

July 30, 1957

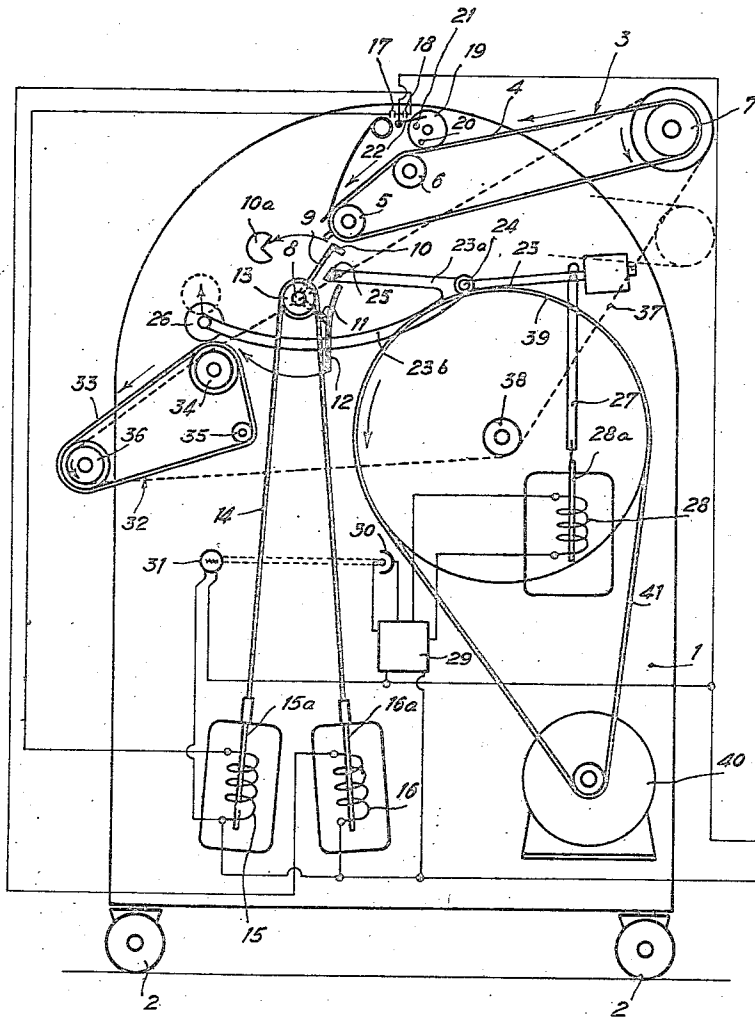
H. L. L. JESUS
APPARATUS FOR FOLDING BED SHEETS AND OTHER
SHEETS OF SUPPLE MATERIAL

2,801,101

Filed June 22, 1953

4 Sheets-Sheet 1

Fig. 1



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Fig. 2

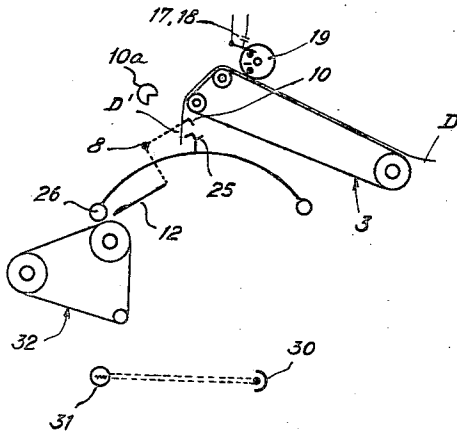


Fig. 3

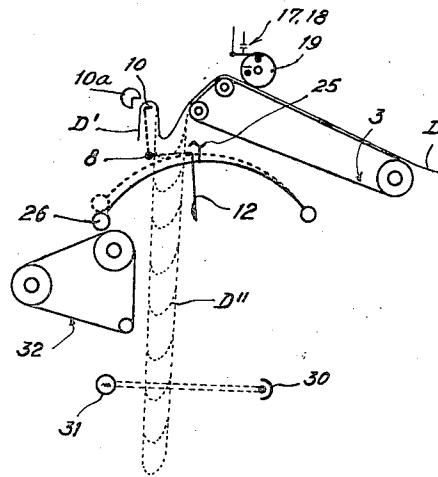


Fig. 4

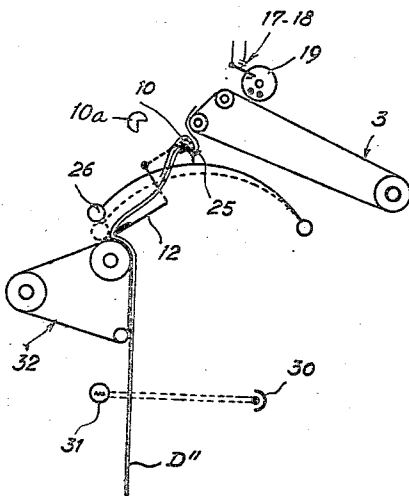
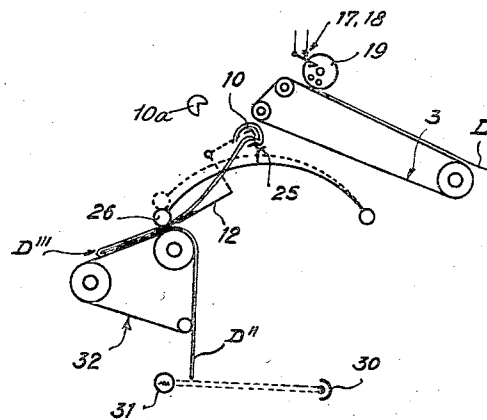


Fig. 5



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Fig. 6

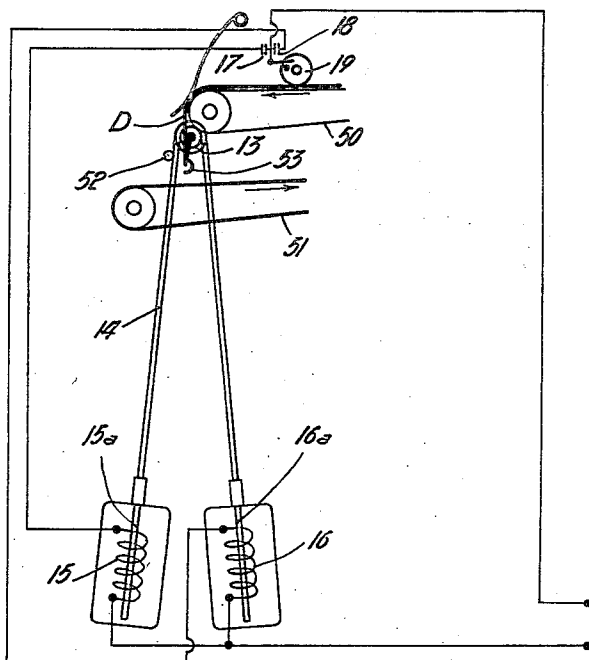
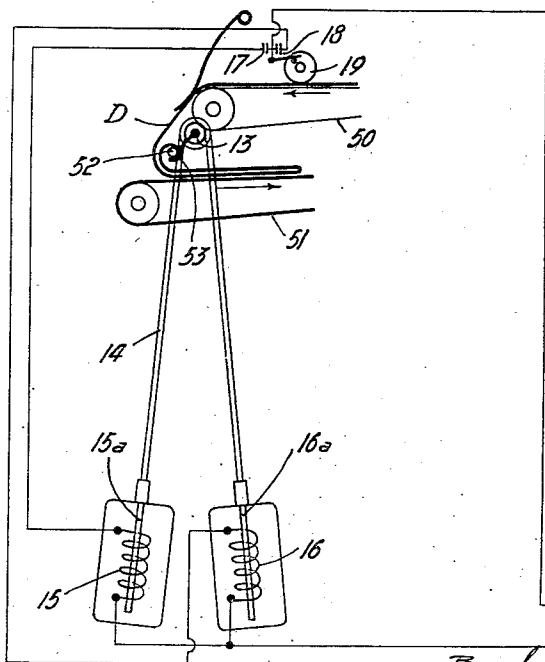


Fig. 7



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Fig. 8

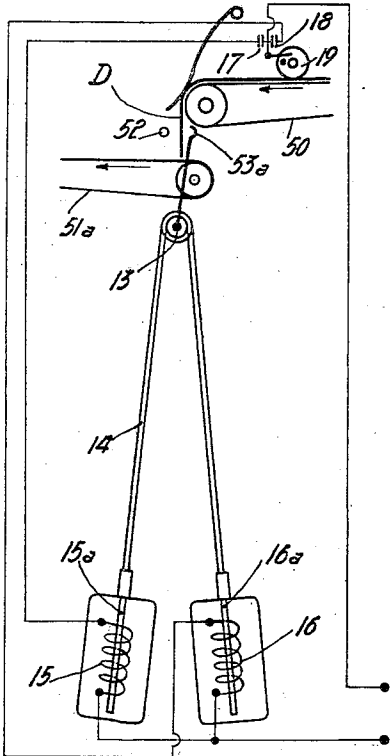


Fig. 9

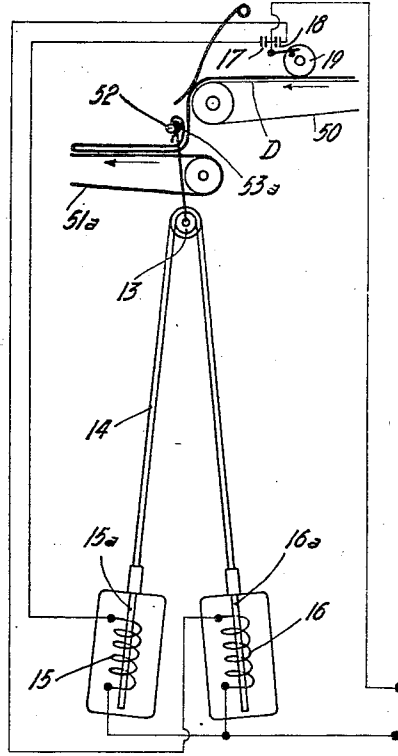
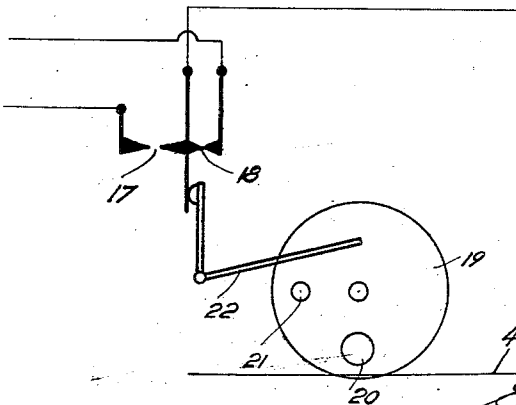


Fig. 10



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2,801,101

APPARATUS FOR FOLDING BED SHEETS AND OTHER SHEETS OF SUPPLE MATERIAL

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13 Claims. (Cl. 270—68)

This invention relates to an apparatus for folding sheets of supple material, more particularly for folding bed sheets, and it is in this latter purpose which is more especially dealt with in the following description and explanations, it being understood, however, that the invention is in no way limited thereto.

One object of the invention is to provide for an apparatus for the folding in two of sheets of supple material such as bed sheets, the positioning of the fold in the middle of the length of the sheet being performed automatically, whatever may be said length.

Another object of the invention is to provide for an apparatus for the folding in four of sheets of supple material such as bed sheets, the positioning of the first fold in the middle of the length of the sheet and the positioning of the second fold in the middle of the length of the sheet already folded in two being both automatically performed, whatever may be the length of the sheet to be folded.

These objects and others will appear in the following description which relates to some specimen embodiments of the invention, given solely by way of illustration and shown diagrammatically on the accompanying drawing, on which:

Fig. 1 is a profile view of one embodiment of an apparatus for the folding in four, a part of the frame-work having been removed so as to show the inside;

Fig. 2 shows the essential components of the apparatus during the first stage of folding;

Fig. 3 shows the essential components of the apparatus during the second stage of folding;

Fig. 4 shows the essential components of the apparatus during the third stage of folding;

Fig. 5 shows the essential components of the apparatus during the fourth and last stage of folding;

Fig. 6 shows another embodiment of an apparatus for the folding in two, at the beginning of the folding stage;

Fig. 7 shows the apparatus of Fig. 6 during the folding;

Fig. 8 shows another embodiment of an apparatus for the folding in two, at the beginning of the folding stage;

Fig. 9 shows the apparatus of Fig. 8 during the folding;

Fig. 10 shows, at a larger scale, a detail of the apparatuses shown in Figs. 1 to 9.

The folding apparatus shown in Fig. 1 comprises a frame-work 1 mounted on casters 2.

In the upper part of the frame-work 1 is a conveyor 3 for carrying the sheets to be folded coming, for instance, from a drying and ironing machine not shown in the drawing. This conveyor consists of belts or strips of webbing 4 passing over rollers 5, 6 and 7, the latter being the driving roller. In order to permit of adjusting the entering of the conveyor 3 at the most suitable receiving level in relation, for instance, to the discharge of a drying machine, the said conveyor is so mounted as to be able to swivel as a whole round an axis coinciding with that of the roller 5.

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Substantially beneath the roller 5 is a spindle 8 rotating in the frame 1. At the ends of this spindle are keyed arms 9 (only one of which is visible on the drawing), bearing a cross-bar 10 which forms the movable pick-up means which can work in conjunction with a fixed stop bar 10a, capable of being heated to complete the drying of this part of the sheet. The arms 9 are integral with arms 11 carrying a deflector shutter 12 which constitutes the shifting means. On the spindle 8 is keyed a pinion 13 engaged with a chain 14, the ends of which are connected to the plungers 15a and 16a of two electromagnets 15 and 16.

The excitation circuits of the electromagnets 15 and 16 (supplied by a source such as the city mains) are controlled by contactors 17 and 18 actuated by means detecting the passage of the sheets over the conveyor 3 (see Fig. 10). These detector means consist of one or more discs 19 penetrating slightly into the spaces between the strips of webbing 4. One at least of the said discs carries a counterweight 20 to bring back the discs as a whole into the so-called "off" position corresponding to the closing of the contactor 18 and the opening of the contactor 17. In addition, one of the discs carries a control finger 21 so arranged as to actuate a lever 22 which, in turn, controls the operation of the contactors 17 and 18.

Two levers 23, pivoted at 24, are also fitted in the frame 1. Each of these levers comprises an upper arm 23a and a lower arm 23b. On the ends of the upper arm 23a a supporting cross-bar 25 is fitted, which can work in conjunction with the cross bar 10 for tightening the two ends of the sheet. On the ends of the lower arms 23b is mounted a tightening cylinder 26, the function of which will be seen later.

The two levers 23 are connected by a rod 27 with the plunger 28a of an electromagnet 28, the circuit of which is controlled through an electronic relay 29. This relay is actuated by a photo-electric cell 30 which intercepts the luminous rays coming from an electric lamp 31.

Opposite the feed conveyor 3 and slightly lower than it is a delivery conveyor 32 comprising one or several flexible belts 33 passing over three rollers 34, 35 and 36, the latter being the driving roller.

The two conveyors 3 and 32 are driven by a common belt 37 from a pulley 38 integral with a wheel 39, which is driven by an electric motor 40 through a belt 41.

The folding apparatus which has just been described works as follows:

When the apparatus is not running, its essential components are in the position shown in Figs. 1 and 2; the contactor 17 is open and the contactor 18 is closed.

When a sheet D (Fig. 2) passes over the conveyor 3, it comes into contact with the periphery of the detector disc 19 which rotates out of its "off" position. However, as the control finger 20 (due to its position on the disk 19) actuates the lever 22 only when the disk 19 has rotated a given angle, that is to say when the front edge of the sheet passed a given distance beyond said disk, the contactors 17 and 18 are not actuated until the front edge of the sheet is hanging by a certain length D' from the front end of the conveyor 3 to pass behind the pick-up bar 10. The length D' is depending from the diameter of the disk 19 and from the position of the finger 21 on said disk. At the time the disk 19 has rotated sufficiently for the finger 21 actuates, by means of the lever 22 the contactors 17 and 18, the former closes while the latter opens. The electromagnet 15 then is energized, the electromagnet 16 is deenergized and the various organs take up the position shown in Fig. 3.

The pick-up bar 10 having carried along the front end D' of the sheet D holds it tightly against the stop bar 10a (Fig. 3). As the sheet D continues to move forward, it

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forms, as shown in Fig. 3, a loop D' which becomes progressively longer until it intercepts the luminous rays directed on to the cell 30. The arrangement of the relay 28 is such that, as soon as the cell 30 ceases to be excited, the electromagnet 28 is excited, which brings the organs 25 and 26 into the position shown in Fig. 4.

On the other hand, so soon as the rear end of the sheet D has passed beyond the detector disc 19, the latter under the action of the counterweight 20 returns to the "off" position, the finger 21 does not longer actuate the lever 22 and, by the action of the contactors 17 and 18 (which are returned in the position shown in Fig. 10), the organs 10 and 12 take up the position shown in Fig. 4.

In this position, the front and rear ends of the sheet are both held tightly, substantially with the edges touching, between the pick-up bar 10 and the supporting bar 25. Simultaneously the shifting shutter 12 presses the loop D' of the folded sheet D against the ascending side of the conveyor 32 on which the second fold begins to form owing to the lower part of the said loop moving upwards again.

As soon as the bottom of the said loop uncovers the source of light 31 (Fig. 5), the cell 30 again becomes excited, and the excitation of the electromagnet 28 ceases. At this moment, the tightening cylinder 26 falls back on to the conveyor 32 against which it applies the four thicknesses of the sheet folded into four.

It will be seen immediately that by designing the apparatus so that the length of that part of folded sheet which is comprised between the tightening zone of the members 26—32 and a line connecting 30 to 31 is equal to the length of that part of the folded sheet which is comprised between the said tightening zone and the ends of the sheet previously held tightly between the members 10 and 25, the second fold D'' of the sheet D will automatically place itself substantially half-way between the ends of the sheet and the first fold.

In certain cases it may be necessary to fold the sheet only in two or to fold it before or after it has passed through the folding apparatus shown in Fig. 1, so as to have a sheet folded eight ply.

Figs. 6 and 7 show an embodiment of a folding apparatus by means of which the desired result can be achieved.

This device (which is here assumed to be intended to make a centre fold in a sheet D) comprises a feed conveyor 50, a delivery conveyor 51 on which the fold is made, and pick-up and tightening means placed in front of the conveyor 50, above the conveyor 51. The pick-up and tightening means comprise a fixed stop bar 52 and a mobile shutter 53 which can work in conjunction with the stop bar 52.

The shutter 53 is mounted on the shaft of a pinion 13 engaged with a chain 14 the ends of which are connected to plungers 15a and 16a of two electromagnets 15 and 16, the circuits of which are controlled from contactors 17 and 18 actuated from a detecting disk 19, the arrangement of this part of the apparatus being the same as in Fig. 10.

When the front end of the sheet D engages between the members 52 and 53 (Fig. 6), the shutter 53 is actuated and presses against the bar 52, thus gripping the said end of the sheet. As the sheet continues to be carried along by the conveyor 50, a loop forms and falls on to the conveyor 51, the bottom or fold Da of the said loop moving along the latter conveyor (Fig. 7). As soon as the rear end of the sheet D passed the disk 19, the shutter 53 is moved away from the stop bar 52. At this moment, the rear end of the sheet drops from the conveyor 50, a fold will be made half way along the length of the sheet whatever may be the length of the sheet.

A similar result is achieved with the alternative embodiment shown in Figs. 8 and 9, in which the pick-up organ is a grooved bar 53a and the conveyor 51a has a

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reverse position with respect to the position of the conveyor 51 of Figs. 6 and 7, the other parts of the apparatus being the same as in the previous example and are indicated with the same reference numbers.

Moreover, these various devices can be arranged cascaded so as to make multiple folds.

It is obvious that the specimen embodiments of the folding apparatus described above and shown on the accompanying drawing, have been given merely by way of illustration and are not restrictive, and that any detail changes can be made therein.

What I claim is:

1. Apparatus for folding sheets of supple material of the kind of bed sheets, comprising: a frame-work; an intake conveyor having a delivery end and mounted on the frame-work for bringing in the sheets to be folded; a delivery conveyor having an intake end and mounted on the frame-work for evacuating the folded sheets; movable pick-up means located under the delivery end of the intake conveyor for picking up successively the front and rear parts of each sheet brought in by the intake conveyor; fixed stop means, in conjunction with which can work the movable pick-up means for temporarily clamping the front part of said sheet; movable supporting means, in conjunction with which can work the movable pick-up means for temporarily clamping both the front and rear parts of the sheet, so that said sheet may be temporarily hanging, folded in two, from the movable pick-up means and the movable supporting means; shifting means so arranged as to move, towards the delivery conveyor, the lower part of the hanging sheet already folded in two, for allowing said sheet to begin a second fold on said delivery conveyor; first control means operatively connected with the movable pick-up means and with the shifting means for actuating them; first detector means located on the delivery end of the intake conveyor to detect the passage of the front and rear ends of each sheet over the intake conveyor, connected to said first control means and so arranged as to actuate the control means with retardment, on detecting the passage of the front end of the sheet, and immediately, on detecting the passage of the rear end of the sheet; movable holding means located above the intake end of the delivery conveyor to hold temporarily the upper part of the sheet placed on the delivery conveyor by the shifting means; second control means operatively connected to said holding means and to the movable supporting means for actuating them; and second detector means to detect the passage of the lower part of the hanging sheet folded in two, connected to said second control means for actuating them.

2. Folding apparatus according to claim 1, in which the movable pick-up means and the shifting means are connected positively one to the other.

3. Folding apparatus according to claim 1, in which: the movable pick-up means comprise a shaft pivoted on the frame-work, two arms connected to said shaft and a pick-up cross-bar connected to the free ends of the two arms; the fixed stop means consists of a cross-bar arranged to work in conjunction with the said pick-up bar; the shifting means comprise a shutter parallel to the movable pick-up cross-bar and two arms to the ends of which the shutter is fixed said arms being connected to said shaft so that the shutter and the pick-up bar swivel as a unit.

4. Folding apparatus according to claim 1, in which the first control means of the pick-up means and of the shifting means comprise a pinion forming one piece with the said pick-up means and shifting means, a chain engaged with the said pinion, at least one plunger connected to one end of the chain and an electromagnet winding to actuate the plunger and electrically connected to the first detector means.

5. Folding apparatus according to claim 1, in which the first detector means comprises at least one switch so

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arranged as to be actuated by the passage of the sheet on the intake conveyor.

6. Folding apparatus according to claim 1, in which the first detector means comprise: at least one disk so arranged as to be touched by each sheet passing over the intake conveyor and capable of rotating when it is touched by said sheet; a control finger carried by the said disk; a pivoted lever capable of being actuated by said control finger; at least one contactor connected to the first control means and so arranged as to be actuated by the said lever when the said disk has rotated by a given angle in relation to a given starting position, and a counterweight fixed on the disk to keep it in the starting position and to bring it back to the said position when the disk, which has rotated under the action of the passage of a sheet, is no more touched by the sheet.

7. Folding apparatus according to claim 1, in which the holding means and the supporting means comprise: two arms pivoted on the frame-work; a cross-bar forming the supporting means fixed on the arms and in conjunction with which the pick-up means operates; and an idler roller forming the holding means, turning on the free ends of the two arms and able to be moved towards the delivery conveyor.

8. Folding apparatus according to claim 1, in which the second control means comprise at least one electromagnet.

9. Folding apparatus according to claim 1, in which the second detector means comprise: a source of light so arranged as to send a light beam in the travel of the descending folded length of the hanging sheet; a photo-electric cell arranged so as to be excited by the said source of light when the length of sheet does not intercept the light beam coming from the said source of light; an electric amplifier connected to the said cell and to the second control means and so arranged as to actuate the latter when the cell is not excited.

10. Folding apparatus according to claim 1, in which the intake conveyor comprises parallel endless belts passing over a front and rear roller and wherein the first detector means penetrates between two of said belts.

11. Folding apparatus according to claim 10, in which the rollers of the intake conveyor rotate in a frame which is pivoted on the frame-work round an axis substantially coincident with the axis of the roller of the delivery end, so that entrance to the said conveyor can be adjusted at different heights.

12. Folding apparatus for folding sheets of supple material of the kind of bed sheets, comprising: a frame-

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work; an intake conveyor having a delivery end and mounted on the frame-work for bringing in the sheets to be folded; movable pick-up means located under the delivery end of the intake conveyor for picking up the front part of each sheet brought in by the intake conveyor; fixed stop means, in conjunction with which can work the movable pick-up means for temporarily clamping the front part of said sheet; control means operatively connected to the pick-up means for actuating them; detector means located on the delivery end of the intake conveyor to detect the passage of the front and rear ends of each sheet over the intake conveyor, connected to said control means and so arranged as to actuate the control means with retardment, on detecting the passage of the front end of the sheet, and immediately, on detecting the passage of the rear end of the sheet; and a delivery conveyor located under the pick-up and the stop means for the sheet which folds itself on said delivery conveyor while the front part of the sheet remains clamped by the pick up and stop means and for evacuating the sheet thus folded in two.

13. In an apparatus for the folding of sheets of supple material of the kind of bed sheets, comprising: a frame-work; an intake conveyor having a delivery end and mounted on the said frame-work for bringing in each sheet to be folded; clamping means located under the delivery end of the conveyor for maintaining temporarily at least the front part of the sheet brought in by said conveyor; control means positively connected to said clamping means for actuating the latter; and detector means responsive to the passage of the sheet on the conveyor and connected to the control means for actuating the latter; the provision of a single bearing conveyor extending under the clamping means so as to receive the sheet to allow the free formation of the fold of the sheet, the displacement of said fold during the leading of the rear part of the sheet, until the forward end of the sheet is released from the clamping means, under the action of the detector means, and the evacuation of the sheet folded in two.

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