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Barkley

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[54] **APPARATUS FOR TEMPORARY STORAGE OF ARTICLES**

[76] Inventor: **Ronald A. Barkley,** P.O. Box 1118 Station H, Ottawa, Ontario, Canada

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[52] **U.S. Cl.** **271/147,** 198/134, 198/165, 214/7, 221/88, 271/213

[51] **Int. Cl.** **B65h 31/06**

[58] **Field of Search** ..... 198/104, 133, 134, 136, 198/7, 165, DIG. 16; 214/7, 16.1 A; 221/79, 88; 271/145, 147, 207, 213

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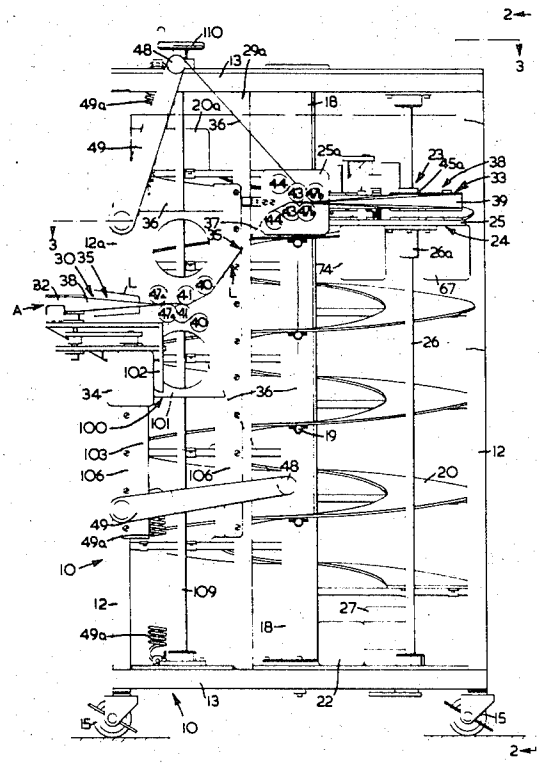
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Primary Examiner—Richard A. Schacher
Assistant Examiner—Richard K. Thomson
Attorney, Agent, or Firm—Browne, Beveridge, Degrandi & Kline

[57] **ABSTRACT**

Apparatus for temporary storage of articles, particularly thin flat articles such as letters, the apparatus having a helical shelf rotatable about its vertical axis, and conveying means for the letters which accept the letters from a fixed delivery point and stack them as a row along the shelf, the letters being orientated in vertical planes radial to the shelf axis. The conveyor means preferably includes a feeder/stacker adjacent the shelf capable of operating either to feed letters from a stack on the shelf and to convey them to another machine, or to deliver the letters to the shelf and stack them. In the preferred embodiment, the shelf rotates about its vertical axis, without vertical movement, during the feeding or stacking operations, and the feeder/stacker moves vertically to maintain a constant relationship with the surface of the shelf.

21 Claims, 5 Drawing Figures



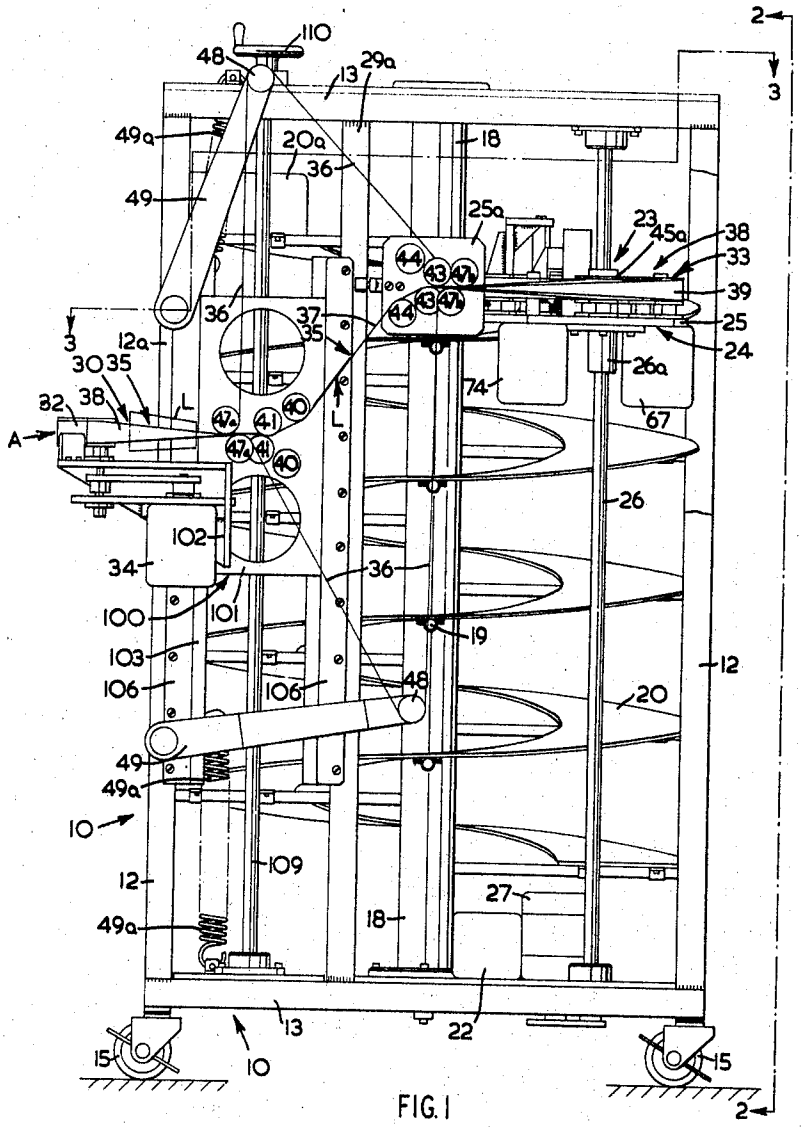

110
48
29a
13
49a
20a
18
36
49
25a
23
45a
38
33
39
25
24
26a
74
67
26
102
34
100
101
103
106
19
12
20
48
49
10
109
27
18
22
15
2
3

FIG. 1

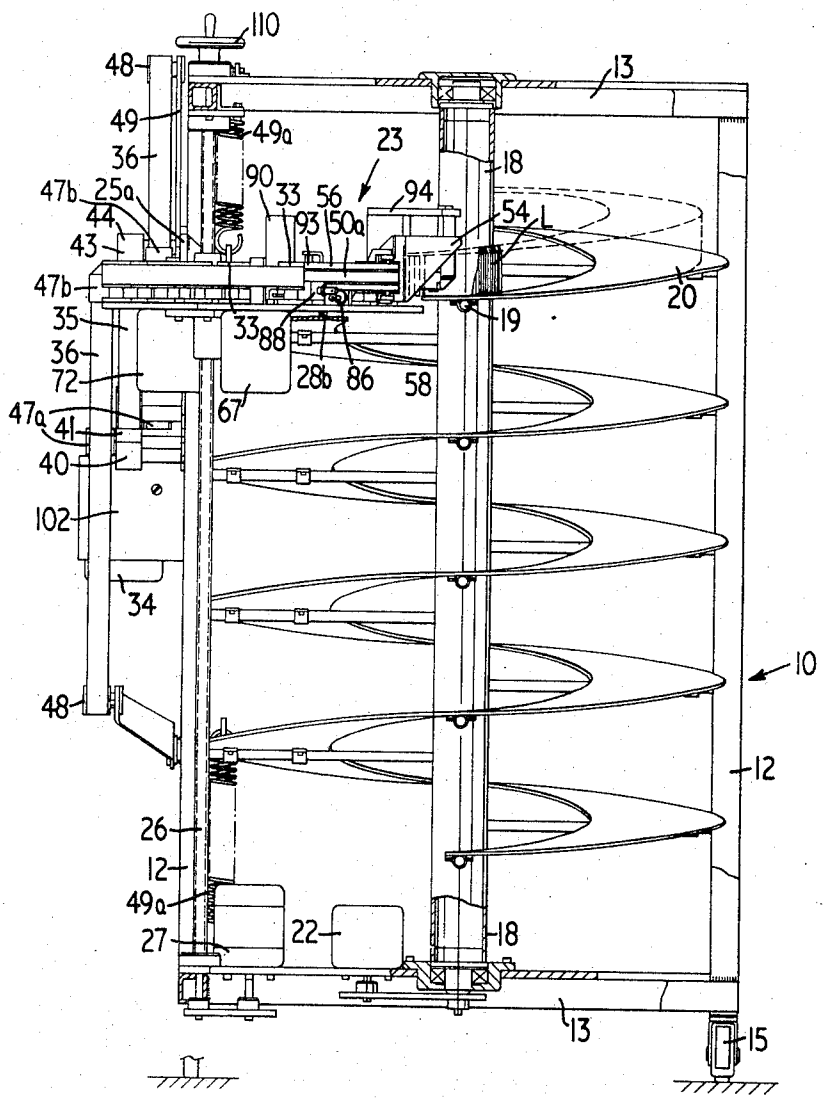

110
48
13
49
49a
23
36
18
90
33
56
94
47b
25a
93
50a
54
L
44
43
20
19
35
88
28b
86
58
72
67
47a
41
40
102
34
10
12
26
22
27
15

FIG. 2.

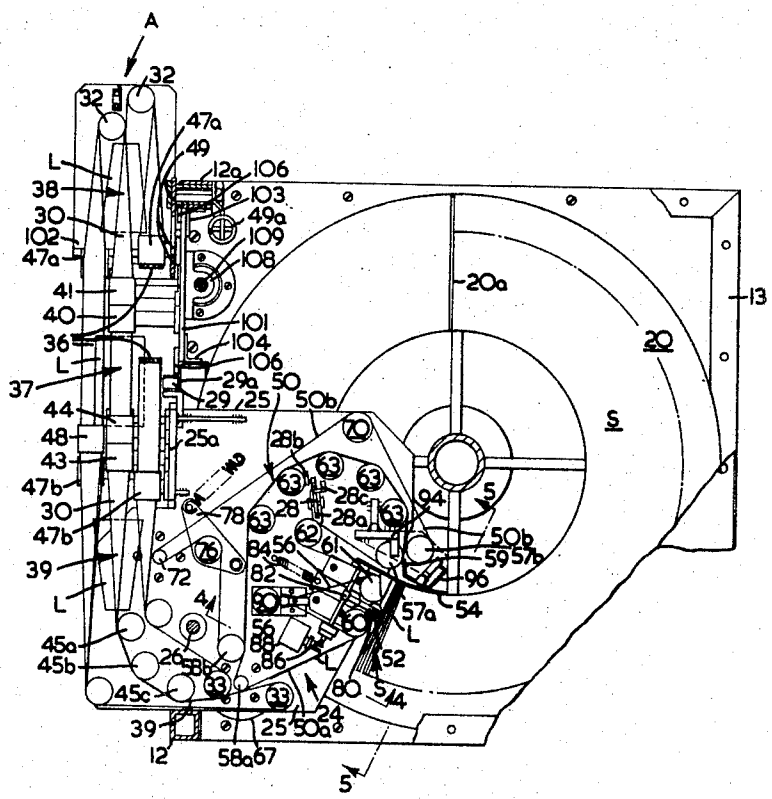

A
32
32
47a
49
L
12a
106
38
103
30
49a
102
109
47a
108
41
20a
13
40
101
20
36
104
L
106
37
29a
50
29
25
50b
44
S
48
25a
28b
43
70
63
63
63
47b
28c
94
5
30
78
28
28a
63
63
50b
47b
62
61
59
57b
84
56
76
72
82
96
39
54
57a
L
L
45a
56
60
52
88
45b
26
58b
86
L
80
5
45c
33
33
14
24
39
25
50a
12
58a
67
5

FIG. 3.

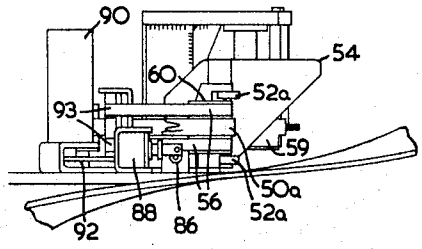

90
54
60
52a
93
59
50a
88
56
52a
86
92

FIG. 4.

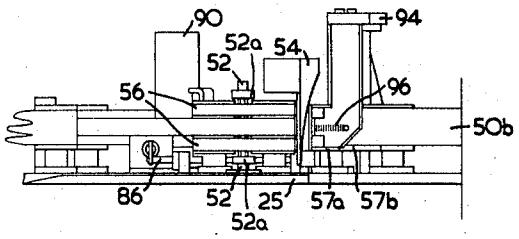

90
94
52a
54
52
96
56
50b
86
52
25
57a
57b
52a

FIG. 5.

APPARATUS FOR TEMPORARY STORAGE OF ARTICLES

The present invention relates to apparatus for storing articles, and in particular to an apparatus providing temporary storage of thin flat articles such as letters.

In existing machinery used for mechanizing the handling or processing of letter mail, apparatus to accept the output of letters from one machine, to store the letters temporarily, and to provide the input of another machine, has been neglected. Machines are available and being used to process 8–10 letters per second but these machines are still fed from trayed letter mail, each tray containing only 600–800 letters. As a result considerable manpower is expended removing letters from trays and manually locating them on the feeder unit, then removing them from the stacker at the output of the unit and putting the letters back into trays to be transported to the next processing operation.

The present invention provides apparatus, which may be termed a "buffer stacker," which can stack, store and feed letters in a semiautomatic fashion. Such an apparatus may be placed at the output of a machine and set in the stack mode to accept letters automatically and stack them in the apparatus until this is filled. The apparatus is preferably portable so that, after being filled, it may be moved to the input of another machine and switched to the feed mode to provide letters, on demand, to the machine. The apparatus may be designed to be capable of stacking and de-stacking letters at a rate of 10 letters per second or more.

Apparatus in accordance with the invention basically comprises a storage unit in the form of a helical shelf with a vertical axis and mounted for rotation around this axis, and conveying means providing for movement of articles seriatim between the shelf and a stationary delivery point outside the shelf along a path which remains substantially fixed in lateral position (i.e., in plan view) as the shelf rotates and which leads directly to different positions along the shelf depending on the rotational position of the shelf. Also, the apparatus has means for providing relative vertical movement between the storage unit and a part of the conveyor means adjacent the shelf so as to maintain a constant relationship thereof to the surface of the shelf as the shelf rotates.

Preferably, the storage unit is mounted for rotation without vertical movement, the part of the conveyor means adjacent the shelf being vertically movable by an amount equivalent to the overall axial height of the shelf.

Previously, it has been known to provide devices in the form of helical conveyors which, by reason of the length of conveyor which is accommodated in a relatively small space, also serves as a temporary storage. However, in such devices, the articles are fed along a helical path, either by means of belts moving along a helical track, or by pushers which push the articles along a stationary helical track, or by vibrating a helical conveyor. None of these devices however uses a helical shelf which is mounted for rotation around its axis, and none provides conveyor means moving the articles along a path which remains substantially fixed in lateral position as the shelf rotates, and which leads directly to different positions on the shelf.

Where the apparatus is specially designed for use with thin flat articles such as letters, the conveying

means preferably include pinch belt means. Since, in the preferred arrangement, the storage unit rotates without vertical movement, the pinch belt means itself must allow for movement of that part of the conveyor means adjacent the shelf so as to maintain a constant relationship thereof with the shelf as this rotates. This movable end part of the pinch belt means is preferably so disposed as to hold the articles in a vertical plane while moving these laterally and allowing transfer of the articles between the pinch belt means and different positions on the shelf whereon the articles are stacked side by side in vertical planes radial to the shelf axis. The pinch belt means also include an intermediate part twisted through 90° relative to the movable end part, the intermediate part providing an inclined path of varying length between a delivery end part of the pinch belt means, which remains stationary, and the movable end part.

The movable end part of the pinch belt means may include a set of pinch belts carried by a feeder/stacker operable selectively to feed articles seriatim from a stack of the articles on the shelf into a main set of pinch belts, or to transfer the articles from the main set of pinch belts onto the shelf to form a stack of the articles in side-by side relationship.

The use of pinch belts as described necessitates that the thin flat articles be flexible. However, this does not pose any difficulties when the apparatus is used as part of an automatic letter handling installation, since such installations are routinely provided with means for automatically rejecting letters having less than a standard degree of flexibility.

The invention also includes a process for temporarily storing flat thin articles such as letters, as set out in the appropriate appended claims.

The invention will be more particularly described by way of example with reference to the accompanying drawing, showing a preferred embodiment, in which:

FIG. 1 shows an elevation of the apparatus,

FIG. 2 shows a further elevation partly broken away, viewed on lines 2—2 of FIG. 1,

FIG. 3 is a sectional plan view on line 3—3 of FIG. 1, and showing the feeder/stacker in the stacker mode,

FIG. 4 is a detail view on lines 4—4 of FIG. 3 showing details of the feeder/stacker, and

FIG. 5 is a further detail view of the feeder/stacker on lines 5—5 of FIG. 3.

Referring particularly to FIGS. 1 and 2, the buffer stacker has a support 10 including four vertical members 12 of square tubing connected by upper and lower horizontal frames 13, and is mounted on small wheels or castors 15 which allow the unit to be moved around to different machines with which it is to be used. The frames 13 carry upper and lower bearings for a central vertical shaft 18, which carries a storage unit in the form of a continuous helical (or spiral) shelf 20 which is co-axial with and encircles the shaft 18. The shelf 20 is annular in plan view (FIG. 3), being horizontal in the radial direction, and is carried by rods 19 extending radially from the shaft 18. The shelf is suitable for receiving letters or like flat thin articles, stacked along the shelf side-by-side and occupying vertical planes, the upper-most articles being supported by vertical abutment 20*a* at the top end of the shelf. An electric motor 22 is provided for rotating the shaft 18, the arrangement being such that this motor operates in a stalled condition so that the shaft is subjected merely to light

rotational pressure during stacking and destacking of letters.

The buffer stacker also includes conveying means carried by support **10** for conveying letters from a stationary delivery point A and stacking them on the shelf **20,** the same conveying means being also usable to feed letters from the same stack and convey them to the delivery point.

The conveying means includes pinch belt means comprising a main pair of opposed pinch belts **30** each in the form of a closed loop having an operative reach **35** and a return reach **36,** the loops each having one end held by one of two stationary vertical pulleys **32** (i.e., pulleys with vertical axes) at point A and having their other end held by one of two movable vertical pulleys **33.** The pulleys **32** are driven by electric motor **34,** which provides enough power to drive the whole of pinch belts **30.** The pulleys **33** are adjacent the inlet end of a feeder/stacker assembly **23** to be described in detail below. The feeder/stacker and the pulleys **33** are all mounted on a carriage **24** which moves in such manner as to maintain a constant relationship with the surface of the adjacent part of shelf **20** as this rotates.

Carriage **24** includes a base plate **25** supported by a nut **26***a* mounted on a vertical lead screw **26** held by bearings in the upper and lower frames **13.** Lead screw **26** is driven by an electric motor **27** mounted on the lower frame **13,** and this motor is controlled by sensing means in the form of a tracking cam **18** mounted on base plate **25** and having an arm **28***a* which projects through an aperture in the plate **25** and which contacts an area of shelf **20** underneath the plate **25,** the cam being spring biased to maintain contact with the shelf. The cam operates two switches **28***b* and **28***c*, switch **28***b* engaging the cam in such a way as to be operated whenever the height of the shelf deviates by more than a predetermined amount from the height of the carriage, and the switch **28***c* having poles which switch over according to the position of the cam and thus controlling the direction of rotation of motor **27.** A control circuit connects these switches with motor **27** in such manner that when switch **28***b* is closed it energises a circuit through the switch **28***c* and thus operates motor **27** to cause the lead screw to rotate to maintain the position of carriage **24** relative the adjacent portion of shelf **20** as the shelf rotates. The carriage **24** is located in the horizontal plane by a roller **29** bearing against a vertical flat surface **29***a* which is the outer flange of an angle member extending between the upper and lower frames **13.** The roller **29** is held pressed against this surface **29***a* by the tension of the pinch belts **30.**

The stationary vertical pulleys **32,** along with motor **34,** and stationary horizontal pulleys **40, 41,** and **47** to be described, are held by further, normally stationary, carriage means **100.** These carriage means **100** include a vertical plate **101** carrying a bracket **102** which supports pulleys **32** and motor **34.** The vertical edges of plate **101** are slidable in grooves formed between vertical angle members **103** and **104,** and outer retaining strips **106.** Angle member **103** is fixed to the adjacent corner member **12***a*, and angle member **104** is fixed to angle member **29***a*. The carriage means **100** includes a nut **108** engaged by vertical lead screw **109** which extends between bearings in upper and lower frames **13,** and lead screw **109** is manually rotatable by hand wheel **110** to adjust the height of carriage **100** and thus the height of delivery point A. The references to this delivery point being stationary will thus be understood to include the case where the height of this is adjustable as described, the delivery point however normally remaining stationary during a stacking or feeding operation.

The operative reaches **35** of the pinch belts **30** move along close together at the same speed and are such as to grip individual letters between them and to convey the letters along the path between pulleys **32** and **33,** this path being substantially fixed in lateral position, i.e., in plan view. The belts are disposed in the vertical plane where they pass around the pulleys **32** and **33,** but both the operative reaches and the return reaches of the belts include intermediate parts twisted through 90° relative to the ends. The intermediate part **37** of the operative reaches of the belts provide an inclined path of variable length between a stationary delivery end part **38** of the belts (terminated by pulleys **32**) and an opposite end part **39** of the belts (terminated by pulleys **33**) adjacent the feeder/stacker and movable vertically therewith, and forming a portion of the movable end part of the whole pinch belt means. The junction between the intermediate part **37** and the stationary delivery end part **38** of the pinch belts is defined by a first set of horizontal pulley means including two pairs of stationary horizontal pulleys **40** and **41** level with the vertical pulley **32,** the belts being twisted 90° between these horizontal and vertical pulleys. Similarly, the junction between the intermediate part **37** and the movable end part **39** of the pinch belts is defined by a second set of horizontal pulley means in the form of two pairs of pulleys **43** and **44** which are level with the vertical pulleys **33** and movable vertically therewith, being carried by vertical plate **25***a* of carriage **24.** The operative reaches of the belts pass from pulleys **43** to pulleys **33** over a series of vertical pulleys **45***a, b, c*, the belts also having a 90° twist between horizontal pulleys **43, 44** and the first vertical pulley **45***a*. Also, the belts are bent around a total angle of about 90° (while remaining vertical) in passing over pulleys **45***a, b, c*, so that the operative reach of the belts adjacent pulleys **33** is perpendicular to that adjacent pulleys **32.**

Since the pulleys **43, 44** (along with pulleys **33** and **45***a, b, c*) are all movable in the vertical direction, without lateral movement, with the carriage **24,** the length of the intermediate part **37** of the operational reaches of the belts varies. This variation is allowed for by providing extended loops **36** of the return reaches of the pinch belts, which extend between horizontal pairs of fixed and movable pulleys **47***a* and **47***b* and which are held well away from the operative reaches by further pulley means **48,** these pulleys **48** being held by arms **49** biased by springs **49***a* away from the operational reaches of the belt to hold these reaches taut in spite of movements of the carriage.

As will be clear from FIG. **1,** the pulleys **40, 41 43** and **44** are arranged in pairs above and below the operative reaches **35** of the belts. In the position shown in FIG. **1** the upper pulleys **40, 41,** and lower pulleys **43,** 44 are operative, but when carriage **24** has moved down below the level of A the lower pulleys **40, 41,** and upper pulleys **43, 44** will be operative.

As will be seen in FIG. **3,** the pulleys **33** are aligned with the discharge point of a further pair of pinch belts **50** which form another portion of the movable end part of the pinch belt means, and which also form part of the feeder/stacker, so that letters can be transferred from pinch belts **30** to shelf **20** and vise versa.

The pinch belts **50** are vertically oriented throughout their length. They include a narrow high friction transport belt **50***a*, and a complementary belt **50***b* which lies close against belt **50***a* to provide a pinch belt transport path from pulleys **57***a*, *b* (defining an inlet into this transport path) to pulleys **58***a*, *b* which define an outlet from the path. Belt **50***a* has a portion which extends radially over a part of the shelf and which is located by central portions of pulleys **60** and **61**, and this belt also passes over pulley **62** and a series of pulleys **63** which latter pulleys define part of the transport path. Belt **50***a* is driven by the pulley **58***a* which is directly driven by electric motor **67**. Belt **50***b* passes with belt **50***a* over pulleys **63** between pulleys **57***b* and **58***b*, and has return reaches held by fixed pulley **70**, a small pulley **72** directly driven by motor **74**, and tensioning pulley **76** held by spring biased lever **78**.

The feeder/stacker also comprises a stacking roller **52**; a movable stop blade **54**; two small high friction slow moving feed belts **56** disposed above and below belt **50***a* and passing over outer portions of pulleys **60** and **61**; and a doubles rejection gate **59**.

The stacking roller **52** is carried by a mounting **80** slideably carried by the carriage **24**, and movable outwardly of the space between pulleys **60** and **61** by a cam **82** acting against the force of spring **84**. The roller **52** has two highly polished wheel portions **52***a* which project beyond the plane of belt **50***a* when the mounting is moved outwards by the cam **82**, to an operative position, and this roller also has a central pulley portion of smaller diameter than wheel portions **52***a* driven by belt **50***a* when the roller is in the operative position, so that wheel portions **52***a* are caused to rotate. Cam **82** is carried by shaft **86** which is rotatable by solenoid **88** acting on a crank at the end of shaft **86**. The other end of shaft **86** carries the stop blade **54** which is of triangular shape as shown in FIG. **4**. The rotation of shaft **86** by the solenoid moves the stop blade **54** from the operative position of FIG. **4**, in which the feeder/stacker is in the stacking mode and in which blade **54** is positioned adjacent the inner edge of the shelf and extends across the path of letters being moved radially inwardly of the shelf by belt **50***a*, to an inoperative position 45° displaced from the operative position in which it allows passage of letters from in front of pulleys **60**, **61** to the inlet of the pinch belts **50***a*, **50***b* defined by pulleys **57***a*, **57***b*. Rotation of the shaft **86** in the reverse direction is caused by a spring (not shown).

The two feed belts **56** are driven by a small motor **90** via a speed reduction belt **92** and pulleys **93** shown in FIG. **4**.

The doubles rejection gate **59** is pivotally carried by a mounting **94** which extends over the belts **50***a*, **50***b*, and includes a spring **96** urging a high friction edge of the gate close to belt **50***a* where this passes over pulley **57***a*.

Operation of the buffer/stacker is commenced with the shelf **20** empty, with the carriage **24** in its uppermost position, and with the feeder/stacker **23** in the stacker mode of FIG. **3**. Also, the drive motor **34** connected to rolls **32** is arranged to rotate these in such direction that the pinch rolls will carry letters L from the delivery point A to the feeder/stacker. The handle **110** is rotated to move carriage **100** so that the delivery end part **38** of the pinch belts **30** is adjusted to suit the height of a machine delivering letters, and placed adjacent the output of the machine, and operation is commenced. Letters leaving the machine then enter the pinch belts **30** in a vertical position, that is on edge with the address surface of the letter in a vertical plane. Once in the pinch belts **30**, the letters are rotated to a horizontal position, before passing into the intermediate part **37** of the pinch belts, the letters returning to the vertical position in the movable end part **39** of the pinch belts before leaving these belts between the rolls **33**. The letters then pass into contact with transport belt **50***a* of the buffer stacker. Belt **50***a* moves the letters inwardly over the outer edge of shelf **20** and the first letter of a batch is wedged between abutment **20***a* and the stacking roller **52**. Subsequent letters are similarly moved by belt **50***a* and wedged between the previously stacked letters and the stacking roller **52**, being also moved up against the stop blade **54** adjacent the inner edge of the shelf. The stacking roller **52** driven by belt **50***a* lifts the letters off the belt **50***a* and the two wheel portions of this roller allow the letter to rest against the stop blade without damaging the letter surface. The stacking operation continuously pushes away the letters as they form the stacks, causing the shelf to rotate at suitable speed. The letters are moved directly from the conveying means onto relatively fixed positions on the shelf, there being no substantial movement of the letters around the shelf such as might cause difficulty in maintaining the stability of the stack. As the shelf rotates, the feeder/stacker and the associated part **39** of the conveyor means gradually decend to maintain a constant relationship with the surface of the shelf.

Once the shelf has been filled, it may be set aside to provide storage, or may be moved immediately to the next processing station to provide a source of letters for that operation. If necessary, the height of the delivery end part **38** of the pinch belts is adjusted by the manual means described, and the feeder/stacker is switched to the feeder mode of operation (which may be controlled remotely) this switching involving reversal of the direction of movement of the pinch belts **30**, and operation of solenoid **88** which rotates the shaft **86** and the stop blade **54** through 45° and permits the letters to pass from belts **56** into pinch belts **50** between pulleys **57***a*, *b*. The shaft rotation also changes the position of cam **82** and the stacking roller **52** and belt **50***a* carried by the central pulley portion of roller **52** withdraws behind the two small high friction feed belts **56**. These two feed belts **56** keep the letter in the stacked position and away from the transport belt **50***a* unless the feed motor **90** is activated, then the slow moving belts advance the letters one by one towards the shelf axis until they enter the pinch belts **50** which grip the leading letter edge and accelerate the letter away from the stack thereby exposing the following letter to the slow moving feed belts. The high friction surface tip of the doubles rejector gate **59** allows only single letters to advance into the pinch belts. During this feeding operation, gentle rotational force is constantly applied by motor **22** to shaft **18** to keep the stacked letters pressed lightly against the feed belts **56**. The friction between the doubles rejection gate and a letter is lower than the friction between the transport belt and a letter but larger than the friction between two letters. The belts **50** carry the letters around to the discharge point between pulleys **58***a* and **58***b*, where they pass into the main pinch belts **30**. During the feed operation the main pinch belts **30** are driven by the motor **34** in the reverse direction and ac-

cept the letters from the pinch belts **50** and carry them to the discharge point A.

A proposed buffer stacker in accordance with the invention would be about 5 ½ feet high, and about 40 inches by 46 inches in cross-sectional area, and would have a helical shelf **20** with a length of about 35 feet, and capable of accommodating about 10,000 letters. The apparatus would be capable of stacking and destacking letters at approximately 10 letters per second.

I claim:

1. Apparatus for storing articles, comprising a storage unit in the form of a helical shelf with a vertical axis and which is mounted for rotation around said axis, conveying means providing for movement of said articles seriatim along a path between the shelf and a stationary delivery point outside the shelf, which path remains substantially fixed in lateral position as the shelf rotates and which leads directly to different positions along the shelf dependent on the rotational position of the shelf, and means for providing relative vertical movement between the storage unit and a part of the conveyor means adjacent the shelf so as to maintain a constant relationship between said part of the conveyor means and the surface of the shelf as the shelf rotates.

2. Apparatus according to claim **1,** wherein said storage unit is mounted for rotation without vertical movement, and wherein said part of the conveyor means adjacent the shelf is vertically movable by an amount equivalent to the overall axial height of the shelf.

3. Apparatus according to claim **1,** wherein said conveying means includes pinch belts.

4. Apparatus for storing thin flat flexible articles, comprising a storage unit in the form of a helical shelf with a vertical axis and which is mounted for rotation around said axis, pinch belt means for conveying said articles seriatim between the storage unit and a stationary delivery point outside the unit along a path which remains substantially fixed in lateral position as the shelf rotates and which leads directly to different positions along the shelf dependent on the rotational position of the shelf, said pinch belt means including a movable end part adjacent the shelf arranged to hold said articles vertical while moving the articles laterally to allow transfer of said articles between the pinch belt means and the shelf, means providing vertical movement of said end part of the pinch belt means so as to maintain a constant relationship thereof to an adjacent portion of the shelf as the shelf rotates, said pinch belt means also including an intermediate part twisted through 90° relative to said movable end part, said intermediate part providing an inclined path of varying length between a delivery end part of the pinch belt means, which delivery end part is stationary in position, and the said movable end part.

5. Apparatus according to claim **4,** wherein the junction between the intermediate part of the pinch belt means and the delivery end part thereof is defined by first horizontal pulley means, and wherein the junction between the said intermediate part and the said movable end part is defined by second horizontal pulley means, said second horizontal pulley means being movable vertically without lateral movement with the said movable end part of the pinch belt means, and wherein further pulley means are provided holding return reaches of said pinch belt means spaced away from the operative reaches thereof, said further pulley means being biased away from said operative reaches to hold the operative reaches taut in spite of movements of said second pulley means.

6. Apparatus according to claim **4,** wherein said pinch belt means comprises a main set of pinch belts, which main set includes said intermediate part and a portion of the movable end part of the pinch belt means, and a further set of pinch belts forming another portion of the movable end part of the pinch belt means, said further set of pinch belts being part of a feeder/stacker operable selectively to feed articles from a stack of said articles on the shelf in side-by-side relationship and in vertical radial planes, into the main set of pinch belts, or to transfer said articles from the main set of pinch belts onto the shelf to form a similar stack of said articles.

7. Apparatus for storing thin flat flexible articles, comprising:

a support,

bearing means carried by the support and having a vertical axis,

a helical shelf co-axially mounted on said bearing means for rotation about the axis thereof,

carriage means movable vertically on said support, means being provided for simultaneously rotating said shelf and moving said carriage means in such manner that the carriage means maintains a vertical constant relationship with the surface of the shelf,

pulley means carrying a main set of pinch belts, including a first set of horizontal pulley means mounted on the support in stationary position, a second set of horizontal pulley means mounted on said carriage means, said first and second sets of pulley means defining the ends of an inclined path of varying length for operative reaches of the pinch belts carried thereby, and further pulleys spaced from the operative reaches of the said pinch belts for holding return reaches of said pinch belts,

and a feeder/stacker also mounted on said carriage means and including means for moving said articles between said main pinch belts and stacked positions on the shelf, in which stacked positions the articles lie in substantially vertical planes extending radially of the shelf.

8. Apparatus according to claim **7,** wherein said pulley means for said main pinch belts also include vertical pulley means mounted on said carriage means and spaced horizontally from said second set of horizontal pulley means, whereby said pinch belts are twisted through 90° on passing from said second set of horizontal pulley means to said vertical pulley means, and wherein said feeder stacker includes a further set of pinch belts carried by further vertical pulley means and capable of receiving said articles from the main pinch belts passing around said vertical pulley means.

9. Apparatus according to claim **6,** wherein said further set of pinch belts has an entry point adjacent one edge of the shelf and a discharge point adjacent an end of the main set of pinch belts, one of the belts of said further set of pinch belts also having a reach extending from said end of the main set of pinch belts to the shelf and passing over the side of the shelf opposite to said one edge.

10. Apparatus according to claim **6** wherein the feeder stacker comprises friction belt means, movable independently of said further set of pinch belts and po-

sitioned over said shelf so as to deliver articles from the shelf to said further set of pinch belts.

11. Apparatus according to claim 6, wherein said feeder/stacker includes movable stop means against which said articles are stacked by the feeder/stacker when operating in a stacking mode, said stop means being movable to allow feeding of said articles from the side of the shelf opposite to that over which the articles pass when being stacked.

12. Apparatus according to claim 6, wherein said feeder/stacker is arranged to stack said articles on the shelf by movement radially inward relatively to the shelf.

13. Apparatus according to claim 8, wherein said further set of pinch belts has an entry point adjacent one edge of the shelf and a discharge point adjacent an end of the main set of pinch belts, one of the belts of said further set of pinch belts also having a reach extending from said end of the main set of pinch belts to the shelf and passing over the side of the shelf opposite to said one edge.

14. Apparatus according to claim 8, wherein the feeder stacker comprises friction belt means, movable independently of said further set of pinch belts and positioned over said shelf so as to deliver articles from the shelf to said further set of pinch belts.

15. Apparatus according to claim 7, wherein said feeder/stacker includes movable stop means against which said articles are stacked by the feeder/stacker when operating in a stacking mode, said stop means being movable to allow feeding of said articles from the side of the shelf opposite to that over which the articles pass when being stacked.

16. Apparatus according to claim 7, wherein said feeder/stacker is arranged to stack said articles on the shelf by movement radially inward relatively to the shelf.

17. Apparatus according to claim 7, wherein said carriage means are movable vertically by a motor controlled by sensing means carried by the carriage means and which senses the height relative to the carriage means of a portion of the shelf adjacent the carriage means.

18. Apparatus according to claim 7, wherein said first set of horizontal pulley means is mounted on further carriage means, said further carriage means being normally stationary during operation of the apparatus but being adjustable in height.

19. Apparatus according to claim 7, wherein said frame is provided with wheels to allow the apparatus to be moved, with articles stacked therein, from one location to another.

20. A process for temporarily storing flat thin articles such as letters, comprising the steps of:

moving said articles seriatim while disposed vertically into a pinch belt arrangement at stationary point,

rotating said articles by said belt arrangement to dispose the articles in a horizontal plane,

moving said articles by said belt arrangement along an inclined plane to a level different from said stationary point, said inclined plane being fixed in lateral position,

rotating said articles into the vertical plane and simultaneously moving said articles in a horizontal direction towards stacking means,

stacking said articles along a helical shelf, said shelf being continuously rotated during stacking so that the lateral position of the stacking operation remains fixed, while continuously raising or lowering the stacking position in accordance with the level of that part of the shelf receiving the articles.

21. A process according to claim 20, wherein said articles are stacked with one end against a stop adjacent one edge of the shelf, which stop remains in fixed position relative to the stacking position during the stacking operation, said process including a subsequent step of displacing the stop from said fixed position and feeding articles from the stack on the shelf with the stop displaced to allow the articles to be fed from the shelf over the said one edge.

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