United States Patent

Sullivan

[15] **3,638,538**

[45] **Feb. 1, 1971**

[54] CONTAINER MACHINERY

[72] Inventor: **John Anthony Sullivan,** Stockport, England

[73] Assignee: **Henry Simon Limited,** Stockport, England

[22] Filed: **July 2, 1970**

[21] Appl. No.: **51,919**

[30] **Foreign Application Priority Data**

July 24, 1969 Great Britain 37,202/69

[52] **U.S. Cl.** .....**93/93 DP,** 198/35

[51] **Int. Cl.**.....**B65h 33/00**

[58] **Field of Search**.....93/93 DP, 93 R, 93 M; 198/35

[56] **References Cited**

UNITED STATES PATENTS

3,191,927	6/1965	Hartbauer et al.	93/93 R UX
3,194,127	7/1965	Larsson	93/93 DP

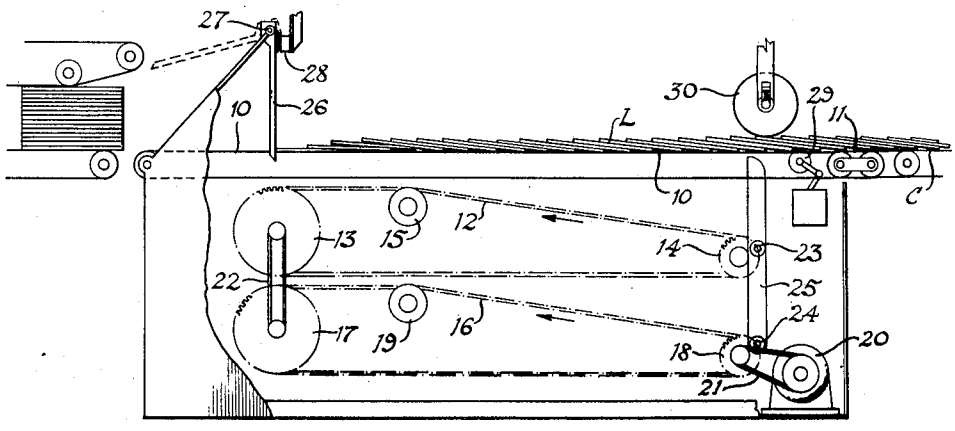
Primary Examiner—Bernard Stickney

Attorney—Norris & Bateman

[57] **ABSTRACT**

A method of forming a stack of cases from a moving line of cases in shingled configuration comprising the steps of providing means to engage the trailing edge of a case in said line and progressing said means forwardly at a speed greater than the speed of movement of said line so that successive trailing edges are in turn engaged by said means whereby that portion of the line forward of said first-mentioned trailing edge is gathered to form a stack of horizontal superimposed cases, and a machine for performing such method.

15 Claims, 7 Drawing Figures



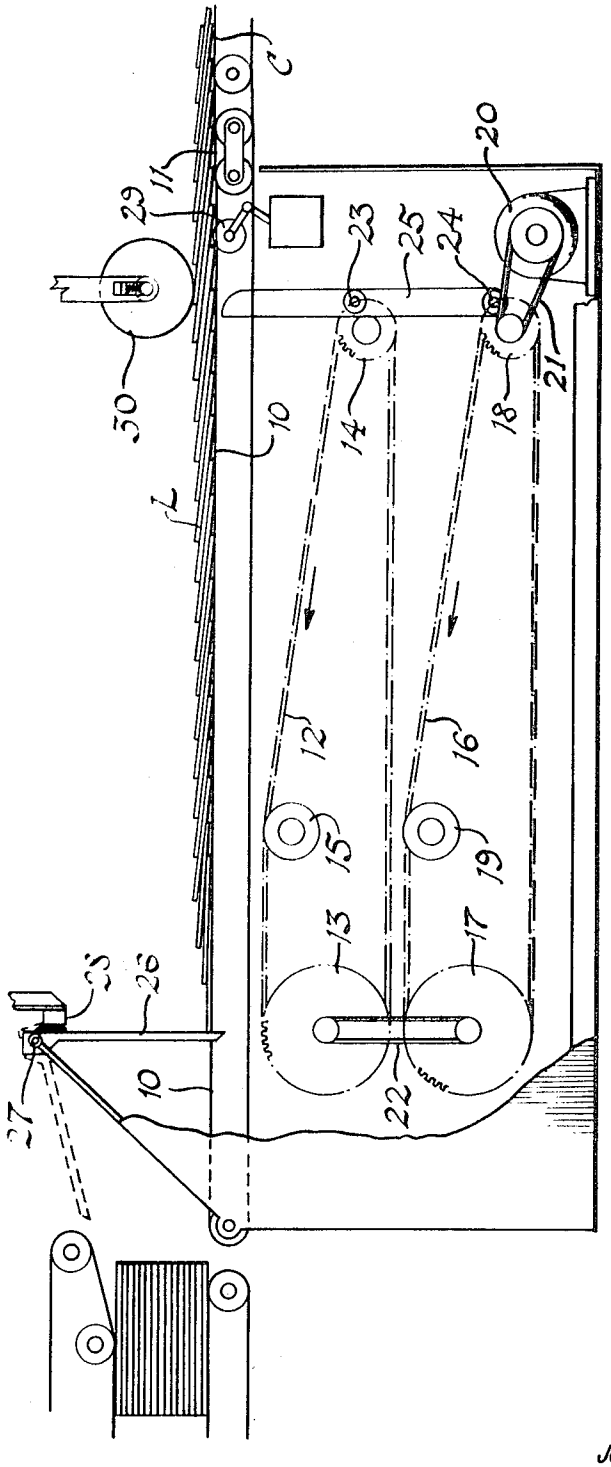


Fig. 1.

INVENTOR
JOHN ANTHONY SULLIVAN

BY Norris & Bateman
ATTORNEYS

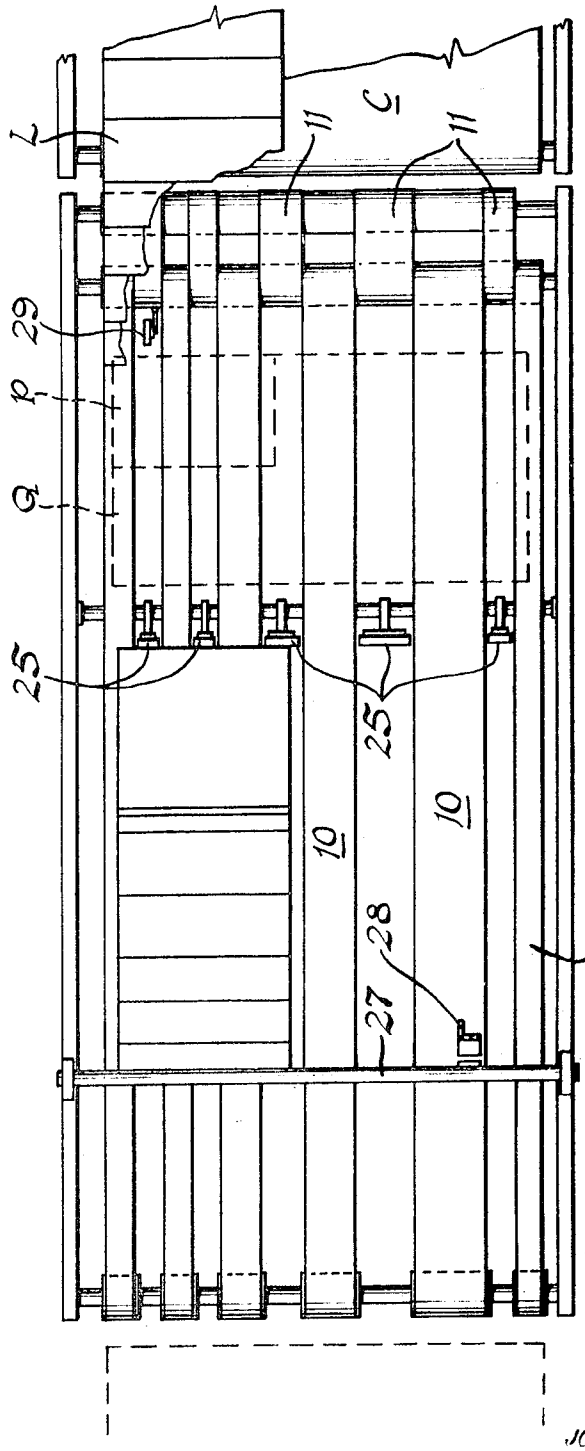


Fig. 2.

INVENTOR
JOHN ANTHONY SULLIVAN

BY Morris & Bateman
ATTORNEYS

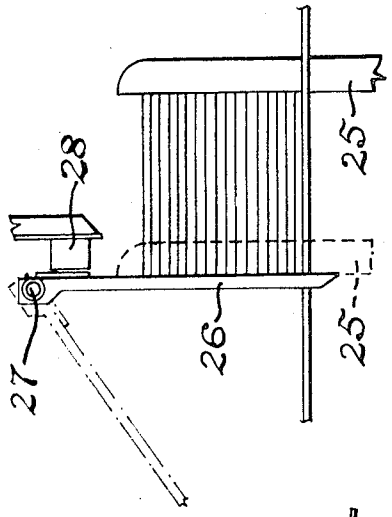


Fig. 4.

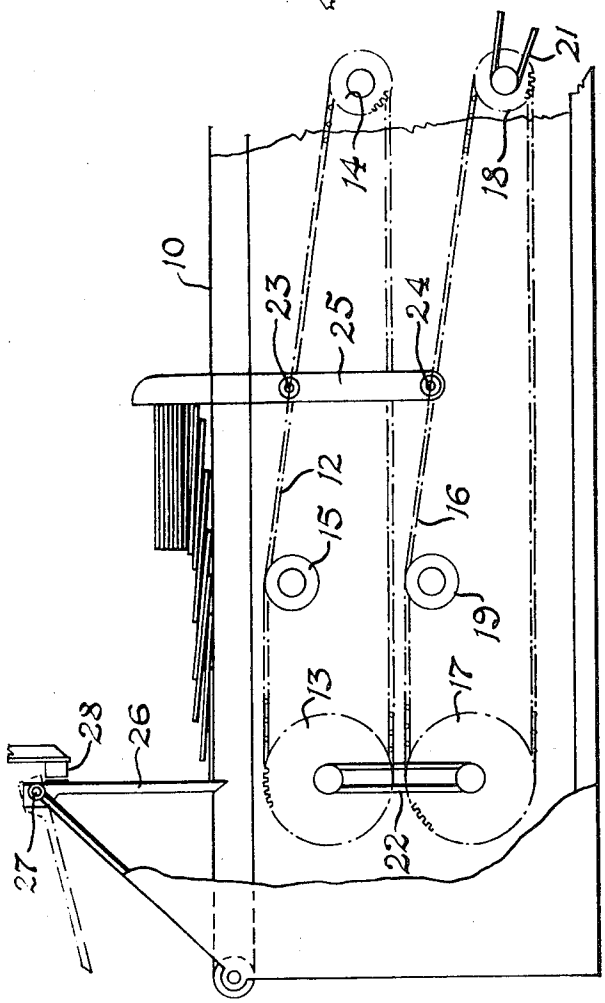


Fig. 3.

INVENTOR
JOHN ANTHONY SULLIVAN

BY
Norris & Bateman
ATTORNEYS

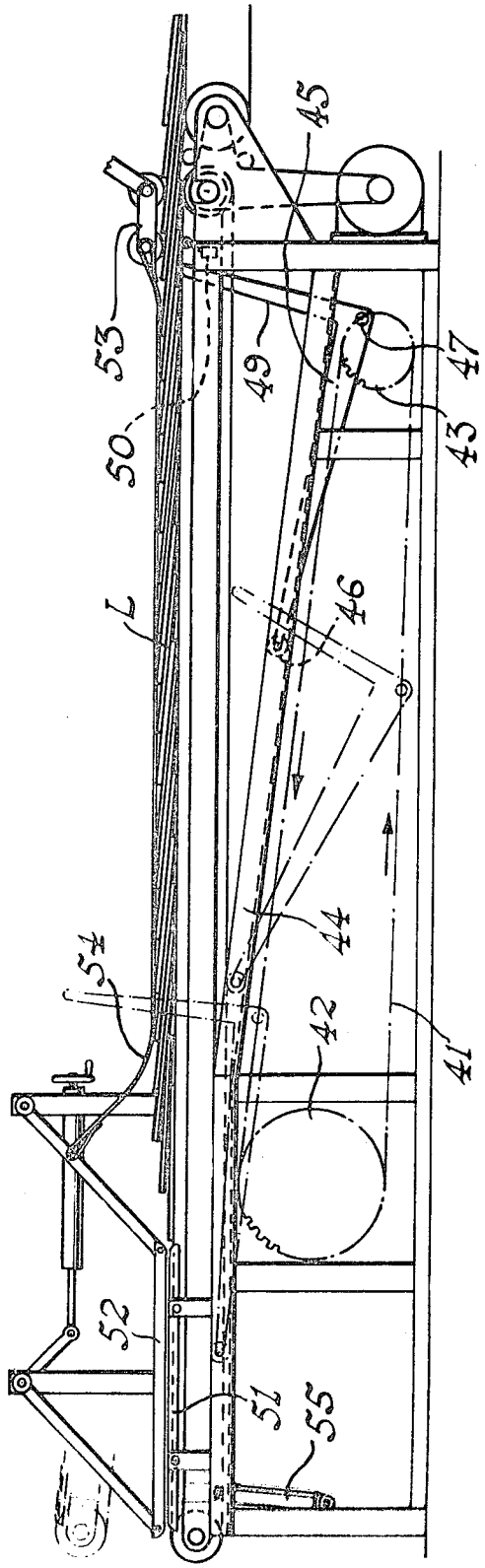


Fig. 5.

INVENTOR
JOHN ANTHONY SULLMAN

BY

Morris & Bateman
ATTORNEYS

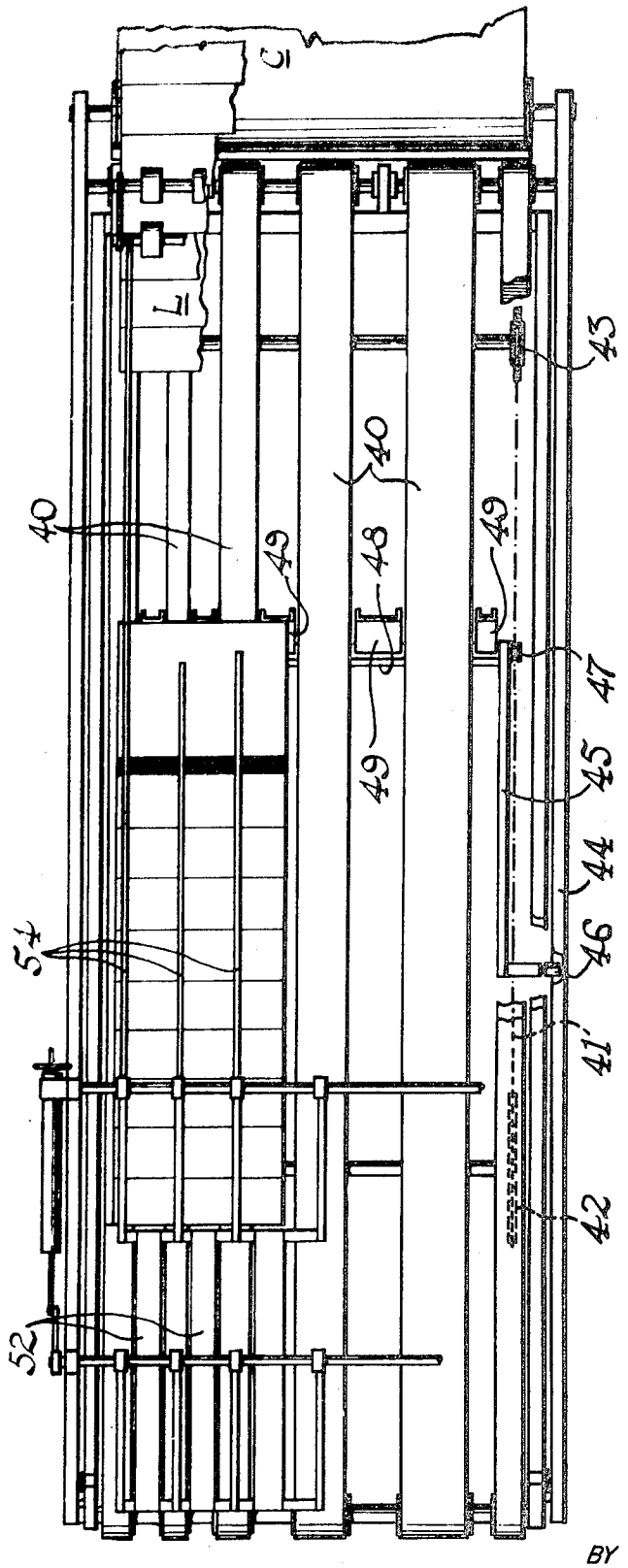


Fig. 6.

INVENTOR
JOHN ANTHONY SULLIVAN

BY
Norris & Bateman
ATTORNEYS

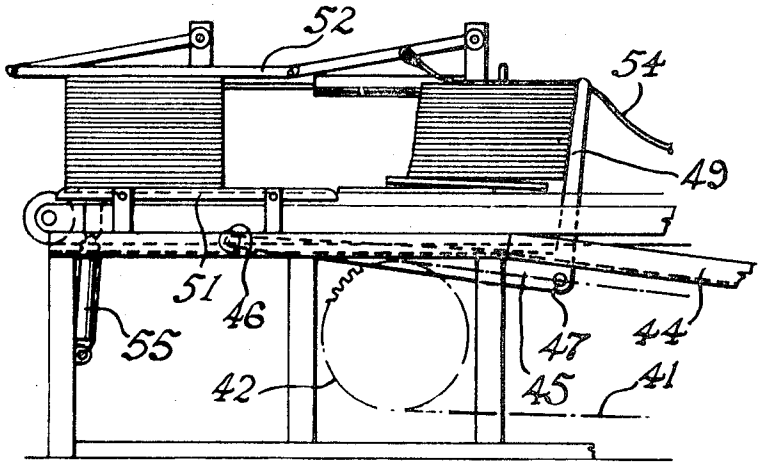


Fig. 7.

INVENTOR
JOHN ANTHONY SULLIVAN

BY
Norris & Bateman
ATTORNEYS

CONTAINER MACHINERY

This invention concerns container machinery, for making boxes or cases from corrugated board or similar material.

In a casemaking plant it is customary to collect the output of formed but collapsed cases from a casemaking machine into stacked bundles which can be tied preparatory to shipping. The provision of an effective machine for forming and progressing such bundles presents serious design problems if the operation of the machine is not to be adversely affected by a badly formed case in the feed of cases thereto.

Casemaking machines are frequently arranged to deliver formed cases onto a conveyor in a configuration such that the leading portion of each case is lapped over the trailing portion of the adjacent preceding case. Such a configuration will be referred to hereinafter as a shingled configuration.

The present invention is based on an appreciation of the fact that a line of cases in shingled configuration is effectively a stack of cases which has fallen onto its side and on the possibility of gathering such a line of cases into a stack.

Thus the present invention is more particularly concerned with a method and machine for receiving a feed of cases in shingled configuration and for stacking and ejecting those cases in the form of bundles of a predetermined number of cases for onward transmission to, for example, a tying machine.

According to the present invention a method of forming a stack of cases from a moving line of cases in shingled configuration comprises the steps of providing means to engage the trailing edge of a case in said line and progressing said means forwardly at a speed greater than the speed of movement of said line so that successive trailing edges are in turn engaged by said means whereby that portion of the line forward of said first-mentioned trailing edge is gathered to form a stack of horizontally superimposed cases.

The invention also includes a machine for carrying out the method aforesaid.

The invention will be further apparent from the following description, with reference to the several figures of the accompanying drawings, which show, by way of example only, two forms of machine embodying the invention and for practising the method thereof.

Of the drawings:

FIG. 1 shows a side elevation of the first form of machine immediately prior to the commencement of an operational cycle;

FIG. 2 shows a plan view of the machine of FIG. 1 part-way through an operational cycle;

FIG. 3 shows a fragmentary side elevation of the machine of FIG. 1 part-way through an operational cycle;

FIG. 4 shows a fragmentary side elevation of the machine of FIG. 1 just before the completion of the working part of an operational cycle;

FIG. 5 shows a side elevation of the second form of machine immediately prior to the commencement of an operational cycle;

FIG. 6 shows a partially cutaway plan view of the machine of FIG. 5 part way through an operational cycle; and

FIG. 7 shows a fragmentary side elevation of the machine of FIG. 5 just before the completion of the working part of an operational cycle.

Referring now to FIGS. 1 to 4 inclusive of the drawings, it will be seen that the first form of machine is adapted to receive a line of cases L in shingled configuration which is fed thereto by a conveyor C which forms part of the output stage of a casemaking machine.

The machine essentially comprises a plurality of conveying belts **10** which are disposed in side-by-side parallel spaced relationship and which extend along the length of the machine. These belts **10** have antifriction surfaces whereby the cases may be easily slid thereover. The line of cases L is transferred from the conveyor C to the belts **10** by means of transfer conveying belts **11** which are provided with grip faces and which extend from the conveyor C to have their forward ends lying between the adjacent belts **10**.

Beneath the level of the conveyor belts **10** at each of opposite sides of the machine are two identical chain drives arranged one above the other. The upper drive at each side of the machine comprises a chain **12** which passes around sprocket wheels **13** and **14** and over support roller **15** whilst the lower drive at each side comprises a chain **16** which passes around sprocket wheels **17** and **18** and over support roller **19**. The four chains can be driven simultaneously and at identical speeds, in the direction of the arrows shown on the drawing, by means of a motor **20** which has chain drives **21** connected with the sprocket wheels **18**, there being chain drive connections **22** between sprocket wheels **17** and **13** at each side of the machine. Bars **23** and **24** extend transversely between the two chains **12** and the two chains **16** on the opposite sides of the machine respectively, the bar **23** being parallel with and vertically above the bar **24**. A number of vertically extending collecting arms **25** are secured to the bars **23** and **24**, for a purpose which will be apparent hereinafter.

As can clearly be seen from the drawings the arms **25** can be moved by the chain drive arrangement to pass from an initial position (as shown in FIG. **1**) at the commencement of the machines cycle to a final position as shown dotted on FIG. **4** at the end of the working part of an operational cycle before return in reverse direction to be arrested at their initial position. As the arms **25** move along the length of the machine in forward direction they are gradually raised to a maximum height at a position corresponding with the position of the supporting rollers **15** and **19** whence they continue to move forwardly at that level before dropping sharply below the level of the conveyors **10** for return to their initial position. When the arms **25** are in an elevated position they protrude through the spaces between adjacent conveyor belts **10** as clearly seen from FIG. **2**.

At the front end of the machine is a door **26** which depends from a horizontal hinge-pin **27**. The door **26** is normally held closed by a magnetic catch **28** to constitute a backstop.

In use the machine receives a line of cases L in shingled configuration as described hereinbefore. The cases entering the machine are counted by means of a photoelectric or other suitable device operated by a roller **29** which is sensitive to the trailing edges of the successive cases in the line L. After a predetermined number of cases have been counted into the machine the motor **20** is operated to cause the arms **25** to move from their initial position as has been described above. As the arms move forwardly and upwardly they engage the trailing edge of the case in the line L corresponding with the required count and push it forwardly so that it overlies its preceding neighbor. As the arms **25** continue forwardly they pick up the successive trailing edges of the cases on the belts **10** to form the entire line into a stack of horizontally superimposed cases. The completed stack is pushed forwardly to meet the door **26** forming a backstop which ensures that the stack is properly squared. The continued forward movement of the arms **25** forces the door **26** to open by pivotting upwardly at the same time releasing the stack for conveyance from the machine to, for example, a tying machine. The arms then move round to return to their initial position where they are arrested to await the next operational cycle.

It will be understood that the arms **25** must be cycled around the machine at a speed which is substantially greater than the speed of the belts **10** to ensure that they are returned to their initial position in time for the next cycle when the required count of cases is again recorded. The necessary excess speed is determined by the total length of the machine and the minimum number of cases which might need to be bundled in any program.

A pressure roller **30** is provided at the input end of the machine and extends transversely over the width thereof. This roller ensures firstly, that the trailing edges of the cases properly actuate the counting mechanism, and secondly that the case immediately following that case making up to a required count is not displaced by the arms **25** at the commencement of an operational cycle.

As can clearly be seen from FIG. 2, the machine is capable of handling cases of varying sizes without adjustment, possible minimum and maximum sizes being indicated by the chain dotted outlines P and Q respectively.

Referring now to FIGS. 5 to 7 inclusive of the drawings, it will be seen that the second form of machine is, as before, adapted to receive a line of cases L in shingled configuration which is fed thereto by a conveyor C which forms part of the output stage of a casemaking machine.

The machine essentially comprises a plurality of conveying belts **40** which are disposed in side-by-side parallel spaced relationship and which extend along the length of the machine. These belts **40** have antifriction surfaces whereby the cases may be easily slid thereover. The line of cases L is transferred from the conveyor C directly onto the belts **40** for progression through the machine.

Beneath the level of the conveyor belts **40**, at each of opposite sides of the machine is a chain drive comprised by a chain **41** which passes around spaced sprocket wheels **42** and **43**. The forward sprocket wheels **42** are of substantially larger diameter than the rearward sprocket wheels **43**, and so arranged that the upper runs of the chains **41** rise steadily from the rear of the machine towards its output end. The two chains **41** are adapted to be driven simultaneously and at identical speeds in the direction of the arrows shown on FIG. **5** by suitable motor means (not shown). Oppositely disposed tracks **44** are provided on the opposite sides of the machine. Each track **44** rises gradually from the rear end of the machine to have a maximum height at a position adjacent the forward end of the machine and extends forwardly from the position of maximum height in a horizontal direction to the extreme front of the machine. An arm **45** is provided at each side of the machine. The arm **45**, on each side of the machine, carries a roller **46** at its forward end, which roller is mounted to run along the track **44** in a reciprocatory manner, and is pivotally connected at its rear end to the chain drive **41** as indicated at **47**. A bar **48** is rigidly connected between the arms **45** on opposite sides of the machine at a position adjacent the pivotal connections **47** and serves to support upwardly extending collecting arms **49** at positions intermediate the two sides of the machine and in register with the spaces between adjacent conveyor belts **40**.

As can clearly be seen from FIG. **5**, when the chains are driven in the direction shown the collecting arms **49** are moved from an initial position (as shown in full lines in FIG. **1**) at the commencement of the machine cycle forwardly along the machine. As the arms **49** are moved forwardly they gradually rise to protrude upwardly through the spaces between adjacent conveyor belts **40** to reach a maximum elevation as they approach their forward position. They then continue to move forwardly at the same level, and in a precisely vertical disposition to their extreme forward position when they are drawn sharply downwardly and rearwardly for return in reverse direction beneath the level of the belts **40** to their initial position.

In use the machine receives a line of cases L in shingled configuration as described hereinbefore. The cases entering the machine are counted by means of a photoelectric or other suitable counting device operated by a roller **50** which is sensitive to the trailing edges of the successive cases in the line L. After a predetermined number of cases have been counted into the machine the chains **41** are driven to cause the arms **49** to move from their initial position as has been described above. As the arms move forwardly and upwardly they engage the trailing edge of the case in the line L corresponding with the required count and push it forwardly so that it overlies its preceding neighbor. As the arms **49** continue forwardly they pick up successive trailing edges of the cases on the belts **40** to form a stack of horizontal superimposed cases. The completed stack is pushed forwardly onto ramps **51** disposed at opposite sides of the machine to raise the stack from contact with the belts **40** so that it remains in position after the arms **49** drop away to be returned to their initial position ready for the next machine cycle.

As the first stack to be formed after initial startup of the machine is pushed onto the ramps **51** it forces spring loaded restraining means **52** upwardly to overlie same.

It will be understood that the arms **49** must be cycled around the machine at a speed which is substantially greater than the speeds of the belts **40** to ensure that they can be returned to wait at their initial position in time for the next cycle when the required count for the cases is again recorded. The necessary excess speed is determined by the total length of the machine, and the minimum number of cases which might need to be bundled in any program. Subsequent stacks are prepared and pushed onto the ramps **51** as before thus displacing the previously formed stack for onward transmission to a tying machine for example. It will be understood that each preceding stack acts as a buffer for the following stack and that each stack is finally squared between the stack previously formed and the arms **49** immediately before they drop downwardly to return to their initial position for the following machine cycle. It will also be understood that once the restraining means **52** have been raised by the first stack to be formed after startup they remain at their elevated position until shutdown.

A pressure roller assembly **53** is provided at the input end of the machine and extends transversely over the width thereof. This assembly ensures firstly that the trailing edges of the cases properly actuate the counting device and secondly, that the case immediately following that case making up to a required count is not displaced by the arms **49** at the commencement of each operational cycle.

Flexible stainless steel bands **54** extend longitudinally of the machine over the belts **40** and are secured at their opposite ends to the restraining means **52** and pressure roller assembly **53**, respectively, and serve to load the line of cases L on the machine to prevent accidental displacement thereof.

The machine includes an hydraulic ram **55** which may be actuated to lift the end of the conveyor belts **40** to the position indicated in broken lines on FIG. **5** so that the discharge point for the cases is raised should it be desired, for any purpose, for the cases to be stacked manually, after feed to a stacking position by the conveyor belts **40**, with the ramps **51** removed.

It will be appreciated that it is not intended to limit the invention to the above examples only, many variations, such as might readily occur to one skilled in the art, being possible, without departing from the scope thereof as defined by the appended claims.

What is claimed is:

1. A method of forming a stack of cases from a moving line of cases in shingled configuration comprising the steps of providing means to engage the trailing edge of a case in said line and progressing said means forwardly at a speed greater than the speed of movement of said line so that successive trailing edges are in turn engaged by said means whereby that portion of the line forward of said first-mentioned trailing edge is gathered to form a stack of horizontal superimposed cases.

2. A machine for forming a stack of cases from a moving line of cases in shingled configuration comprising means to engage the trailing edge of a case in said line which means is adapted to be progressed forwardly at a speed greater than the speed of movement of said line so that successive trailing edges are in turn engaged thereby, whereby that portion of the line forward of said first-mentioned trailing edge is gathered to form a stack of horizontal superimposed cases.

3. A machine according to claim **2** including a plurality of conveyor belts disposed in side-by-side parallel spaced relationship and adapted to be fed with said line of cases in shingled configuration, said means for engaging the trailing edge of a case in said line comprising collecting arms adapted to be raised so as to protrude upwardly through the spaces between adjacent conveyor belts and to be moved forwardly at a speed greater than the speed of said belts so as to gather the cases on the belts forwardly thereof to form a stack.

4. A machine according to claim 3 wherein said collecting arms are adapted to be raised gradually as they move forwardly to a maximum height whence they continue to move forwardly at that height to push the completed stack forwardly before being lowered rapidly for return beneath the level of the conveyor belts to a position adjacent the rear of the machine ready for the following operational cycle.

5. A machine according to claim 4 having two identical chain drives lying in a vertical plane and disposed one above the other on each side of the machine, each chain drive comprising an endless chain extending around spaced sprocket wheels and over a support such that the upper run of the chain rises gradually from the rear of the machine to a maximum height and continues forwardly at that height to the forward sprocket wheel, a first horizontal bar lying transversely of the machine and connected by its opposed ends to the chains of the two upper chain drives respectively, a second horizontal bar lying transversely of the machine vertically beneath said first bar and connected by its opposed ends to the chains of the two lower chain drives respectively, each said collecting arm being arranged vertically and being connected to each of said bars for movement therewith.

6. A machine according to claim 4 having, on each side of the machine, a track which rises gradually from the rear of the machine to a maximum height and which continues forwardly at that height, an associated chain drive lying in a vertical plane and comprised by an endless chain extending around spaced sprocket wheels, the upper run of the chain being parallel with the rising portion of the track, and an arm whose forward end engages said track for reciprocatory movement therealong and whose rearward end is pivotally connected with said chain for movement therewith; a bar lying horizontally and transversely of the machine and connected by its opposed ends with the rear ends of the two arms on opposite sides of the machine respectively, said collecting arms being secured to said bar so as to extend upwardly therefrom.

7. A machine according to claim 4 having counting means responsive to the trailing edges of cases being fed onto the conveyor belts and adapted to initiate operation of the collecting arms each time a predetermined count of cases corresponding with the number required in a stack is recorded.

8. A machine according to claim 5 having counting means responsive to the trailing edges of cases being fed onto the conveyor belts and adapted to initiate operation of the collecting arms each time a predetermined count of cases corresponding with the number required in a stack is recorded.

9. A machine according to claim 6 having counting means responsive to the trailing edges of cases being fed onto the conveyor belts and adapted to initiate operation of the collecting arms each time a predetermined count of cases corresponding with the number required in a stack is recorded.

10. A machine according to claim 4 having stop means adjacent the forward end of the machine against which the completed stack is moved in order to square same.

11. A machine according to claim 8 wherein said stop means is comprised by a door against which the stack can be pushed but which opens to allow onward transmission of the stack after squaring.

12. A machine according to claim 11 wherein said door is equipped with a magnetic catch.

13. A machine according to claim 4 having ramp means at the forward end of the machine onto which each stack is pushed and raised from contact with the conveyor belts to form a stop against which the following stack may be squared before the former is displaced by the following stack for onward transmission.

14. A machine according to claim 5 having ramp means at the forward end of the machine onto which each stack is pushed and raised from contact with the conveyor belts to form a stop against which the following stack may be squared before the former is displaced by the following stack for onward transmission.

15. A machine according to claim 6 having ramp means at the forward end of the machine onto which each stack is pushed and raised from contact with the conveyor belts to from a stop against which the following stack may be squared before the former is displaced by the following stack for onward transmission.

* * * * *

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,638,538 Dated February 1, 1972

Inventor(s) John Anthony Sullivan

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

First page of patent - change February 1, 1971 to read --February 1, 1972--.

Signed and sealed this 6th day of June 1972.

(SEAL)
Attest:

EDWARD M.FLETCHER, JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents

FORM PO-1050 (10-69)

USCOMM-DC 60376-P69
☆ U.S. GOVERNMENT PRINTING OFFICE : 1969 O—366-334