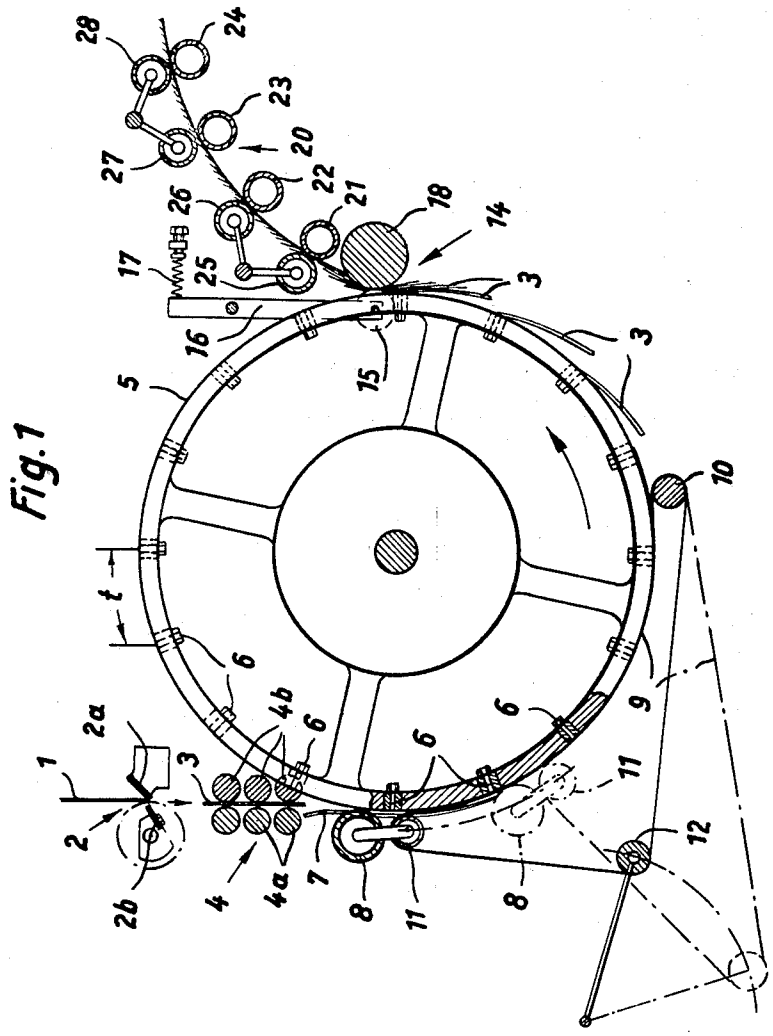
Oct. 29, 1968 P. FABRIG 3,408,063

APPARATUS FOR STACKING SHEETS OF MATERIAL

Filed May 25, 1966 2 Sheets-Sheet 1

Fig. 1



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Filed May 25, 1966 2 Sheets-Sheet 2

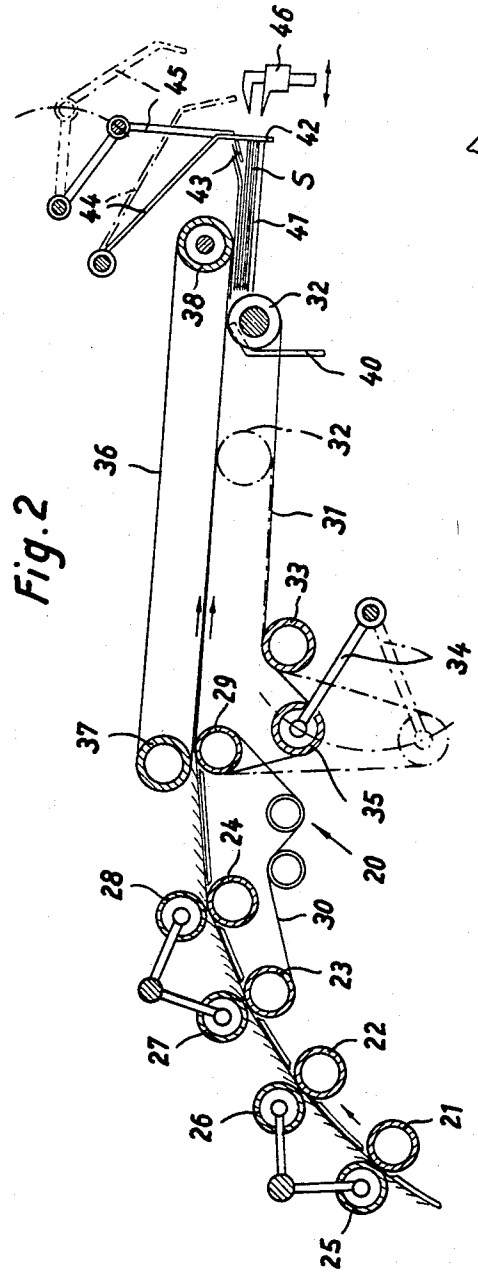


Fig. 2

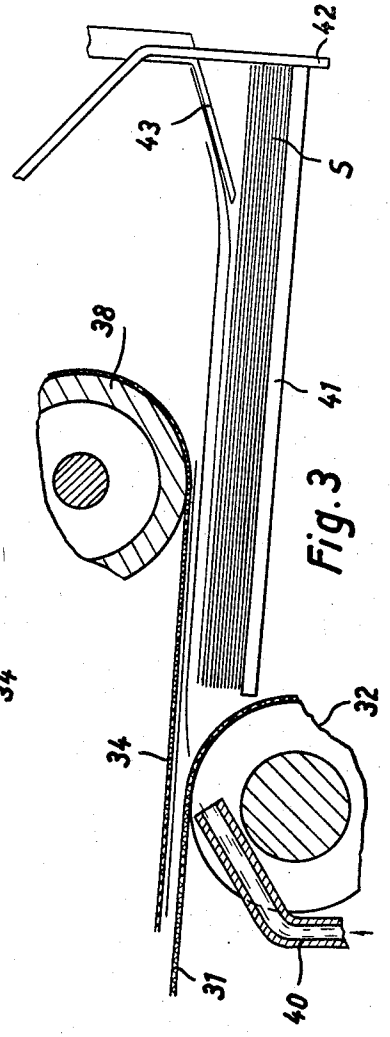


Fig. 3

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United States Patent Office 3,408,063
Patented Oct. 29, 1968

3,408,063

APPARATUS FOR STACKING SHEETS OF MATERIAL

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Filed May 25, 1966, Ser. No. 552,745
Claims priority, application Germany, Nov. 13, 1965, B 84,488
4 Claims. (Cl. 271—3)

ABSTRACT OF THE DISCLOSURE

An apparatus for collecting and stacking sheets which are cut off in consecutive order from a continuous web. A slow-down transport system for the cut sheet and a device for taking partial stacks of equal size from the stacking apparatus without interrupting the continuous flow of the sheets to the stack.

The present invention relates to an apparatus for collecting and stacking sheets cut from travelling bands of material, in which the successive sheets are conveyed by suction applied in the region of their leading edges at a speed substantially equal to the speed of the incoming sheets and are then transferred to a slower-moving transport system, which conveys the sheets in staggered superimposed formation to a stacking station.

In known suction distributors, the sheets are guided from above in substantially horizontal direction to a suction wheel which, after about a quarter-turn, feeds them from above to a star distributor which can be regulated according to the desired number of sheets. During this movement, the sheets peeled off from the suction wheel are braked to a standstill suddenly in the pockets of the star distributor. As a result the sheets are exposed to the inertial forces depending on their speed of arrival and they tend to buckle. Since buckling of the sheets is to be avoided, there speed of arrival must be limited, and account has to be taken of the size of the sheets and the type of material.

In another known suction-distributor unit, employed for the staggered laying-down of envelope blanks on a relatively slowly travelling delivery band, a sudden strong reduction of the travelling speed of the sheets is avoided. Suction elements seize the leading edges of the sheets on the upper portion of a distributor wheel and gradually reduce their angular velocity over an angle of rotation of about 90° in relation to the distributor wheel rotating with the speed of arrival of the sheets. The sheets manually peeled off the suction wheel are then introduced in a descending movement into a delivery band, which operates substantially at the reduced terminal velocity of the suction elements.

The object of the invention is to eliminate the disadvantageous effects of the inertial forces during the reduction of the travelling velocity required for the staggered stacking of the sheets, without incurring a considerable expenditure involved in a control system effecting the gradual reduction of the velocity of the suction system. This is achieved according to the invention in that successive sheets are initially conveyed under suction applied in the region of their leading edges at a speed substantially equal to the speed of the incoming sheets and are then transferred from below to a transport system moving at a slower speed for transfer in staggered superimposed formation to a stacking station. The sheets hanging loosely prior to reaching the transfer point are only briefly upset and straighten out thereafter immediately to continue their run without the formation of folds. In this manner, even long sheets can be processed at high speeds.

Suction apertures are preferably arranged on a circular path, e.g. on a suction wheel, and the point of transfer to the slower-running transport system is located in a region in which the sheets ascend in a substantially vertical direction. This offers the further advantage that the sheets in hanging freely from the periphery of the suction wheel in front of the transfer point are swung outward by centrifugal force, and as a result each successive sheet can run without disturbance and without undue friction underneath a preceding sheet into the slower-moving transport system.

Preferably, a multiplicity of suction apertures are arranged on the suction system with relatively close spacing, their connection with the suction line being controllable in such a manner that in the region between the entry point and the transfer point alternately every suction aperture, every second suction aperture, every third suction aperture, etc., becomes effective. In this manner, the change-over from one sheet size to another is very simple and depends on the incoming velocity of the sheets. By contrast, in the known embodiments, the suction apertures are arranged on the suction system with a spacing which corresponds to the largest sheet size. If the size is reduced, then the take-off rollers associated with the cross cutter must be accelerated to such a degree, that the spacing of the leading edges of the successive sheets again coincide with the spacing of the suction apertures. This complication is thus eliminated.

The invention will be described further, by way of example, with reference to the accompanying drawings, in which:

FIG. 1 is a cross-section through a suction wheel, showing means for the introduction and removal of sheets;

FIG. 2 is a cross-section through a take-off conveyor having stacking and counting means; and

FIG. 3 is a partial cross-section of the stacking and counting means on an enlarged scale.

A band of material **1**, e.g. a paper band, travelling at high speed, runs through a cross-cutter **2**, which severs the band into sheets **3** of equal length. The cross-cutter **2** is shown in the drawing as a rotatable cutter having a stationary knife **2***a* and a rotatable knife **2***b*. The cross-cutter **2** is followed by a take-off device **4** having a number of serially arranged powered roller pairs **4***a*, **4***b*. The peripheral velocity of the take-off rollers is somewhat greater than the traveling speed of the paper band prior to reaching the cross-cutter **2**, in order to create a small gap between successive sheets **3**. In the illustrated embodiment the take-off device **4** is so arranged, that the sheets emerge from it in a downward vertical direction. From the take-off device **4** the sheets are fed to a suction system travelling with the velocity of the incoming sheets, said suction system comprising in the present illustrated embodiment in a manner known per se by a suction wheel **5** driven at the speed of the incoming sheets and comprising at least two discs, with axially parallel rows of equidistantly spaced suction apertures **6** on its circumference. The suction wheel **5** is so arranged, that the sheets leaving the take-off device **4** run to it tangentially from above in the vertical direction. The sheets are guided on to the wheels **5** by guide vanes **7** disposed below the take-off device **4** as well as a pickup roller **8** which presses the sheets against the periphery of the suction wheel **5**. Adjusting means ensure that the leading edges of the sheets **3** on the suction wheel **5** and pointing in

the direction of travel just cover a row of suction apertures in each case. A multiplicity of suction apertures are provided around the periphery of the suction wheel **5**. Their spacing *t* corresponds to the smallest sheet length envisaged.

The suction apertures **6** are connected to a suction line through a control means here not shown, which effects that in each case only those suction apertures which are located on the sector between the entry point on the pickup roller **8** and a transfer point, to be described hereinafter, leading to a slower-travelling transport system are under vacuum. Furthermore, the control of the suction apertures is so constituted, that for adaptation to the sheet length within the aforesaid region in each case either every suction aperture row, every second or every third, etc. suction aperture row can be rendered effective.

The pickup roller **8** is followed in the direction of rotation of the suction wheel **5** by a traction band **9**, which presses the received sheets over a considerable portion of the sector extending to the transfer point against the periphery of the suction wheel. This relative extensive application of the sheet against the suction apertures ensures, that the vacuum in the suction apertures engaging the sheet is built up to its full extent and that the sheets adhere securely with their leading edges to the suction wheel. The traction band **9** has in the example here shown three guide rollers **10**, **11** and **12**, of which the first **10** is fixedly mounted while the second **11** is coupled to the pickup roller **8**. The distance of the roller **8** from the take-off device **4** is adjustable for adaptation to the sheet length in peripheral direction of the suction wheel **5**. The third roller **12** acts as a tensioning roller. In this manner, it is possible to vary the angle of envelopment of the traction band in dependence of the distance between the pickup roller **8** and the take-off device **4**, adjustable according to sheet length (see the positions drawn in full and composite lines respectively of the traction band **9** in FIG. 1).

The transfer point **14**, leading to the slower-travelling transport system is so situated in the present embodiment, that the sheets adhering with their leading edges to the suction wheel **5** run to it substantially vertically from below. Between leaving the traction band **9** and reaching the transfer point **14**, the sheets adhering by suction with their leading edges to the periphery of the suction wheel **5** hang freely downwards. The sheets are additionally swung away from the periphery of the suction wheel by the action of centrifugal force. At the transfer point **14**, a tear-off roller **15** is located between the discs of the suction wheel. This roller **15** is mounted on a pivot lever **16** and is urged by a spring **17** engaging the lever against a roller **18**, the periphery of which is at a small distance from the periphery of the suction wheel **5**. The roller **18** is driven at a speed which is several times smaller than the peripheral velocity of the suction wheel **5** and corresponds to the transport velocity of the following transport system designated as a whole by the reference **20**. The tear-off roller **15** pushes the sheets away from the periphery of the suction wheel **3** and on to the roller **18** so that the sheets are thereafter moved at the smaller peripheral speed of this roller **18**. On transition to the lower speed inertial forces arise which briefly upset the freely hanging sheets, which then straighten out immediately. The deceleration at the transfer point **14** has the result that the sheets pass in a staggered superimposed arrangement to the transport system **20**. Therefore, as can be seen in FIG. 1, each successive sheet must run in beneath the preceding sheet. It is thus seen that it is advantageous that the sheets are swung away to an appreciable extent from the surface of the suction wheel **5** by the action of the centrifugal force.

The transport system **20** shown separately in FIG. 2 has at the start of the conveyor path driven conveyor rollers **21** to **24**, effecting deflection in horizontal direction, which are opposed by pressure rollers **25** to **28** which press the stream of sheets against them. The conveyor rollers **23** and **24** and a driven roller **29** following them in transport direction form guide rollers of a traction band **30**. The traction band **30** is adjoined by a belt conveyor having a slight downward slope in transport direction. The bands of the lower traction belt **31** of the belt conveyor are looped around the roller **29** at the entry end and around a driven roller **32** at the outlet end and are passed around a fixed driven guide roller **33** as well as around a guide roller **35** mounted on a pivotally adjustable lever **34**. The upper traction belt **36** of the belt conveyor extends in the transport direction beyond the lower traction band **31** and runs over two driven rollers **37** and **38**.

The mounting, here not shown, of the roller **32** located at the outlet end of the lower traction belt **31** is linked with airblast-tubes **40**, which are directed from below against the sheets emerging from the belt conveyor. In this way the sheets leave the belt conveyor without friction, floating on a stream of air. The emerging sheets pass on to a receiving table **41**, and come to rest against a stop **42**. The sheets are thus stacked into a neat pile. Above the receiving plate **41** a separator **43** is arranged on a rocking lever **45**. The stop **42** is likewise arranged on a rocking lever **44** and can be moved with the latter into an ineffective position (drawn in composite lines in FIG. 2), as soon as the separator **43** reaches into a corresponding interval of the incoming staggered stack at a short distance in front of the stop and partitions off a desired number of sheets above the receiving plate **41**. Here, the separator briefly acts as a stop for the sheets. The stack S separated by the separator **43** above the receiving plate **41** is seized, while the stop **42** is disengaged, under the separator **43** by a reciprocating clamp **46**, the separator **43** moving into its ineffective position and the stop **42** returning into its effective position, so that a fresh stack S can be formed on the receiving plate.

When the length of the sheets is changed, a correspondingly long receiving plate **41** must be substituted and the distance between the leading roller **32** of the lower traction band **31** and the stop **42** is to be changed accordingly, which is effected by adjusting the position of the guide roller **35** in the manner indicated by composite lines in FIG. 2.

I claim:

1. An apparatus for stacking sheets cut off from a continuous web of material, comprising suction apertures arranged in a circular path, said suction apertures gripping the leading edges of said sheets and conveying same at a speed substantially equal to the speed of the incoming sheets, means to strip said material from said suction apertures, a transport system for receiving said sheets from said suction apertures, said system travelling at a slower speed, said sheets being introduced from below into said transport system and said slower moving transport system having a point of transfer from said suction apertures located in an area in which said sheets move upwardly in a substantially vertical direction.

2. An apparatus for stacking sheets according to claim **1**, and comprising a suction wheel, a plurality of said suction apertures disposed around the periphery of said wheel at equal distances from one another, said distances substantially corresponding to the shortest cut off length of said sheets and control means for said suction apertures operable dependent upon the length of said sheets.

3. An apparatus for stacking sheets according to claim **2**, and comprising a receiving platform, an adjustable, pivotable stop on said platform, said stop having an operative and an inoperative position, means feeding compressed air for conveying said sheets travelling in staggered superimposed formation from said transport system to said receiving platform for coming to a rest at said stop, a pivotable separator member operative when said stop is in said inoperative position, said member constituting a temporary stop and subdividing said

stacked sheets into a predetermined number of sheets, and a reciprocating clamp means for removing said subdivided number of sheets from said platform.

4. An apparatus for stacking sheets according to claim 3, and a belt conveyor interposed between said transport system and said receiving platform, said transport system having an adjustable length for varying the distance between said belt conveyor and said stop for accommodating sheets of various lengths.

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