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Duchinsky et al.

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[54] **DEVICE FOR COLLECTING PILES OF PRINTED MATTER INTO BUNDLES**

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Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 237,017, March 22, 1972, abandoned.

[52] **U.S. Cl.** ..... **214/6 BA,** 214/6.5, 271/178, 271/212

[51] **Int. Cl.** **B65g 57/30**

[58] **Field of Search** ..... 214/6 BA, 6.5, 7; 271/177, 271/178, 179, 180, 181, 212

[56] **References Cited**

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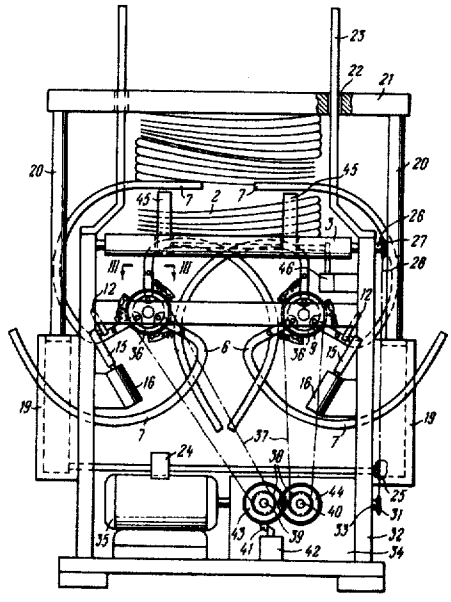
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Assistant Examiner—Leslie J. Paperner
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[57] **ABSTRACT**

The device includes a pile advancing rollerway, the rollers of which are mounted so that the ends thereof are free and spaces are left intermediate of these free ends. Levers are mounted radially on shafts and arranged in opposition to one another so as to form opposing pairs of said levers defining a pile assembling zone. These levers have their arms of an overall length approximating the spacing between these shafts and being offset relative to one another, so that on rotation of these shafts the arms of these levers are brought together and overlap to support a pile in the assembling zone. The device further includes means for spreading these levers, with said shafts being stationary, to provide for delivering of collected bundle from the collecting zone in the same plane in which the piles are advanced thereinto. A compressing plate compresses a bundle being collected. The disclosed structure provides for collecting piles of any printed matter into bundles, prevents running of the levers on the same shafts onto one another and enables to effect compressing of a bundle directly in the course of its collecting.

4 Claims, 5 Drawing Figures



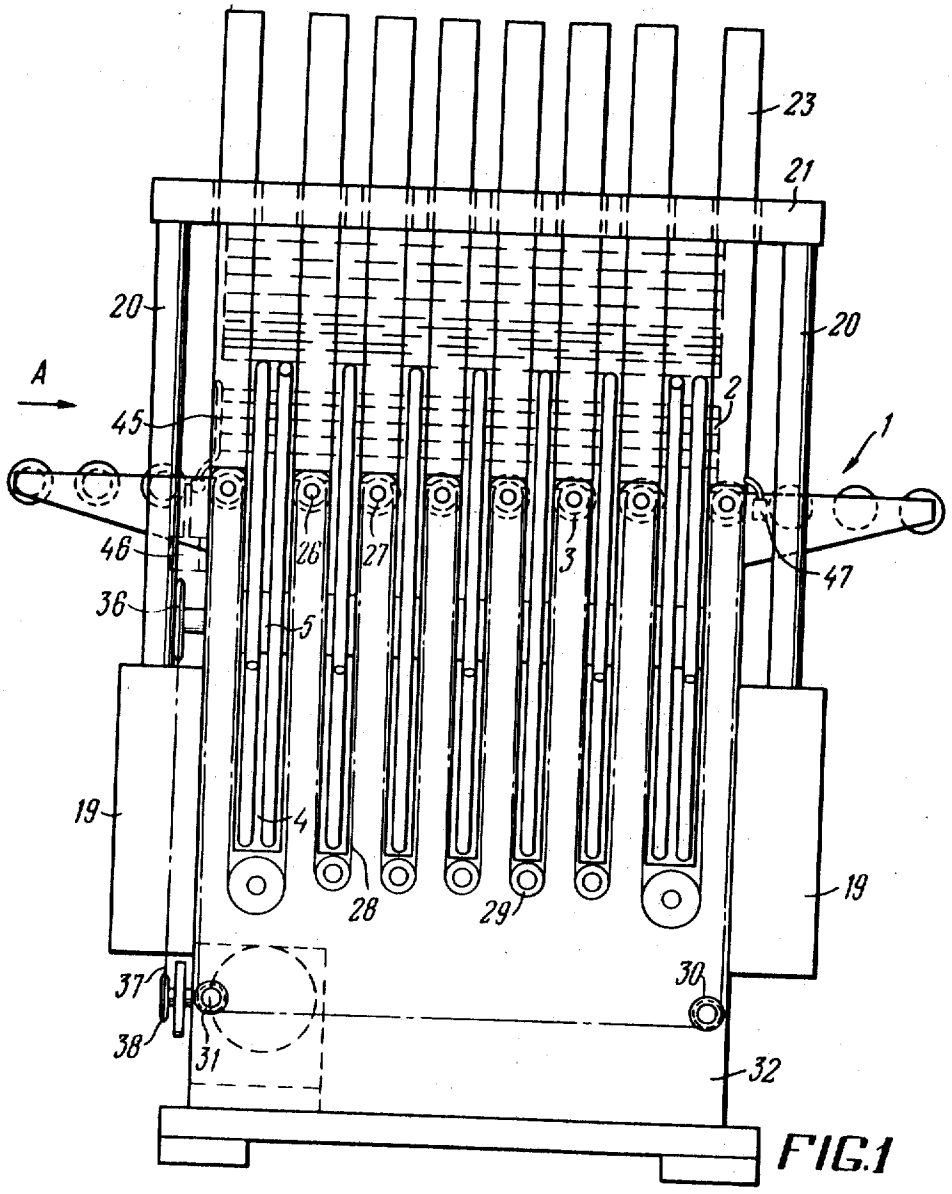
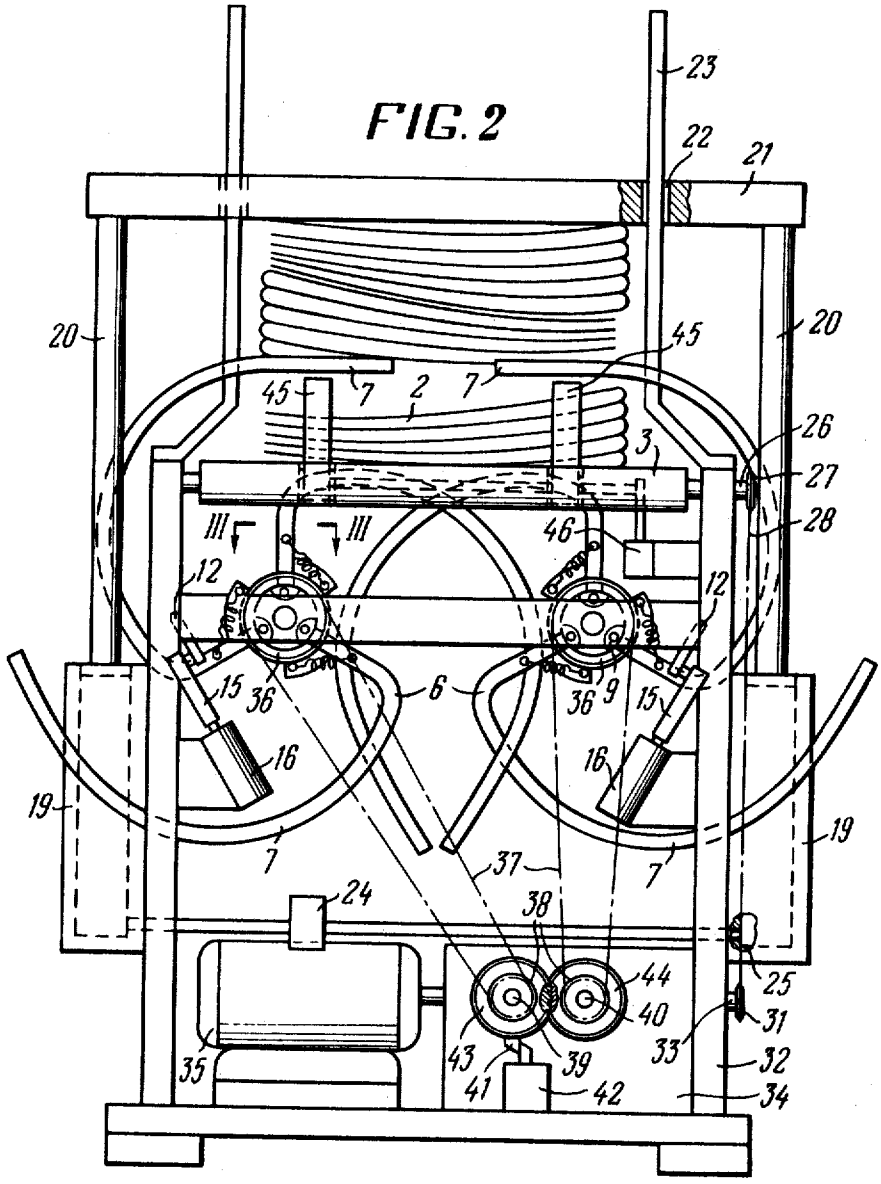


FIG.1

FIG. 2


23
22
21
20
20
45
45
7
2
7
26
3
27
28
III
III
46
12
12
15
36
6
36
9
15
16
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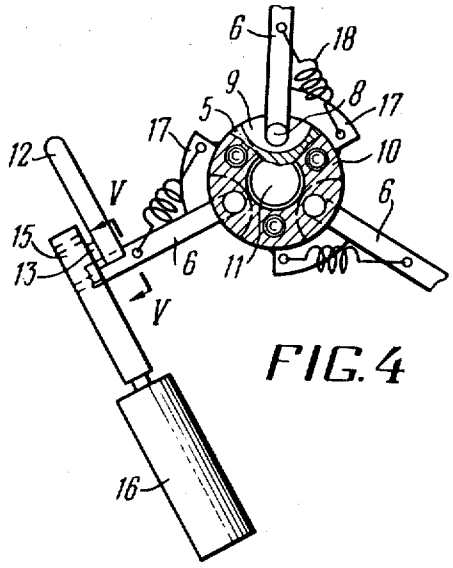


FIG. 4

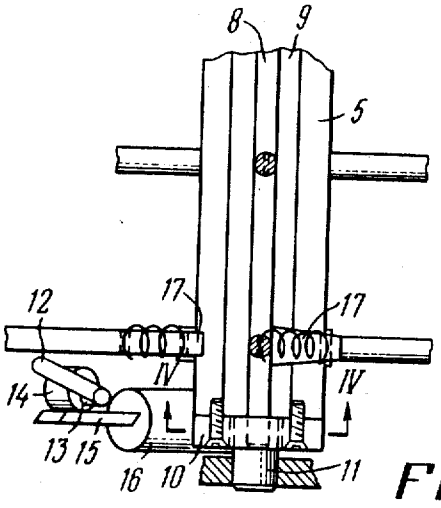


FIG. 3

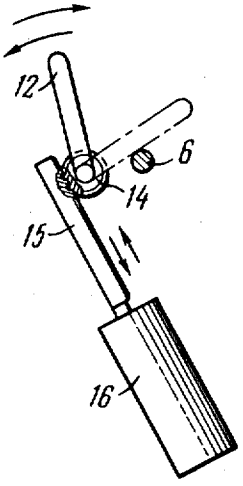


FIG. 5

DEVICE FOR COLLECTING PILES OF PRINTED MATTER INTO BUNDLES

PRIOR REFERENCE TO RELATED APPLICATIONS

This application is a continuation-in-part of our previous application Ser. No. 237,017, filed on Mar. 22, 1972 and now abandoned.

BACKGROUND OF THE INVENTION

The present invention relates to devices for collecting piles of printed matter into bundles and may be used with utmost effectiveness for collecting piles of folded newspapers into bundles.

In the present disclosure the expression "a pile of newspapers" is meant to describe an arbitrary number of newspapers placed one on top of another, so that their cross folds are disposed at the same side.

The expression "a bundle of newspapers" is meant to imply an assembly of piles of newspapers placed one on top of another so that the cross folds of adjacent piles alternate, i.e., the cross folds of an adjacent pair of piles are facing in opposite directions. This pattern of collecting piles into bundles is aimed at preventing eventual crumbling of a bundle at subsequent handling, e.g., at packaging.

At present, there is known a device for collecting piles of newspapers into bundles. The device comprises a pile feeding rollerway, a mechanism for collecting piles into bundles, and a mechanism for delivering collected bundles. In this known apparatus the mechanism for collecting piles into bundles comprises a vertically reciprocable table onto which piles of newspapers are placed in succession and with the cross folds of the newspapers in all these piles facing in the same direction; a gripping mechanism including a system of spreadable arms, into which the piles are fed in succession by the vertically reciprocable table; and a delivery rollerway onto which a collected bundle is advanced from the gripping mechanism by an ejector.

The bundle collecting operation performed by this known apparatus is effected by a pile being fed into the gripping mechanism, with subsequent rotation of this mechanism and feeding of a successive pile thereinto. The gripping mechanism is rotatable to effect rotation of the folds of the newspapers in a pile through 180° relative to a successive pile, in which way a stable bundle is formed.

However, the presence in the known device of the vertically reciprocable table, of the specific delivery rollerway, and of the ejector mechanism has been found not only to complicate the structure of the device, but also to affect its capacity, since the vertically reciprocable table has to be driven through a full reciprocation — i.e., through a double stroke — to feed a successive pile into the gripping mechanism. This operation is a time-consuming one. The relatively low capacity of the described above known device renders impractical its incorporation in automatic continuous-flow lines for handling printed matter, since these lines are operable only when their components can be run at high speeds with great productivity. Furthermore, the above-described known device does not perform compressing of a bundle simultaneously with collecting it, which affects the appearance of collected bundle.

There are also known in the printing art devices for collecting piles of printed matter e.g., books and magazines — into bundles. These devices comprise a belt-type conveyor for advancing the piles, and a pair of shafts extending at both sides of the conveyor. The shafts are driven for intermittent timed rotation and carry thereon radially extending levers arranged in opposing pairs defining a bundle collecting zone. The levers have pile-supporting bent portions adapted to lift a pile at timed rotation of the two shafts, with the levers of each said opposing pair having arms of a length ensuring that the pile-supporting bent portions of these levers engage a pile solely by the sides of the latter.

With the levers of the last-described known device supporting a pile solely by the sides thereof, the device cannot be employed for collecting bundles of piles of newspapers, since in this case a pile of newspapers, which possesses very small rigidity, is apt to sag and then to fall down. This renders the operation of collecting piles of newspapers into stacks by this device virtually impossible. This situation cannot be remedied by increasing the length of the arms of the levers of this known device, since such extended arms would abut against the conveyor belt and thus make the operation impossible. Apart from that, the last-described known device does not include means for delivering a collected bundle from the collecting zone, whereby the device cannot be incorporated into automatic continuous-flow lines for handling printed matter. Neither does the known device include means for compressing a bundle simultaneously with collecting it, with the result that the piles in a bundle might be offset with respect to one another. This affects the appearance of the final bundle and hinders its subsequent packaging.

SUMMARY OF THE INVENTION

It is an object of the present invention to create a device for collecting piles into bundles, which device should be capable of forming bundles of piles of any printed matter.

It is an important object of the present invention to create a device which should provide for feeding piles to be collected and for delivering collected bundles in the same plane as the piles are fed.

It is a further object of the present invention to create a device which should perform compressing of a bundle directly in the course of collecting thereof.

These and other objects are attained in a device for collecting piles of printed matter into bundles, such device comprising a pile advancing conveyor and a pair of shafts extending at both sides of this conveyor. The shafts are adapted to be driven for synchronous intermittent rotation and carry thereon radially extending levers arranged in opposing pairs to define a zone of collecting of piles advanced by the conveyor. The levers include bent portions adapted to support a pile in the collecting zone, in which apparatus, in accordance with the present invention, the pile advancing conveyor is a rollerway wherein the rollers are mounted so that they have free ends, a space being left intermediate of these free ends of adjacent rollers through which the bent portions of the levers are able to pass. Each such lever has its arms of a length maximally approximating the spacing between the two shafts, with said levers being offset relative to one another so that when the arms thereof are positioned in the collecting zone, the pile-supporting portions thereof are brought adjacent

to one another and overlap to support a pile across the entire bottom plane thereof and to lift it above the rollerway. Subsequent rotation of the shafts brings these portions apart, whereby the pile is lowered onto the successive one, in which way a bundle is formed. The device further includes arm spreading means providing for the final bundle being delivered from the collecting zone in the same plane in which a pile is fed thereinto.

The herein disclosed structure of the bundle collecting device renders the latter capable of collecting piles of any printed signatures into bundles, because the levers of the device have their arms of a length maximally approximating the spacing between the shafts, whereby the pile-supporting portions of the arms overlap and support the pile across the entire bottom plane thereof. In the manner sagging of the pile is positively prevented. Furthermore, the incorporation of the lever spreading means enables a collected bundle to be lowered onto the same pile advancing rollerway, whereby feeding of a pile to be assembled and delivering of a collected bundle are effected in the same plane. This eliminates any unnecessary and excessive mechanical action to which a bundle is usually subjected when feeding of the piles and delivering of the bundles is effected in different planes. The combining of the operations of feeding piles to be assembled and delivering of the collected bundles makes the herein disclosed device incorporable in an automatic continuous-flow line for handling printed matter such as, e.g., for delivering and packaging printed matter.

To prevent running of the levers carried by the same shaft onto one another, it is expedient that these shafts should carry abutments, with such abutment having one end of a spring secured thereto, and the other end of the spring being connected to the respective lever to bias this lever against the abutment. The shafts have journals and recesses made in the cylindrical surface thereof. These recesses rotatably receive therein spindles having the said levers secured thereon, which provides for spreading of these levers by the said lever spreading means.

To provide for compressing of a pile simultaneously with collecting thereof, it is advisable that the device should include air cylinders having plunger rods and a compressing plate rigidly mounted on said rods and disposed above the pile-supporting portions of the said levers with minimal spacing therefrom. The cylinders communicate with each other and with the ambient atmosphere through check valve means to provide for a vertical travel of the rods thereof together with the said plate under the action of a bundle being collected the cylinders are associated with stop means adapted to limit the travel of the rod of each respective air cylinder to ensure the said minimal spacing.

BRIEF DESCRIPTION OF THE DRAWINGS

For the present invention to be better understood, given hereinbelow is a description of an embodiment thereof, with reference being had to the accompanying drawings, wherein:

FIG. 1 is a side elevation of a device for collecting piles of printed matter into bundles, in accordance with the present invention;

FIG. 2 is a view taken along arrow line "A" in FIG. 1;

FIG. 3 is a sectional view taken along line III—III in FIG. 2;

FIG. 4 is a sectional view taken along line IV—IV in FIG. 3;

FIG. 5 is a sectional view taken along line V—V in FIG. 4.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now in particualr to the appended drawings, the herein disclosed device comprises a rollerway 1 FIG. 1 for advancing piles 2. The rollers 3 of the rollerway 1 are mounted so that the ends thereof are free and a space 4 is left intermediate these ends of adjacent rollers 3.

There are disposed at both sides of the rollerway 1, adjacent to the free ends of the rollers 3 thereof, shafts 5 carrying thereon levers 6. These levers are mounted radially on these shafts and are arranged in opposing pairs to define a bundle collecting zone, with the levers having portions 7 bent as arcs of a corresponding radius (See FIG. 2) and adapted to support a pile 2 across the bottom plane thereof.

The radius of curvature of each portion 7 is determined by a condition of that when the levers 6 are brought into the collecting zone, the spacing between the bent portions and the longitudinal axis of symmetry of the rollerway should be sufficient for passage of a pile of a maximal height. the arms of the levers 6 have an overall length which maximally approximates (i.e., which is as close as possible to) the spacing between the shafts 5. The arms of each lever are uniformly angularly spaced from one another (e.g. by 120° as is the case in the presently described embodiment), so that when each successive pair of arms of the opposing pair of the levers 6 is brought into the collecting zone by the rotation of the shafts 5, the respective bent portions 7 of these arm successively pass through the spaces 4, come together and overlap and then go apart.

To provide for the delivery of a collected bundle in the same plane in which the piles have been brought into the collecting zone — i.e., in the plane of the rollerway 1 — the levers 6 are mounted on the respective shafts 5 so that they can be spread apart. This is attained by all the levers 6 of each one of the shafts 5 being rigidly mounted on a respective spindle 8 FIG. 3 so that the levers should be able to pass through the respective spaces 4. The free ends of the rollers 3 of the rollerway 1 are positioned intermediate of these levers. The cylindrical surfaces of the respective shafts 5 have made therein recesses 9 in which the spindles 8 are rotatably received. The spindles are secured in flanges 10 mounted on the journals 11 of the respective shaft 5 FIG. 4. Rotation of the spindles 8 is necessary to provide for spreading of the levers 6 when the superimposed piles supported by the levers are to be placed on top of a pile that is the last in the bundle being collected, and which has been advanced into the collecting zone by the rollerway 1.

The means for spreading the levers 6 of each shaft 5 includes a pusher 12 rigidly mounted on a spindle 13 carrying a pinion 14 meshing with a toothed rack 15. The latter is reciprocable by any suitable known arrangement — e.g., by an air cylinder 16 FIG. 5.

To prevent running of the levers 6 of either one of the shafts 5 onto one another, each shaft has mounted thereon abutments 17 FIG. 3. Each such abutment has attached thereto one end of a spring 18, the opposite end of the spring being attached to the respective one

of the levers **6**. The spring permanently biases the respective lever toward the abutment **17**.

To provide for the direct compressing of a bundle in the course of its being collected, the device includes air cylinders **19** FIG. **1**, of which the respective plunger rods **20** have rigidly secured thereto a common compressing plate **21**. This plate is positioned above the portions **7** of the levers **6** and has made therein apertures **22** through which limiting strips **23** extend to prevent offsetting of the newspapers in the bundle being collected. The air cylinders **19** communicate with each other and with the ambient atmosphere through a check valve **24**.

The plate **21** is positioned above the portions **7** of the arms **6**, with a minimal spacing therebetween. This spacing provided should assure that there is no direct contact or friction between the bottom plane of the plate **21** and the portions **7** of the levers **6** when these portions have no piles supported thereby.

The presence of this minimal spacing is provided for by the downward stroke of the plunger rods **20** being limited by stop means — e.g., by the bottoms **25** of the respective air cylinders **19**.

The rollers **3** of the rollerway **1** are adapted to be positively rotated during operation of the device by the respective arbors **26** of the rollers carrying thereon sprockets **27** interconnected by a driving chain **28** running over sprockets **29, 30** and **31** mounted on the framework **32** of the device. The sprocket **31** FIG. **2** is mounted on the output shaft **33** of a reducer **34** associated with an electric drive motor **35**.

The shafts **5** are intermittently synchronously rotated by having mounted thereon sprockets **36** connected through respective driving chains **37** to sprockets **38** mounted, respectively, on the shafts **39** and **40** of the reducer **34**. The shaft **39** is associated with a single-revolution clutch **41** controlled by a solenoid **42** and is operatively connected with the shaft **40** through a pair of meshing gears **43** and **44**. In this manner there is effected synchronous rotation of the two last-mentioned shafts **39** and **40** in opposing directions. The incorporation of the single-revolution clutch **41** provides for intermittent rotation of the shafts **5**, together with the levers **6**, through 120°, during which rotation the pile-supporting portions **7** of the pairs of the levers positioned above the rollerway **1** in the bundle collecting zone go apart, while the portions **7** of the other pairs of the levers, positioned under the rollerway **1**, pass through the respective spaces **4** intermediate of the free ends of the rollers **3**, enter the collecting zone and become positioned above the rollerway **1** so that there is left a space intermediate of these portions **7** and the longitudinal axis of symmetry of the rollerway sufficient for passage of piles of a maximal height.

To control the travel of the piles **2**, there is positioned at the end of the collecting zone a stop **45** FIG. **1** selectively actuated by an appropriate device — e.g., by a solenoid **46** which retracts this stop into the recesses in the rollers **3** of the rollerway after a bundle has been collected — whereby the bundle is released and permitted to leave the collecting zone.

The device also includes a pickup **47** FIG. **2** that responds to a pile being introduced into the collecting zone and sends a command to energize the solenoid **42** of the solenoid-controlled single-revolution clutch **41**.

OPERATION OF THE DEVICE

Prior to the herein disclosed device being engaged for operation, the levers **6** are brought into an initial position whereat there is left a space between the portions **7** of the respective pairs of these levers and the longitudinal axis of symmetry of the rollerway **1**. This space is sufficient for passage of a pile of a maximal height. Then the motor **35** is energized, and its rotation is transmitted through a kinematic train of the elements **27, 28, 29, 30, 31** and **34** to the rollers **3** of the rollerway **1**, successive piles **2** are fed into the collecting zone. When a successive pile **2** engages the stop **45**, the pickup **47** responds and sends a command to energize the solenoid **42** of the single-revolution clutch **41**. Then the kinematic train made up by the elements **44, 43, 38, 37 36** transmits rotation to the shafts **5**, and the latter rotate jointly with the levers **6** supported thereby through 120°. During this rotation the pile-supporting portions **7** of the pairs of the levers **6** which have been positioned under the rollerway **1** pass through the respective spaces **4** intermediate of the free ends of the rollers **3**, rise above these rollers, come together and overlap. When in the overlap position they take upon themselves the pile **2** in the collecting zone and support this pile across the entire bottom plane thereof. Then the said portions **7** lift this pile off the rollerway, so that this pile **2** engages the bottom plane of the plate **21** and continues rising together with this plate. The portions **7** of the levers **6** rise above the rollerway **1** so that the spacing therebetween is sufficient for passage of a pile of a maximal height. In this position of the levers **6** the single-revolution clutch **41** is disengaged, and the shafts **5** stop after having been rotated through 120°, as it has been already explained.

Then a successive pile is fed into the collecting zone, and the single-revolution clutch **41** is re-engaged in the above-described manner, whereby the shafts **5** are rotated once again through 120°. During this rotation the pairs of the levers that are positioned above the rollerway **1** go apart and lower the pile they have been supporting onto the successive pile in the collecting zone, which last-mentioned pile is already supported by the pile-supporting portions **7** of the successive pairs of the levers **6** that have entered the collecting zone from under the rollerway **1** in the above-described way. In this way, the two piles marry, forming a bundle. Plate **21** compresses the piles **2** by its own weight during the time a stack is being collected. As the plate **21** is thus lifted by the bundle being collected, the plunger rods **20** are displaced in the air cylinders **19**, the air being drawn into the air cylinders through the open valve **24**.

When the last pile **2** to be collected into the bundle is advanced into the collecting zone by the rollerway **1**, the valve **24** is closed, and the air cylinder **16** is placed into operation, whereby the toothed rack **15** is displaced, and the pinion **14** meshing with the rack **15** is rotated. Pinion **14** in turn rotates the spindle **13** provided with the pusher **12**. The latter abuts against the levers **6**, as it is shown in FIG. **5**, and spreads them beyond the limiting strips **23**. The piles that have been supported by these levers **6** in a superimposed state are lowered onto this last pile, and a final bundle **48** is delivered by the rollerway **1**, after the pushers **12** have been retracted, for subsequent handling, such as, e.g., for packaging.

After the bundle **48** has been carried away, the valve **24** is opened, and the plate **21** smoothly lowers, owing to the presence of the air cushion in the air cylinders **19**, into its initial position whereat the plunger rods **20** abut against the bottoms **25.**

Then the above-described bundle collecting operation is repeated.

What we claim is:

1. A device for collecting piles of printed matter into bundles, comprising, in combination: a rollerway adapted to advance piles to be collected into bundles, rollers of said rollerway mounted so that the ends thereof are free and spaces are left intermediate of said free ends of adjacent ones of said rollers; shafts mounted longitudinally of said rollerway at both sides thereof adjacent to said free ends of said rollers, said shafts being adapted for intermittent synchronous rotation in opposite directions; levers mounted radially on said shafts and arranged thereon in opposition to one another forming opposing pairs of said levers defining a bundle collecting zone, said levers having arcuately bent portions of a predetermined radius and adapted to support a pile and to lift it on synchronous rotation of said shafts; said levers of each said opposing pair having their arms of a length maximally approximating the spacing between said shafts and being offset relative to each other, so that when each pair of said opposing pairs of levers are positioned in said collecting zone said pile-supporting portions thereof come together and overlap, said levers, with said shafts being driven through said rotation, being adapted to cooperate with the piles in said collecting zone so that a pair of said arms positioned under a pile lying on said rollerway, which has been advanced into said collecting zone, passes through said spaces intermediate of the respective ones of said rollers, rise above said rollers and take the pile upon themselves, supporting the pile across the bottom plane thereof by said pile-supporting portions of said levers, while another pair of said pairs of said arms, positioned above said pile and supporting thereon the piles that have been already collected, are brought apart by further rotation of said shafts, lowering said previously collected piles onto said pile that is being lifted thereunder, whereby all said piles marry, forming a bundle; means for spreading said levers while said shafts remain stationary and providing for delivery of the collected bundle from said collecting zone in the plane in which piles are advanced into said collecting zone.

2. A device as claimed in claim **1**, wherein said shafts have journals and recesses in the cylindrical surface thereof; and further including spindles having said levers rigidly mounted thereon and rotatably received in said recesses, whereby said levers can be spread by said lever spreading means; flanges mounted on said journals of said shafts; said spindles being journalled in said flanges; abutment means mounted on said cylindrical surface of each said shaft; spring means having one end thereof connected to said abutment means and having the other end thereof connected to the respective one of said levers, said spring means being adapted to bias said levers toward said abutment means, whereby there is prevented running of said levers of each one of said shafts onto one another as said shaft is rotated jointly with said levers in a predetermined direction.

3. A device as claimed in claim **1**, further including air cylinders associated with plunger rods, the cylinders arranged outside said collecting zone; a compressing plate rigidly mounted on said plunger rods and arranged above said pile-supporting portions of said levers at a minimal spacing therefrom; said cylinders communicating with one another and with ambient air via check valve means, whereby said plunger rods together with said compressing plate can be vertically displaced under the section of the pile being collected; stop means associated with said air cylinders for limiting the stroke of the respective ones of said plunger rods of said air cylinders and provide said minimal spacing.

4. A device as claimed in claim **3**, wherein said stop means includes the bottoms of said air cylinders.

* * * * *