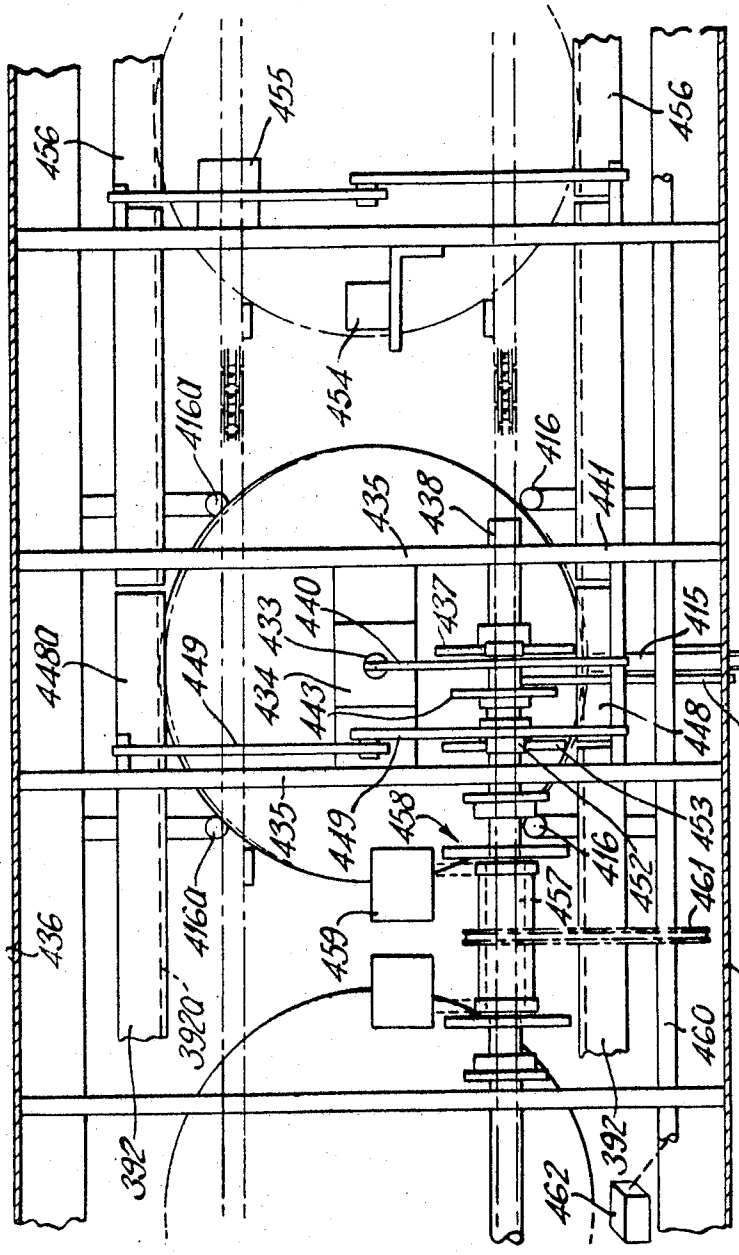


FIG. 2.

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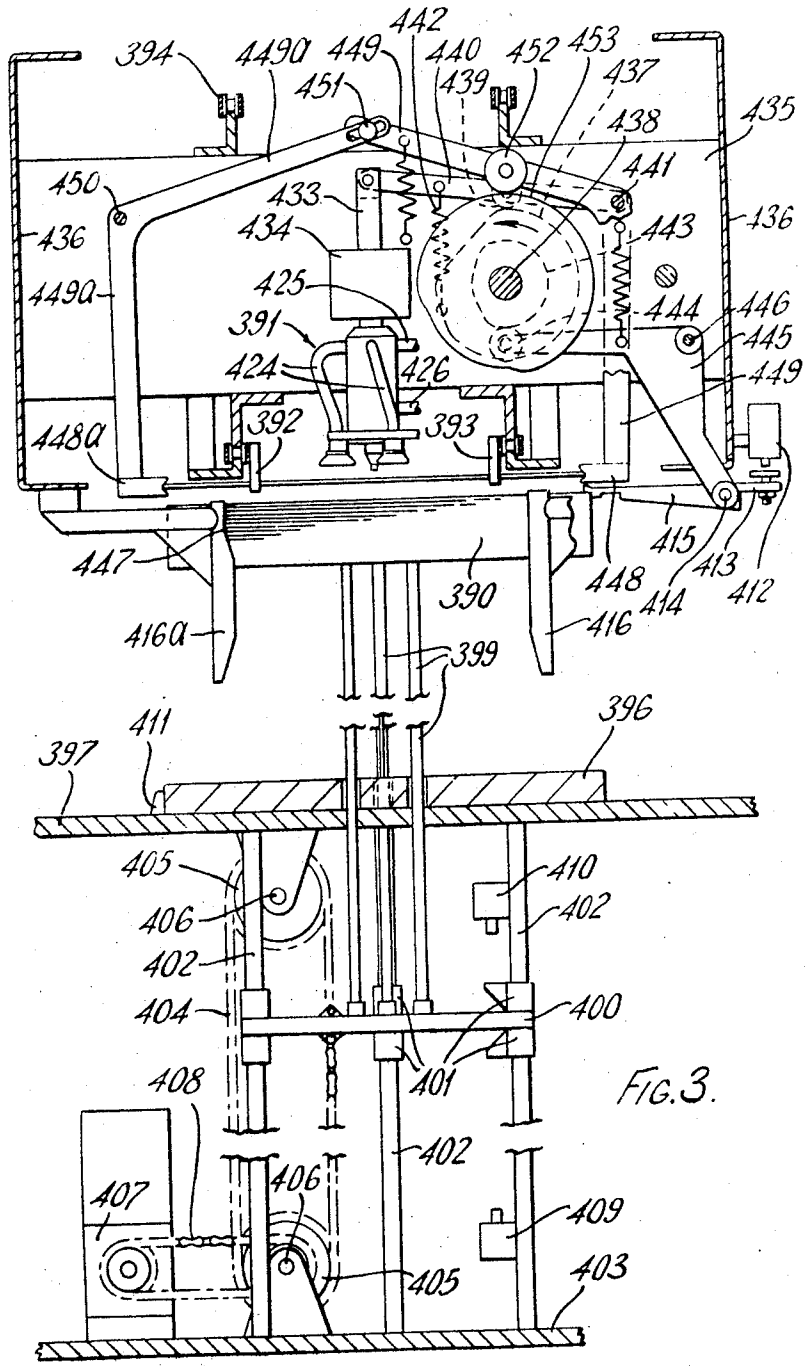


FIG. 3.

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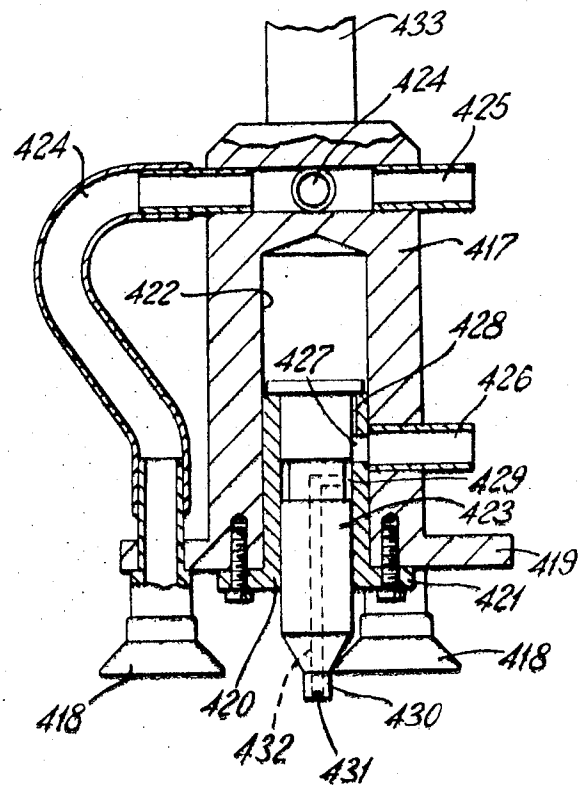


FIG. 4.

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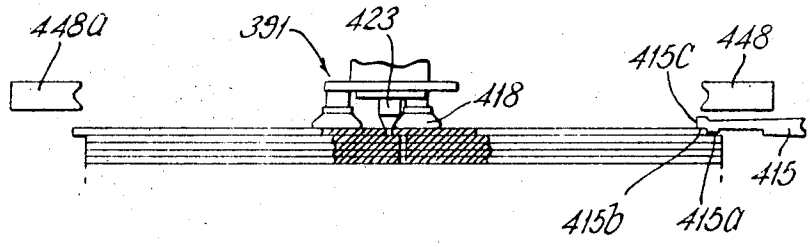


FIG. 5A.

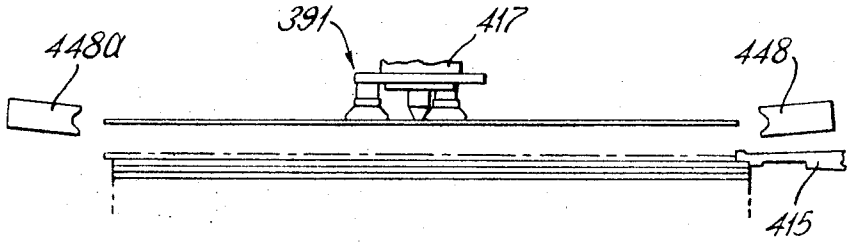


FIG. 5B.

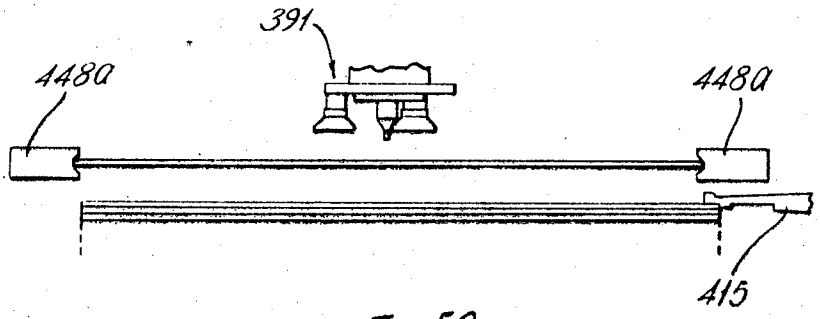


FIG. 5C.

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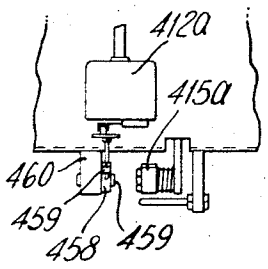


FIG. 7.

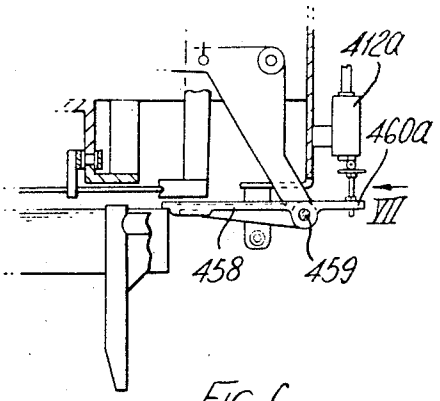


FIG. 6.

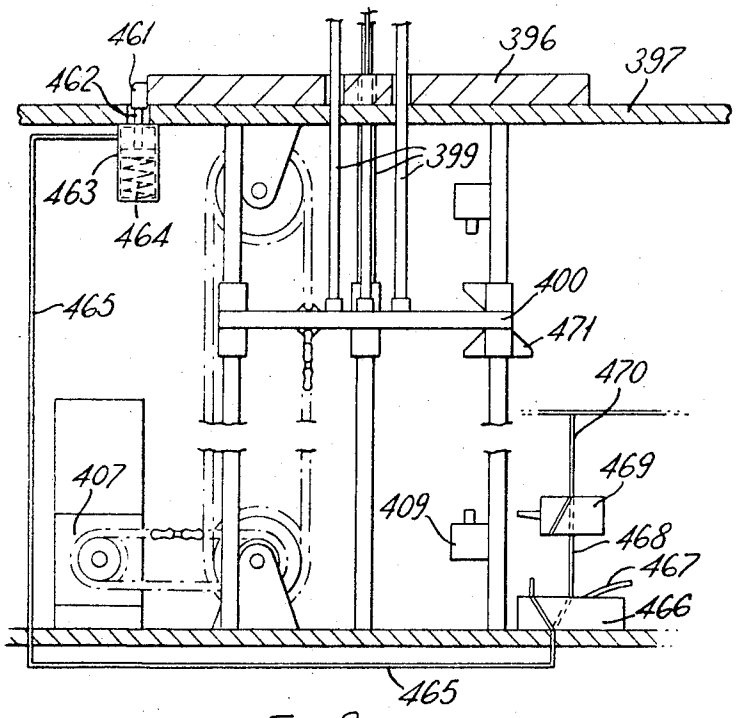


FIG. 8.

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RECORD FEEDING APPARATUS

This invention relates to apparatus for feeding records successively from a stack. The present invention may with advantage be employed in a record packing machine as disclosed in U.S. Pat. application, Ser. No. 36,261.

According to the invention, we provide apparatus for feeding records successively from a stack, comprising means for displacing the uppermost record out of alignment with the remainder of the stack, a plurality of suction pads engageable with said uppermost record after said displacement at positions around but not overlapping the central hole of said record, locating means associated with said pads for entering said central hole to ensure desired lateral location of said record relative to said pads, and means for simultaneously lifting said pads and applying suction to said pads while said locating means engages the next adjacent record in the stack to assist separation of said uppermost record from said next adjacent record.

In a preferred embodiment the apparatus includes lifting means adapted to receive a stack of records and raise said stack into operative relationship with said displacing means and suction pads, and means for sensing the level of the uppermost record of the stack as the latter is raised by the lifting means, said lifting means having control means associated with said sensing means so that the control means causes operation of the lifting means to cease when said uppermost record has been raised to a predetermined level.

The sensing means and control means may be arranged to cause the lifting means to resume operation whenever removal of records from the top of the stack results in the uppermost remaining record in the stack being at a second and lower predetermined level.

In an apparatus as defined above, whenever the last record is removed from the stack there is an interval before feeding from a fresh stack can commence and if desired this break in supply can be avoided by providing an apparatus for feeding records from two stacks alternately, comprising two apparatus as defined above, and including means for detecting when all records have been fed from the stack of one of said apparatuses and means for terminating operation of the one apparatus and initiating operation of the other apparatus under control of said detecting means.

Apparatus embodying the invention may also include a variety of other features, as will be seen from the following description of one preferred form of apparatus. Reference will be made to the accompanying drawings in which:

FIG. 1 is a diagrammatic side view of apparatus for feeding records, one at a time, from the top of a stack,

FIG. 2 is a plan view of part of the apparatus of FIG. 1, drawn to a larger scale, and showing more detail,

FIG. 3 is a section on the line III—III of FIG. 1, but showing more detail, and drawn to the same scale as FIG. 2,

FIG. 4 is a view, partly in section, and on a larger scale of a detail of FIG. 3,

FIGS. 5A, 5B and 5C show three successive stages in the separation of a record from the top of a stack,

FIG. 6 shows a modification to part of the apparatus of FIG. 3,

FIG. 7 is a view of the modified part shown in FIG. 6 taken in the direction of arrow VII of FIG. 6, and

FIG. 8 shows diagrammatically a modification to a different part of the apparatus of FIG. 3.

Referring first to FIG. 1 two stacks of records **390, 390*a*** are shown respectively positioned beneath suction feed assemblies **391, 391*a*** arranged to remove successive records from the top of the stacks. The stack **390** is shown after removal of some records therefrom by assembly **391**, and when the last record has been removed, the assembly **391*a*** is operated to start removing records from the top of stack **390*a***. Whilst records are being removed from stack **390*a***, a further stack is positioned beneath assembly **391** which operates, after the stack **390*a*** has been exhausted, and so on. Records removed from the stacks **390, 390*a*** are placed, by the associated feed assembly, between a pair of grooved horizontal guides **392**, of which only one is visible in FIG. **1**, along the grooves **392*a*** of which the records are pushed, in the direction of arrow A, by fingers **393** carried on chain conveyors **394**. On reaching the right hand end of the guides **392** (as viewed in FIG. **1**) the records drop on to the top of a small stack **395** (which functions as a buffer store) and are removed one at a time from the bottom of stack **395** by mechanism (not shown) which forms no part of the present invention. The stacks **390, 390*a*** are carried on pallets **396** which are movable over a flat horizontal table **397** to the positions shown. Each pallet is provided with a vertical central pillar **398** which passes through the central holes of the records, and three holes arranged symmetrically around the centre thereof and within an area corresponding to the label area of the record (i.e. that part in the centre of the record having no playing groove formed in it). When a pallet is positioned below one of the feed assemblies **391, 391*a*** the three holes therein are arranged to line up with three further holes provided in the table **397** so that three rods **399** (FIG. **1**) may project through the aligned holes to lift the stack of records as will be described later, to a position adjacent the associated suction feed assembly.

As the mechanisms for removing records from the stacks **390, 390*a*** are identical, in the following description only the mechanism for removing records from stack **390** will be described in detail.

Referring now to FIGS. **2, 3** and **4** the rods **399** are secured at their lower ends (FIG. **3**) to a triangular platform **400** having a bearing **401** fixed to each of its corners. The bearings are slidable on guide bars **402** which extend vertically between the underside of the table **397** and a base **403**. The platform is raised and lowered between the bars **402** by a chain **404** which passes round sprockets **405** carried on stub shafts **406**, the lower one of which is driven from a reversible motor **407** by a further chain **408**. Fixed to one of the guide bars **402**, at a position near to the base **403**, is a micro-switch **409**, and at a position near the table **397**, is a further microswitch **410**.

In operation a pallet **396**, carrying a stack of records, is moved to the position shown in FIG. **3**, where it comes up against a stop **411**. At this stage the platform **400** is stationary and at the lower end of its path of movement, so that the upper ends of the rods **399** are below the table **397**. In this position the holes in the pallet **396** line up with the holes in the table **397**. The arrangement is such that after the pallet engages the stop **411**, a start button (not shown) is depressed to start the motor **407** which drives the chain **404** in a direction such as to start raising the platform. This causes

the rods **399** to pass through the aligned holes in the table **397** and pallet **396** to engage with and raise the stack of records carried on the pallet. This movement continues until a micro-switch **412** is opened, which causes the motor **407** and thus the platform **400** to stop. The switch **412** is operated by one end **413** of a lever freely mounted on a pivot pin **414** which is supported as will be explained later. The other end of the lever is formed as a finger **415** which rests on top of the stack of records. As records are removed from the top of the stack the height thereof will be reduced and the finger **415** will thus swing anti-clockwise on the shaft **414** until the end **413** of the finger **415** closes micro-switch **412,** which causes the motor **407** to again start driving the chain so as to raise the platform. The level of the top of the stack is thus kept at a reasonably constant height. As the stack moves upwards towards the finger **415** it is guided laterally by two pairs of posts **416, 416***a* FIG. **2**), thus keeping the sides of the stack substantially vertical.

The suction assembly **391** is shown in detail in FIG. **4** and consists of a housing **417** which carries three suction pads **418** equispaced round a flange **419** provided at the bottom of the housing. The pads **418** are connected by pipes **424,** carried in housing **417,** to a suction pipe **425** which is in turn connected to a source of suction (not shown). A further pipe **426,** also carried in the housing **417** is connected to a source of pressure air (not shown).

A bush **420** is provided with a flange **421** which is fixed to the underside of flange **419,** and extends into a vertical bore **422** formed in the centre of the housing **417.** The bush **420** is provided with a hole **427** which aligns with the pipe **426,** and a longitudinal slot **428** formed in its inner surface between the hole **427** and the top end of the bush. Passing down the centre of the bush **420** is a plunger **423** provided at its upper end with a flange which engages the top end of the bush **420** and prevents the plunger **423** from falling out of the bush **420.** The plunger **423** has a circumferential recess **429** which, during separation of the top record from the stack, becomes aligned with hole **427** in bush **420.** The plunger extends below the suction pads **418** and is formed at its lower end into a short cylindrical nose **430** having a diameter which is less than the diameter of the central hole in a record, and a slot **431** formed in its end face. The recess **429** is in communication with the slot **431** by means of a hole **432.**

The assembly **391** is mounted so that it may be moved vertically towards and away from the top of the stack **390** as it removes successive records therefrom. For this purpose there is provided a bar **433** (FIG. **3**) which extends vertically upwards from the top of the housing **417.** through a fixed bearing block **434** in which the bar **433** can slide. The block **434** is carried between cross members **435** which are fixed at their ends to side frames **436** of the apparatus. The blocks **434** are so positioned that the assembly **391** moves in a vertical path which is slightly offset to the left (as viewed in FIG. **3**) of the vertical centre line of the stack **390.** The assembly **391** is raised and lowered by a cam **437,** fixed to a cam shaft **438** which rotates as shown by the arrow in FIG. **3,** on which runs a roller **439** carried by an arm **440** pivoted at one end to a stub shaft **441** and at the other end to the top of the bar **433.** The roller **439** is kept in contact with the cam **437** by a spring **442.**

Before the top record of the stack can be separated therefrom, it has to be moved to the left (as viewed in FIG. **3**) so that its central hole is in vertical alignment with the nose **430** of the assembly **391.** For this purpose, the finger **415,** previously mentioned as a level detector for the stack **390,** is moved by a cam **443,** also fixed to the cam shaft **438,** on which runs a roller **444** carried by one arm of a bell-crank lever **445,** pivoted at **446.** The other arm of the lever **445** supports, and is freely connected to the pivot pin **414.** To allow for the sideways movement of the top record of the stack, the two posts **416***a* (FIG. **2**) have their stack engaging faces shaped, near their top ends, as shown in FIG. **3** at **447.**

The end of the finger **415** which engages the record is shaped as shown in FIGS. **5A–5C.** The face **415***a* is of such depth that it engages the edge of only the top record, the face **415***b* engaging the top surface of the top record, and the face **415***c* is arranged to engage the edge of the top record, after the latter has been displaced and the finger withdrawn, so that the finger cannot move to displace the next record until the top record has been lifted away. This situation is shown in FIG. **5B,** where in chain dot lines a record which has not been picked up, is indicated.

The removal of a record from the top of stack **390** will now be described. With the parts positioned as shown in FIG. **3,** the switch **412** is open, and the motor **407** stopped. The finger **415** is resting on the top record. The finger moves forward (to the left in FIG. **3**) and pushes the record until it engages the shaped portion **447** of the posts **416***a*, at which position the central hole of the record is vertically below the nose **430.** The assembly **391** is lowered and the nose **430** locates in the central hole of the top record and rests on the next lower record, the central hole of which is still on the vertical centre line of the stack **390** (FIG. **5A**). The finger **415** is then moved back so that it disengages from the top record and rests on the next lowest one, ready to move it to the left. As the housing **417** is stil moving downwards the plunger **423** will move upwards relative to the bush **420,** to bring recess **429** in alignment with hole **427** in the bush **420,** and the further pipe **426** in housing **417.** This action lifts the flange, provided at the top of the plunger **423,** clear of the top of bush **420,** which puts the further pipe **426** into communication with the space between the top of the plunger **423** and the end of the bore **422** in the housing **417,** via hole **427** and slot **428.** The housing **417** continues downwards, until the pads **418** engage the label area of the record surface, when suction is applied to the pads **418** and pressure air is applied through pipe **426.** The pressure air feeds into recess **429,** through hole **432** and out through slot **431** in the end of nose **430,** to assist in separating the top record from the next lower one. Pressure air also feeds from hole **427** along slot **428** in bush **420,** and into the space above the top of plunger **423.** The pressure air acts on the top of plunger **423** and also on the closed end of hole **422** in housing **417.** Due to the plunger being unable to move downwards, as the nose **430** is in contact with the stack **390** the housing **417,** and thus the pads **418,** are forced upwards, and the top record lifted to separate it from the stack, by the suction applied to the pads. When the record has been separated, the pressure air in pipe **426** is turned off and plunger **423** returns to the position shown in FIG. **4.** The assembly **391** is lifted further, by cam **437,** until the record is so positioned that it can be gripped

by two gates **448, 448***a* (FIGS. **2, 3**), at two diametrically opposite points, which are formed as movable parts of the guides **392** (FIG. **5B**). The gates **448, 448***a* are fixed to one end of levers **449, 449***a* respectively , the lever **449**, being freely carried on stub shaft **441**, and the lever **449***a* being freely carried on a further stub shaft **450**. The other ends of the levers **449, 449***a* are pivotally connected at **451**. The lever **449** carries a roller **452** which runs on a cam **453** fixed to cam shaft **438**. By the time the record being lifted on the pads **418** has reached the position shown in FIG. **5B**, the gates **448, 448***a* have been moved out of alignment with the guides **392** as shown in that Figure. The assembly **391** is now stopped in its upward path, whilst the gates are moved towards the record, by cam **453** until they grip the record, at which point the suction is cut off from the pads **418** and the assembly **391** moves upward again to disengage the nose **430** from the central hole in the record. The record is then engaged by fingers **392** which push the record, in the direction of arrow A (FIG. **1**) and deliver it to the top of the small stack **395**.

Included in the stack of records **390** are a number of metal supporting discs (not shown) which are of the same dimensions as a record, but are not delivered to the stack **395**. The metal discs are fed from the stack, as they reach the top thereof, in the same way as a record, but as they are being pushed along the guides **392**, by finger **393**, their presence is detected by a magnetic or capacitative sensing device **454** (FIG. **2**) which energises a solenoid **455** to cause a further pair of gates **456**, in the guides **392** and similar to gates **448, 448***a*, to be moved out of alignment with the guides **392**, so that the metal discs drop into a collection box **456***a* (FIG. **1**).

The cam shaft **438** is driven from a further shaft **457** via a single-revolution clutch **458**, which is operated upon energisation of a solenoid **459**. The shaft **457** is driven from a drive shaft **460** by a chain **461**, which is driven continuously from a drive unit diagrammatically shown in FIG. **2** at **462**. The clutch **458** is constructed and operates in exactly the same manner as the clutch **351** and solenoid **372** shown in FIGS. **2, 3** of copending application of even date entitled "Improvements in apparatus for releasing articles from a stack."

The arrangement is such that when the last record has been removed from the stack **390** the switch **410** is closed, by platform **400**, which starts the motor **407** to cause the platform, and thus the rods **399**, to descend until the platform closes switch **409** to stop the motor **407**. The rods **399** are now retracted below the table **397** and the empty pallet **396** can be replaced by one carrying a further stack of records.

Closing of the switch **410**, as mentioned above, also causes feed of records to be continued from stack **390***a* by the assembly **391***a* in the same manner as just described in relation to stack **390** and assembly **391**.

When the last record of stack **390***a* has been fed by assembly **391***a*, records are again fed by assembly **391**, the changeoever taking place after a short time delay so that the last record from stack **390***a* can be pushed along the guides **392** to a position so that it does not impede the operation of assembly **391**.

In the apparatus above described the finger **415** carries out two functions; namely, as a detector for operating the micro-switch **412**, so as to keep the top of the stack of records at a reasonably constant height, and also as a pusher for moving the top record of the stack to the left (as viewed in FIG. **3**) so that its central hole is in vertical alignment with the feed assembly which removes the top record from the stack. The use of the finger **415** in such a manner may lead to the switch **412** being operated when the height of the stack of records is between predetermined upper and lower limits, and thus cause the motor **407** to stop or start at inopportune times.

To counter this two separate fingers may be provided, one shown at **415***a* (FIGS. **6** and **7**) being arranged to operate only as a pusher as previously described (and being similar to finger **415** except that it has no tail **413**), and a further finger **458** provided to act as a level detector for the height of the stack of records. This further finger **458** is freely mounted on a pivot pin **459** carried in a block **460** mounted on one of the side frames **436**. One end of the finger **458** is formed as a tail **460***a* which operates a micro-switch **412a**, which is similar to the switch **412** previously described, and operates in exactly the same way. The other end of the lever **458** rests on top of the stack of records and carries out the same function as previously described with reference to the use of finger **415** as a level detector.

Also in the apparatus above described the pallet **396** is movable over the table **397** up to a stop **411**. When all the records have been removed from the pallet, the latter has to be moved away from the stop before a new full pallet can be moved up to the stop.

To make the changeover of pallets easier a retractable stop may be provided. Such a stop is shown at **461** in FIG. **8**. The stop is formed on the end of a piston rod **462**, the piston of which moves in cylinder **463**, a spring **464** being provided in the cylinder to bias the stop **461** into the position. shown in FIG. **8**. The cylinder **463** is connected by a pipe **465** via a valve **466** operated by a foot pedal **467**, a pipe **468**, a further valve **469** and a further pipe **470** to a source of pressure air, not shown.

With the apparatus in the position shown in FIG. **8** the pallet cannot be moved beyond the stop **461**. When all the records have been removed from the pallet the platform **400** starts to descend, as previously described, and when it operates switch **409**, a lug **471** movable with the platform causes the valve **469** to move from the full line position to the dotted line position and pressure air flows along pipe **468**.

When the operator wishes to replace the now empty pallet with a full one, he presses down the pedal **467** which causes the valve **466** to move from the full line position to the dotted line position. This allows pressure air to flow along pipe **465** and into the cylinder **463**. The air pressure in the cylinder overcomes the spring **464** and the piston, and therefore also thestop **461**, are moved downwardly so that the stop is retracted below the surface of the table **397**.

The empty pallet may now be pushed to the left (as viewed in FIG. **8**), and a new full pallet moved in the same direction towards the stop **461**, which is restored to its original position by the spring **464** when the operator releases the foot pedal **467** to return the valve **466** to the full line position and thus cut off the supply of air to the cylinder **463**.

It will be appreciated that the valve **469** is provided so that, even if the pedal **467** is operated, the stop **461** cannot be retracted while the platform **400** and rods **399** are raised.

What we claim as our invention and desire to secure by Letters Patent is:

1. Apparatus for feeding records successively from a stack, comprising means for displacing the uppermost record out of alignment with the remainder of the stack, a plurality of suction pads engageable with said uppermost record after said displacement at positions around but not overlapping the central hole of said record, locating means associated with said pads for entering said central hole to ensure desired lateral location of said record relative to said pads, and means for simultaneously lifting said pads and applying suction to the pads while said locating means engages the next adjacent record in the stack to assist separation of said uppermost record from said next adjacent record.

2. Apparatus as claimed in claim 1, including lifting means adapted to receive a stack of records and raise said stack into operative relationship with said displacing means and suction pads.

3. Apparatus as claimed in claim 2, including means for sensing the level of the uppermost record of the stack as the latter is raised by the lifting means, said lifting means having control means associated with said sensing means so that the control means causes operation of the lifting means to cease when said uppermost record has been raised to a predetermined level.

4. Apparatus as claimed in claim 3, in which said sensing means and control means are arranged to cause the lifting means to resume operation whenever removal of records from the top of the stack results in the uppermost remaining record in the stack being at a second and lower predetermined level.

5. Apparatus as claimed in claim 4, in which said sensing means includes a pivotally mounted finger arranged so that one of its ends rests upon the uppermost record whenever the latter is no lower than the second predetermined level, said finger being arranged to influence the control means.

6. Apparatus as claimed in claim 5, in which the displacingmeans comprises a finger pivotally mounted upon a reciprocable member, one end of said finger resting upon the top of said stack and having a stepped underside so that it simultaneously engages the upper and edge surfaces of the uppermost record.

7. Apparatus as claimed in claim 6, in which the finger of the sensing means is arranged to serve also as the finger of the displacing means.

8. Apparatus as claimed in claim 2 for feeding records from a stack carried on a pallet, including support means having a surface over which said pallet is movable and through which said lifting means passes to raise said stack, stop means associated with said support means, means for resiliently urging said stop means to an operative position above said surface, said stop means being arranged to abut against said pallet when said stack is positioned above said lifting means, means to move said stop means to a retracted position below said surface, and control means for effecting operation of said moving means to permit movement of said pallet over said surface away from said lifting means.

9. Apparatus for feeding records from two stacks alternately, comprising two apparatuses each as claimed in claim 1, and including means for detecting when all records have been fed from the stack of one of said apparatuses and means for terminating operation of the one apparatus and initiating operation of the other apparatus under control of said detecting means.

10. Apparatus as claimed in claim 1, in which the pad lifting means is arranged to raise the uppermost record to a position between movable parts of a pair of grooved horizontal guides, said movable portions being connected to actuating means operable in synchonism with said pad lifting means so that said movable portions are held apart while the record is lifted between them and then moved together to engage said record and become aligned with the remainder of said guides.

11. Apparatus as claimed in claim 10, including a pair of chain conveyor extending between and parallel to said horizontal guides, said chain conveyors each carrying a plurality of regularly-spaced pusher fingers adapted to propel records engaged between said guides, the pad lifting means being arranged to lower the suction pads after each record has been engaged by the guides and propelled out of the path of said suction pads.

12. Apparatus as claimed in claim 1, in which the locating means comprises a plunger having a nose engageable within the central hole of the uppermost record after displacement thereof, the suction pads and pad lifting means being arranged to lower the plunger and pads into engagement with the uppermost record after operation of the displacing means so that said nose enters said central hole and rests on the record next to said uppermost record while the pads complete their downward movement into engagement with the uppermost record.

13. Apparatus as claimed in claim 12, including means for blowing air through said nose while the pad lifting means is raising the suction pads to lift the uppermost record.

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