United States Patent

Nielsen

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[45] **Sept. 26, 1972**

[54] WEB SLACK BOX HAVING A ROTATABLE WEB ACCUMULATOR

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[52] **U.S. Cl.** **226/118**

[51] **Int. Cl.** **B65h 17/42**

[58] **Field of Search** ..... 226/113, 118, 119; 179/100.2 Z

[56] **References Cited**

UNITED STATES PATENTS

3,209,974 10/1965 Nye 226/118

FOREIGN PATENTS OR APPLICATIONS

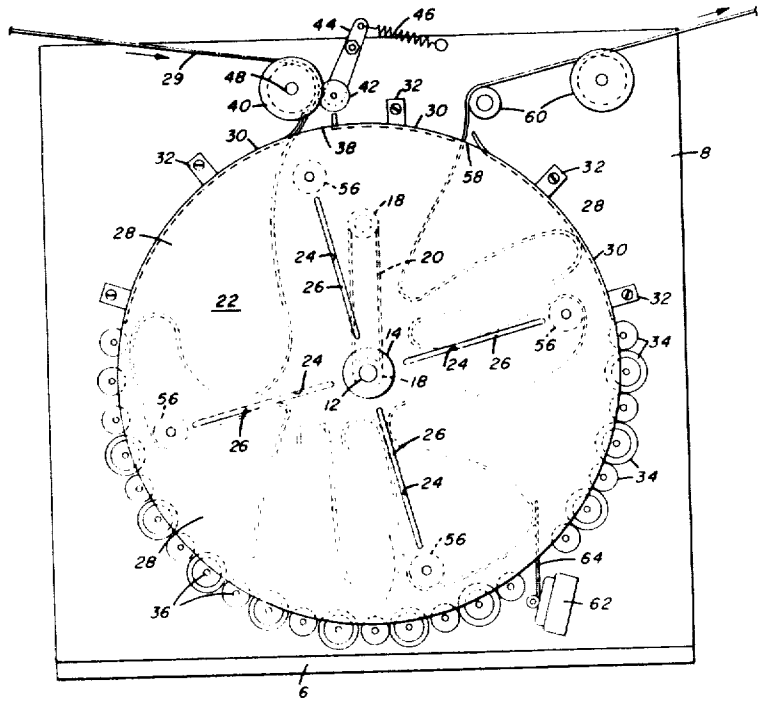
236,896 11/1964 Austria 226/119

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[57] **ABSTRACT**

A slack box having a rotatable web accumulator comprising a hub and radially extending partitions mounted for rotation in a vertical plane. The hub and partitions cooperate with side walls or discs to form quandrantal compartments for receiving a web in succession upon rotation of the hub by a hub drive mechanism. A web feeding mechanism gravity feeds the web in random looped fashion successively into each of the compartments as the hub is rotated, and the web feeding rate and hub speed rotation are selected such that each compartment is substantially filled with coils and loops of the web before it is fed into the next adjacent compartment. The web is successively withdrawn from the filled compartments and preferably fed continuously into a web processing device or the like. A sensing mechanism senses the amount of web or the web-filled condition of each of the compartments as it is moved past the sensing mechanism, and in response to a web-filled condition that is higher or greater than a predetermined web-filled condition, stops or disables the hub drive and web-feeding mechanisms for discontinuing web feed into the web accumulator. When sufficient web has been withdrawn from the web-filled compartment so that its web-filled condition is lower or less than the predetermined web-filled condition, the sensing mechanism enables or actuates the web feeding and hub drive mechanisms for feeding web into the rotating web accumulator.

14 Claims, 4 Drawing Figures



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SHEET 1 OF 2

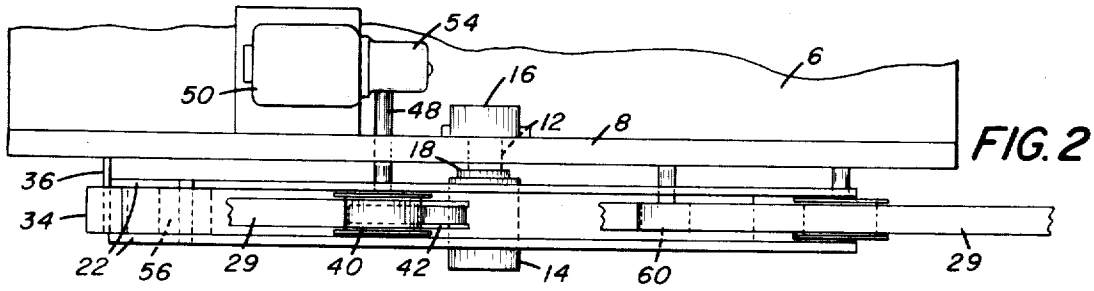


FIG. 2

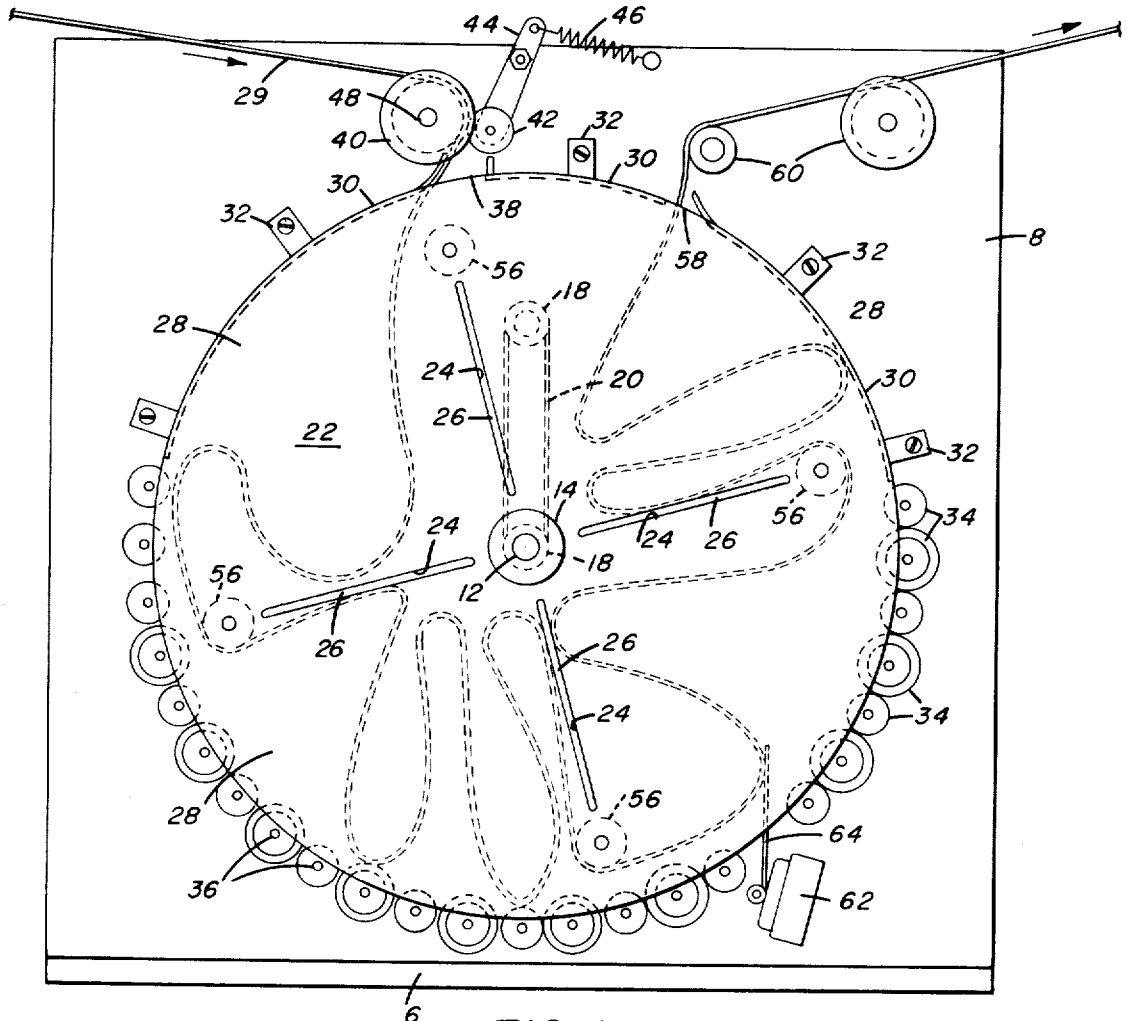


FIG. 1

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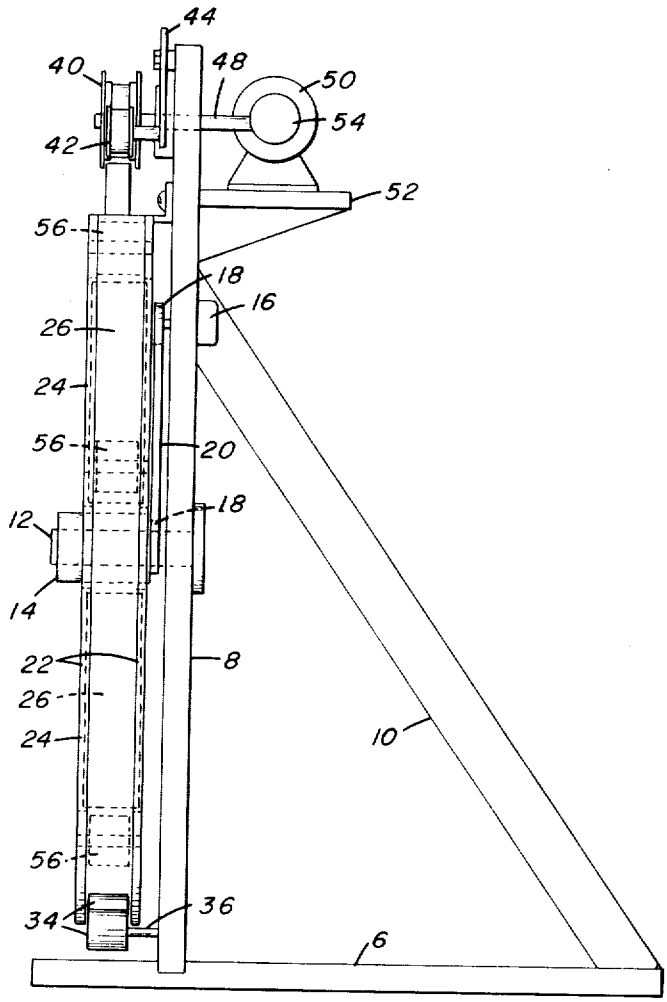


FIG. 3

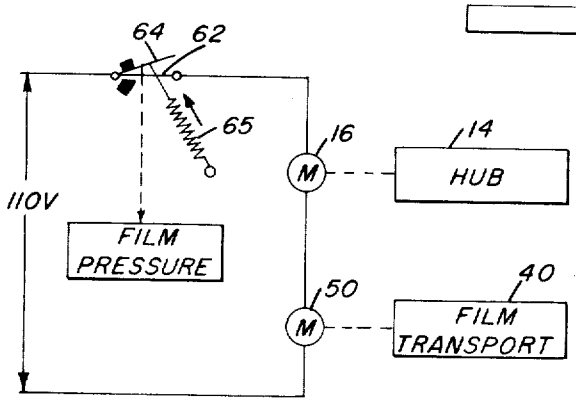


FIG. 4

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WEB SLACK BOX HAVING A ROTATABLE WEB ACCUMULATOR

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates generally to web handling mechanisms, and more specifically to a web slack box having a rotatable web accumulator.

2. Description of the Prior Art

It is known in the prior art to provide slack boxes for storing web material at the feed and take-off ends of a continuously operating machine such as a photographic film processing device. This permits intermittently stopping film transport into or out of the device for short periods of time for some purpose such as inspection, splicing, or the like without affecting the continuous operation of the processing device. One type of slack box for such a machine is shown in German Pat. No. 138,821 comprising one or more solution-filled tanks into which the film is freely randomly fed in serpentine or looped fashion. Such a slack box is not usable in applications in which a dry web is stored or accumulated. Another slack box of this general type receives a freely falling dry web in serpentine or looped fashion, but it is incapable of accumulating a sufficient length of film without crushing the bottom or lower loops of web due to the weight of the upper web loops or convolutions. Another well-known type of slack box comprises a film supporting elevator mechanism for normally accumulating the film on rollers rotatably mounted on upper and lower spaced apart, parallel shafts. The upper shaft is fixed, and the lower shaft and rollers form a part of a vertically, reciprocally movable elevator mechanism. Accordingly, when the film feed into the processing device is stopped to permit a splicing operation or the like, the elevator mechanism begins to move upwardly as the film continues to be withdrawn from the slack box, and when it reaches a predetermined height, a switch is activated by any suitable means for enabling or actuating the film-feeding mechanism. Since the film is fed into the slack box at a faster rate than it is withdrawn therefrom, the elevator mechanism will then move downwardly as it accumulates film, and when it reaches a predetermined point where sufficient film has been it will actuate another switch disabling or deactuating the film-feeding mechanism. Although the elevator slack box operates in a satisfactory manner, it is of relatively complicated construction comprising many parts that greatly increases problems of assembly, operability and repair. Accordingly, such slack boxes are expensive to manufacture, and in addition take up a considerable amount of space. Furthermore, in view of the large number of rollers and loops involved, the force required to pull the film through the slack box is relatively high.

It is therefore an object of the present invention to provide an improved slack box for a web or the like that is capable of accumulating successive webs of varying widths without requiring any alteration of the slack box.

Another object of the invention is to provide a slack box in which the weight of the freely accumulating web loops does not crush the bottom or lower web convolutions.

Another object of the invention is to provide a slack box having rotatable compartments for accumulating and supporting a long length of free web without crushing the bottom or lower web convolutions.

Another object of the invention is to provide an improved slack box for a web or the like that is capable of storing or accumulating a long length of web while utilizing a minimum amount of space.

Another object of the invention is to provide an improved slack box for material such as a web or the like that is of simple design and construction, thoroughly reliable in operation, and economical to manufacture.

The invention and its objects and advantages will become more apparent from the detailed description of the preferred embodiment presented below.

SUMMARY OF THE INVENTION

This invention includes within its scope a slack box having a rotatable accumulator for storing a continuous web material such as a film or the like. The slack box comprises a rotatable hub and a plurality of radially extending partitions rotatable therewith and cooperating with a pair of spaced side plates or discs to form a plurality of angularly spaced compartments open at the periphery. The film is fed by any suitable film-feeding mechanism into each of the film compartments in succession as the hub and partitions are rotated by any suitable hub drive mechanism. The rate of film feed into each compartment and the rotational speed of the hub are properly selected such that each compartment is substantially filled with coils and loops of film before the film enters the next succeeding compartment. A retaining rail comprising arcuate plates and/or a plurality of rollers encircles the compartments to prevent the escape of film from the compartments. A sensing mechanism such as a switch is provided for sensing the amount of film or the film-filled condition of the compartments as they are moved past the switch. The switch is movable by some means such as film tension or pressure from a normally closed position, in which it actuates or enables the film-feeding and hub drive mechanisms, to an open position, in which it deactuates or disables the film feeding and hub driving mechanisms. The film tension or pressure for moving the switch to its open position may result from some means such as film tension or pressure due to the accumulation of a large number of compacted coils and loops of film in a film-filled compartment. After a sufficient length of film has been withdrawn into a processor or the like from a rotatable film-filled compartment, the film tension or pressure is reduced due to the reduction in the number of film loops or convolutions, and the resultant reduction in the compaction of the film loops. This reduction in film tension or pressure allows the switch to return to its normally closed position for actuating or enabling the film-feeding and hub drive mechanisms for again feeding film into the compartments in succession.

BRIEF DESCRIPTION OF THE DRAWING

In the detailed description of the preferred embodiments of the invention presented below, reference is made to the accompanying drawings, in which:

FIG. 1 is a front elevational view of one embodiment of a rotatable slack box of this invention;

FIG. 2 is a top plan view of the slack box of FIG. 1;

FIG. 3 is a right end elevational view of the slack box of FIG. 1; and

FIG. 4 is a schematic electrical wiring diagram for the slack box.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

With reference to the drawings, a horizontal base **6** is shown having a vertically upstanding frame plate **8** secured to the base by any suitable means such as welding and/or cross beams **10** (FIG. 3). A laterally extending stub shaft **12** is secured to plate **8** for rotatably supporting a hub **14** rotatably driven by a motor **16** through sprockets **18** on the motor shaft and hub over which a belt **20** is trained as best seen in FIG. 3. A pair of axially spaced circular discs **22** are secured by any suitable means to the hub periphery for rotation therewith, and are provided with radially extending slots **24** (See FIG. 1) in alignment with one another for receiving rectangular ribs or partitions **26** extending between discs **22** (see FIG. 3). The partitions in cooperation with hub **14** and discs **22** form quandrantal compartments **28** (FIG. 1) for receiving a web such as a film **29**. Although only four compartments are formed, it should be understood that any other number of compartments may be provided depending upon the angular spacing between slots **24** or partitions **26**. The open ends of compartments **28** at the periphery of the discs are closed off in part at the upper end of the slack box by arcuate retaining plates **30** encircling discs **22**. Retaining plates **30** are secured to frame **8** by screws extending through flanges **32** on plates **30**. Since the film or film loops rarely engage plates **30** due to gravity acting on the film, there is no appreciable danger of film emulsion damage due to film slippage between the film and plates **30**. The open ends of compartments **28** at the lower end of the slack box are closed off by a plurality of adjacent rollers **34** of the same or varying sizes rotatably mounted on shafts **36** laterally extending from and secured to frame plate **8** as best seen in FIGS. **2** and **3**. Rollers **34** are provided to minimize possible film emulsion damage due to interaction between the film loops and the rollers caused by film pressure and gravity. If desired, rollers **34** preferably formed from Teflon or the like may be provided around the entire periphery of discs **22**.

Any suitable web-like material such as film **29** received from a film supply, not shown, is fed through a gate **38** (FIG. 1) in or between adjacent retaining plates **30** into a film compartment **28** by any suitable friction drive roller **40** over which the non-emulsion or base side of film **29** is trained. The film is held in driving engagement with drive roller **40** by a grooved pressure roller **42** rotatably mounted at one end of a pivotal lever **44** and biased into engagement with roller **40** by a spring **46**. THe grooved periphery of roller **42** registers with the film emulsion and prevents damage thereto. The drive roller **40** is mounted on a shaft **48** journaled in frame **8** and driven by a motor **50** through any suitable drive coupling **54** as best seen in FIGS. **2** and **3**. Motor **50** is mounted on a shelf **52** secured by welding or the like to frame **8**. THe drive roller **50** is driven to feed film **29** into film compartments **28** in succession at a predetermined rate in relation to the rotational speed of hub **14** such that the compartment **28** in register with gate **38** will be filled to a predetermined web-filled condition as the next succeeding empty compartment is moved into alignment with the gate. To prevent damage to the film as it moves from a filled compartment to an adjacent empty compartment, the discs **22** rotatably support rollers **56** adjacent the end of each of the radially extending partitions **26** over which the film **29** passes.

One of the retaining plates **30** is further provided with an exit slot **58** through which the film is withdrawn or removed from the slack box, trained over one or more rollers **60**, and fed continuously into a film processing device or the like, not shown. A sensing mechanism of any suitable type is provided for sensing the film-filled condition of a compartment **28**, and in response thereto controlling the operation of the hub and film-feed drive motors **16**, **50** respectively. The sensing mechanism may be of any suitable known type such as a photosensitive sensor, or a fluidic sensor, or the like, and is shown in this invention as a switch **62** (FIG. 1) interposed adjacent two of the retaining rollers **34**, and having an actuator arm **64** extending radially inwardly between discs **22** and into a compartment **28**. The switch **62** is inherently biased by any suitable expansion spring **65** (FIG. 4) to a normally closed or "on" position as illustrated schematically in FIG. 1 in which it completes a power circuit to the hub and film feed drive motors **16**, **50** respectively for actuating or enabling the motors **16**, **50** for simultaneously rotating hub **14** and compartments **28**, and roller **40** for feeding film **29** into a compartment. When a film-filled compartment of film is moved past switch arm **64**, the closely packed coils and loops of film have sufficient weight, rigidity and pressure to move switch arm **64** against the bias of compression spring **65** for moving the contacts of switch **62** to their open or "off" position. In this position the electrical circuit to hub and film-feed drive motors **16**, **50** respectively is broken for deactuating or disabling the motors so that the compartments cease to rotate and no film is fed into a compartment **28**. Film **29** continues to be withdrawn from the slack box into the processor, and when a sufficient length of film has been withdrawn from the film-filled compartment, the film coils and loops therein gradually lose their pressure or tension as they become enlarged and reduced in number until such pressure is less than the force exerted by spring **65**. Accordingly, switch arm **64** is returned by spring **65** to its normal position closing switch contacts **62** for enabling the drive motors **16**, **50** for again simultaneously rotatably driving the compartments and feeding film into a compartment in timed relation thereto.

Although hub **14**, discs **22** and partitions **26** rotate as a unit within the encircling retaining plates **30** and rollers **34**, it is possible to modify the slack box by providing rigid discs or plates **22** secured to frame **8**, and having hub **14** provided with radially extending partitions **26** secured thereto, and the hub and partitions rotatable as a unit between the discs. In such a modification, retaining plates **30** and rollers **34** would be arranged to encircle partitions **26** and could be secured to one or both of the discs **22**. Rollers **56** could be rotatably mounted at the end of each partition to support film and prevent damage thereto as the film passes from one compartment to another.

The invention has been described in detail with particular reference to a preferred embodiment thereof, but it will be understood that variations and modifications can be effected within the spirit and scope of the invention as described hereinabove.

I claim:

1. In a slack box for accumulating a web, the combination comprising:

web accumulating means having a plurality of adjacent compartments;

means for feeding a web into one of said compartments;

means for moving said compartments in succession past and in timed relation to said web-feeding means for filling each of said compartments to a predetermined web-filled condition; and

means coupled to said web-accumulating means and said web-feeding means for sensing the web-filled condition of each of said compartments in succession, and in response to the sensing disabling said web-feeding means and said web-accumulating moving means when the web-filled condition of said sensed compartment is substantially equal to or greater than said predetermined web-filled condition, and enabling said web-feeding means and said web-accumulating moving means when the web-filled condition of said sensed compartment is less than said predetermined web-filled condition.

2. The invention according to claim 1 wherein said compartments are rotatable, and said moving means imparts rotation to said compartments.

3. The invention according to claim 1 wherein said web-accumulating means comprises a rotatable member having a plurality of radially extending, angularly spaced partitions cooperating therewith to form a plurality of compartments.

4. The invention according to claim 1 wherein said web-accumulating means comprises a rotatable member having circular spaced discs, and a plurality of radially extending, angularly spaced partitions between said discs cooperating with said member and said discs to form a plurality of compartments.

5. The invention according to claim 1 wherein said web-accumulating means comprises a rotatable member having circular spaced discs, and a plurality of radially extending, angularly spaced partitions between said discs cooperating with said member and said discs to form a plurality of compartments, and web-retaining means encircling the periphery of said discs.

6. The invention according to claim 5 wherein said web-retaining means is provided with a web inlet and a web outlet, and comprises an arcuate plate encircling a portion of the periphery of said discs, and a plurality of adjacent rollers encircling the remainder of the periphery of said discs.

7. The invention according to claim 1 wherein said sensing means comprises an electrical switch having an actuator arm extending into a compartment and responsive to the web pressure therein for movement from a normally closed position to an open position for disabling said web-feeding means and said compartment moving means.

8. The invention according to claim 1 wherein said sensing means comprises an electrical switch movable between open and closed positions and in circuit with said web-feeding means and said compartment moving means, said switch having an actuator arm extending into a compartment and responsive to the web pressure for movement between a normally closed position enabling said web-feeding means and said compartment moving means and an open position disabling said web-feeding means and said compartment moving means.

9. In a slack box for accumulating a web, the combination comprising:

web-accumulating means having a plurality of adjacent compartments;

means for feeding a web into one of said compartments;

means for moving said compartments in timed relation to said web-feeding means for filling each of said compartments in succession;

switch means responsive to the web pressure in one of said web-filled compartments for movement from a normal closed position for enabling said web-feeding means and said compartment moving means, to an open position for disabling said web-feeding means and said compartment moving means; and

means for withdrawing the web from said one web-filled compartment until the web pressure in said one web-filled compartment is reduced causing said switch means to be moved to its closed position.

10. The invention according to claim 9 wherein said compartments are rotatable, and said compartment moving means imparts rotation to said compartments.

11. The invention according to claim 9 wherein said web-accumulating means comprises a rotatable member having a plurality of radially extending, angularly spaced partitions cooperating therewith to form a plurality of compartments.

12. The invention according to claim 9 wherein said web-accumulating means comprises a rotatable member having circular spaced discs and a plurality of radially extending, angularly spaced partitions between said discs and cooperating with said member and said discs to form a plurality of compartments.

13. The invention according to claim 9 wherein said web-accumulating means comprises a rotatable member having circular spaced discs and a plurality of radially extending, angularly spaced partitions between said discs and cooperating with said member and said discs to form a plurality of compartments, and web-retaining means encircling the periphery of said discs.

14. The invention according to claim 13 wherein said web-retaining means is provided with a web inlet and a web outlet, and comprises an arcuate plate encircling a portion of the periphery of said discs, and a plurality of adjacent rollers encircling the remainder of the periphery of said discs.

* * * * *