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R. KLEMM
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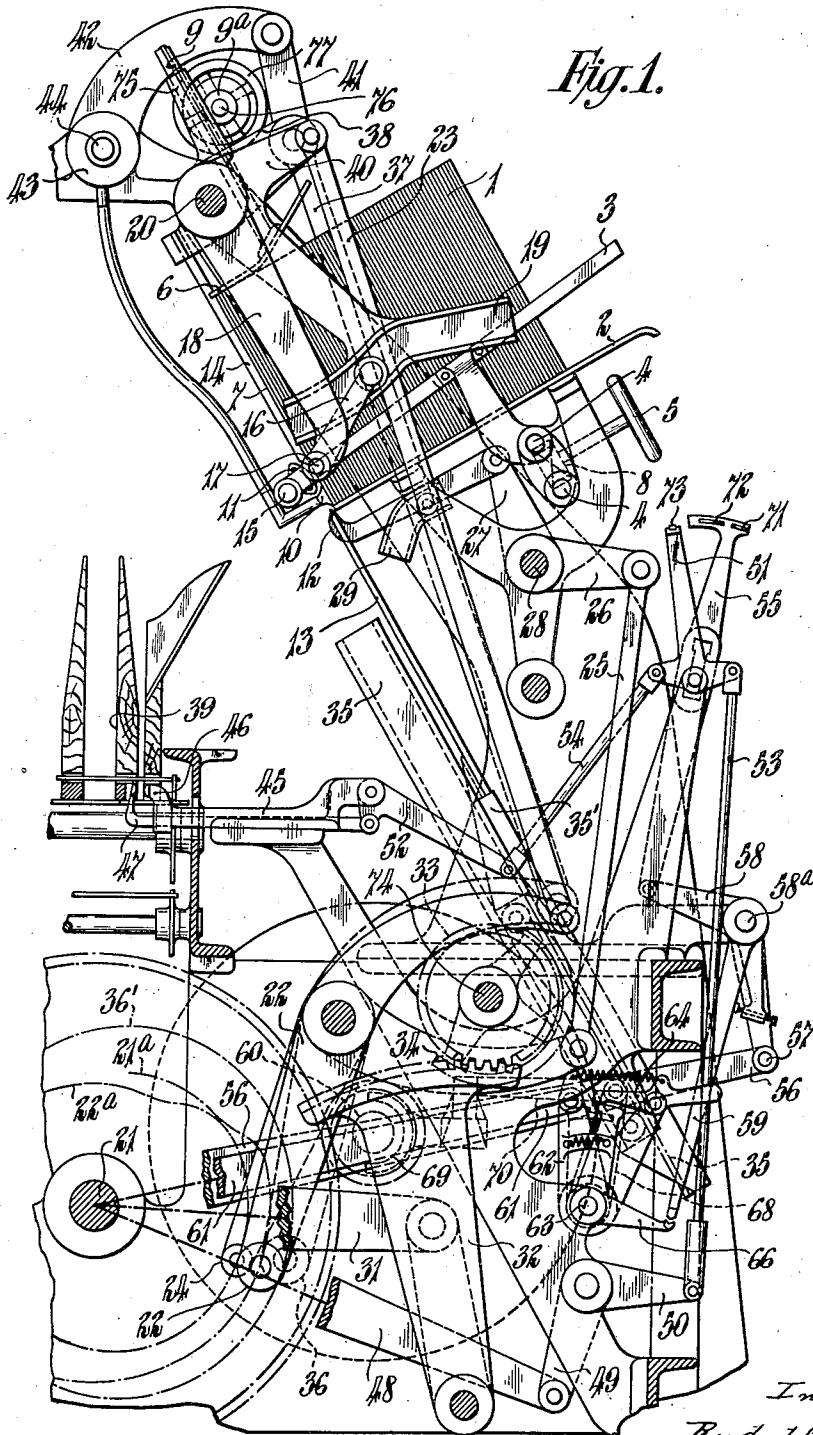


Fig. 1.

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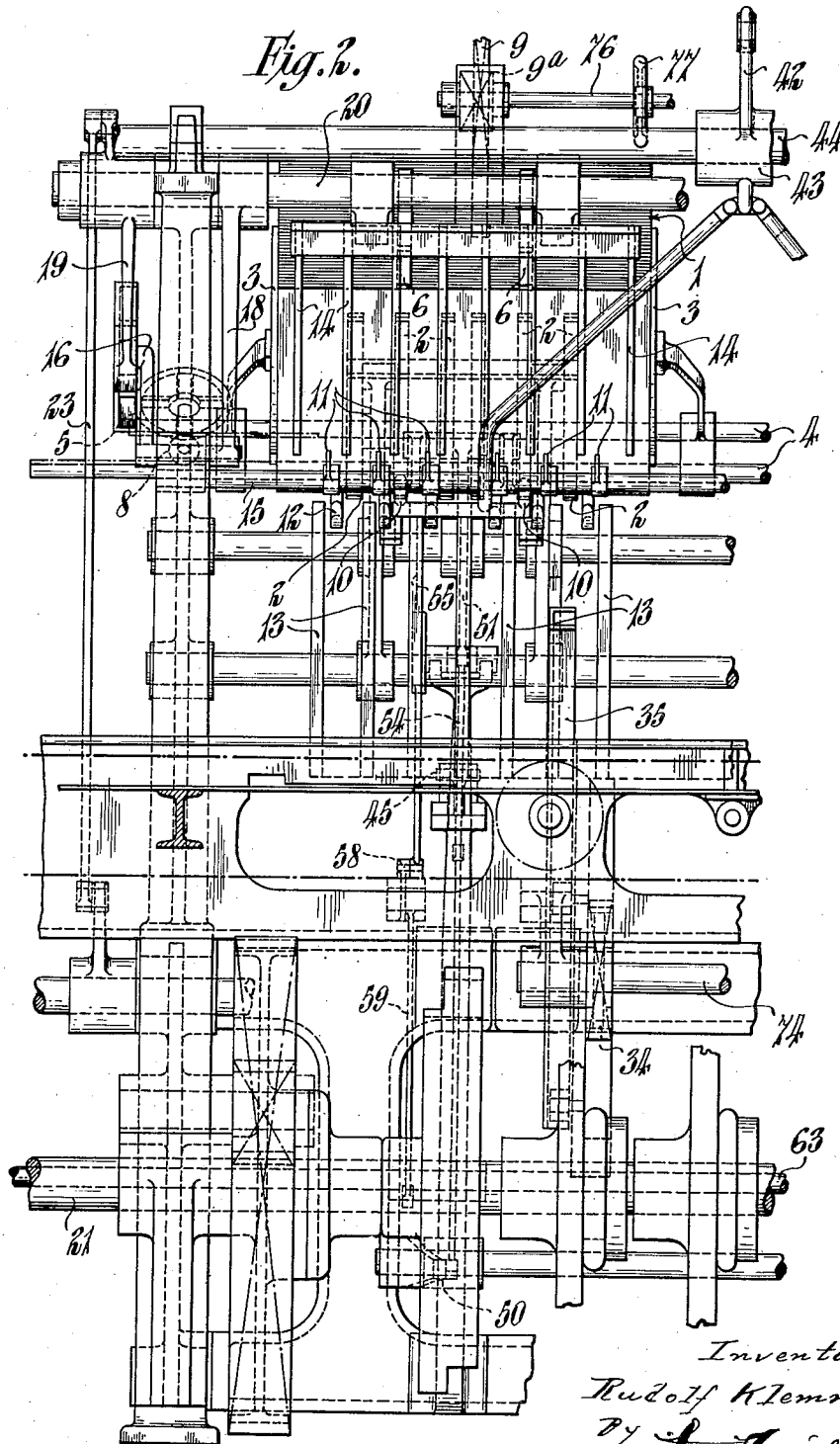
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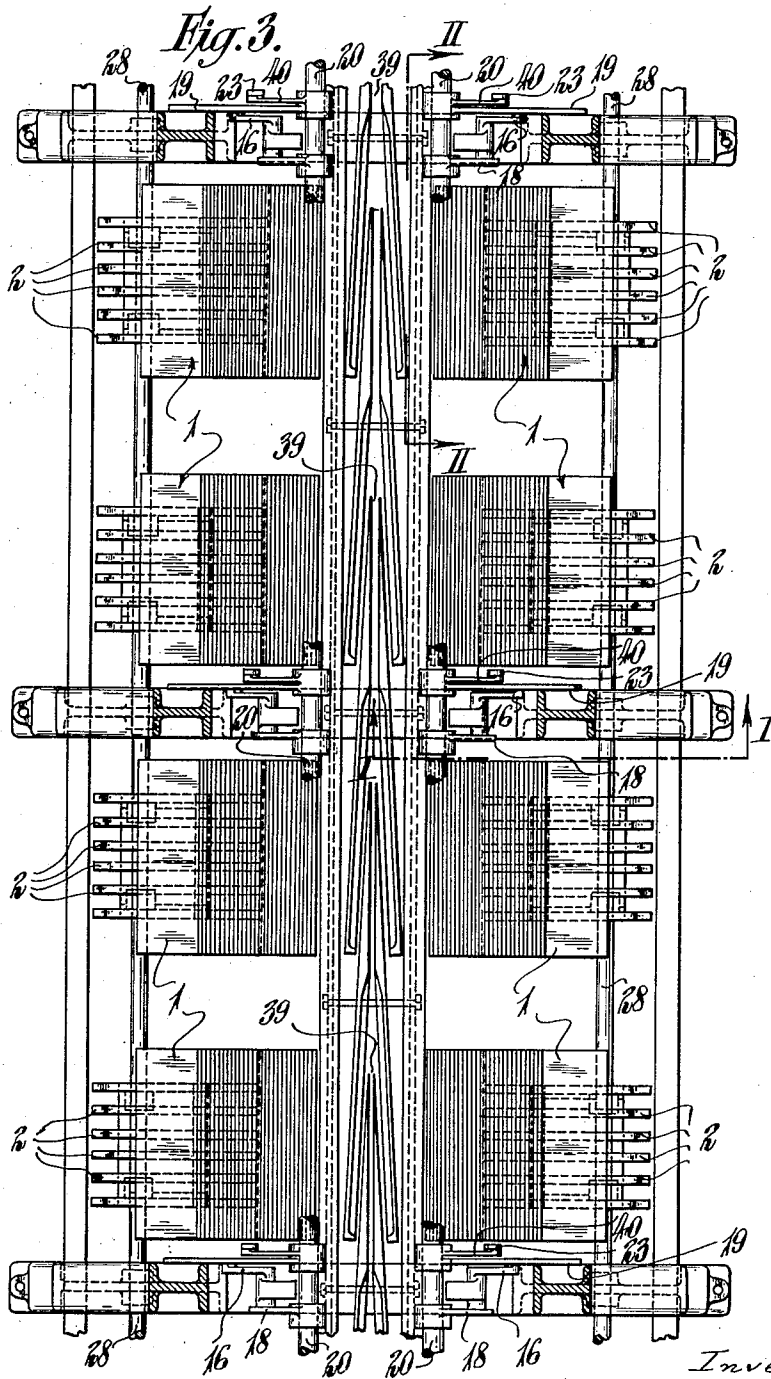
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6 Sheets-Sheet 3



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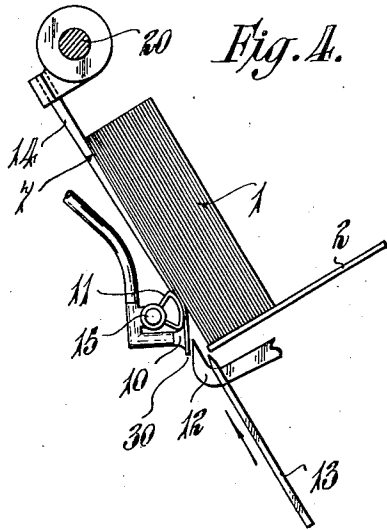
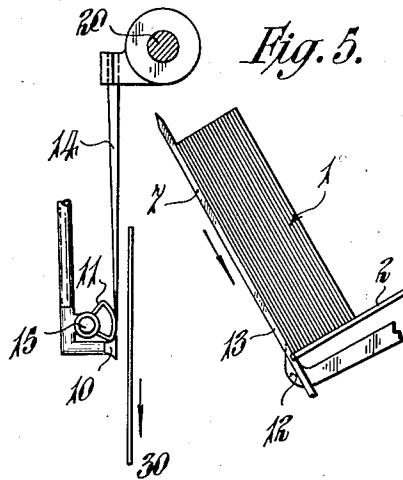
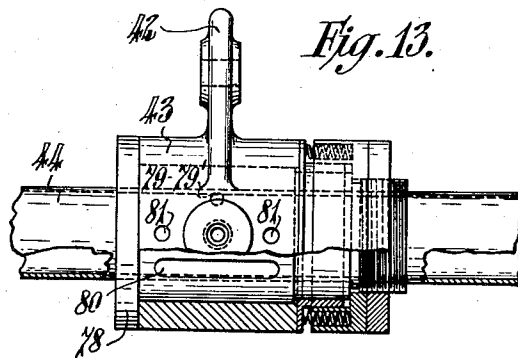
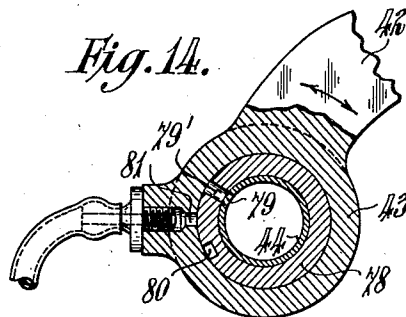
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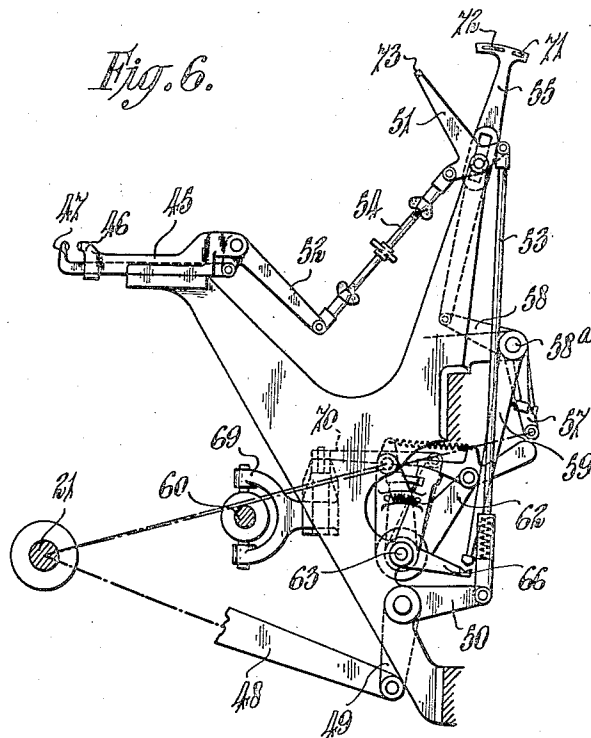
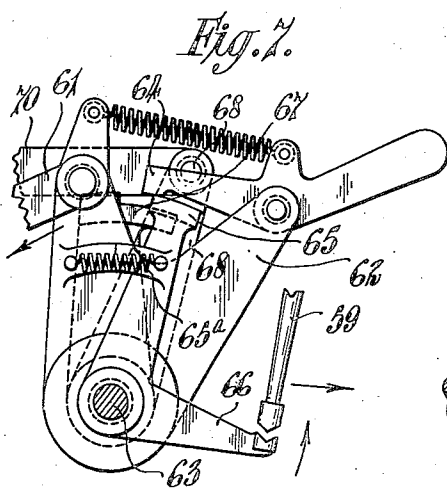
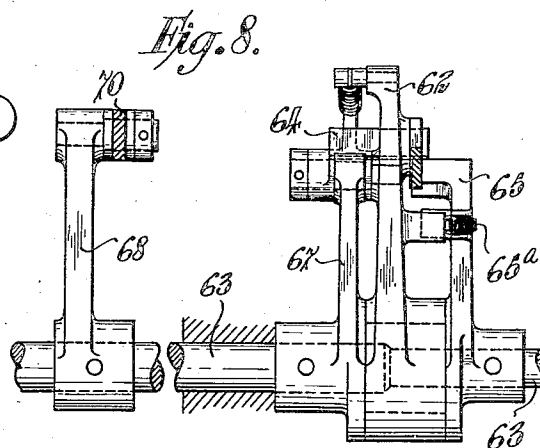
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6 Sheets-Sheet 5



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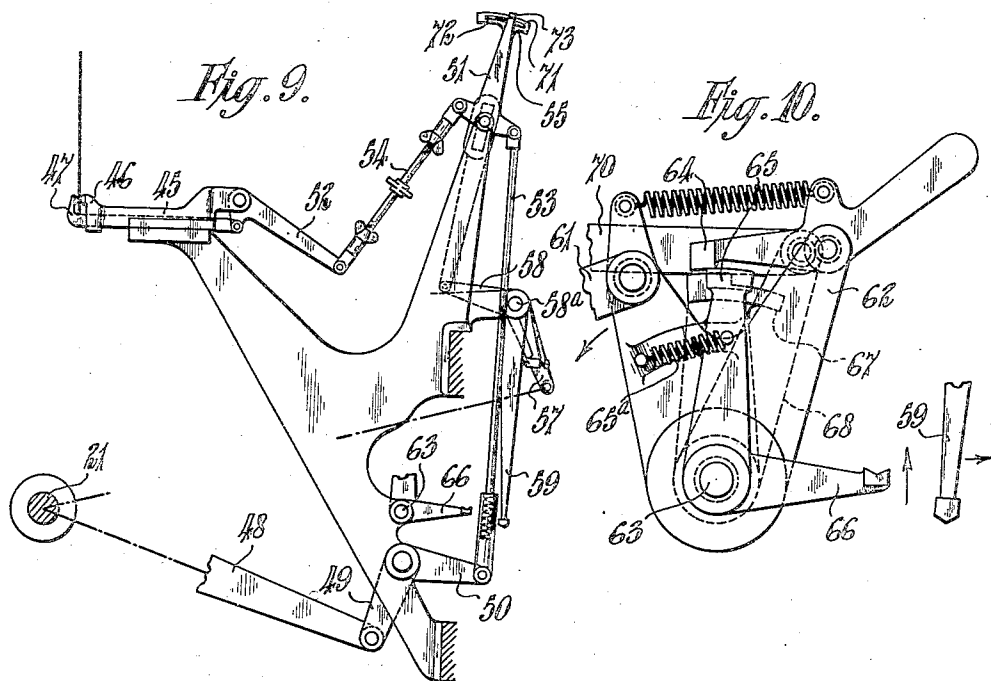
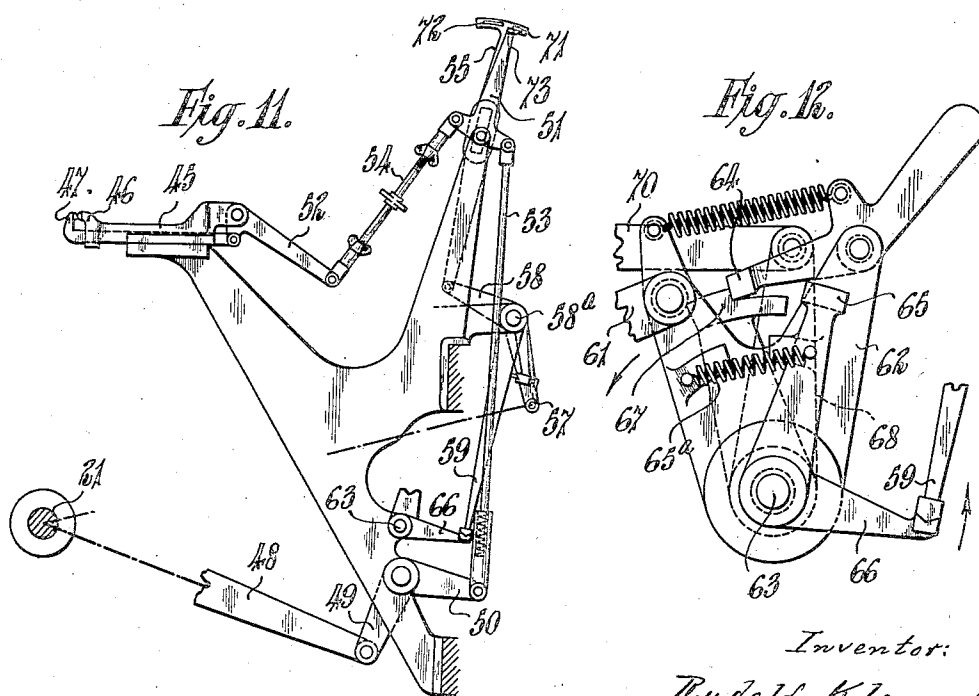
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6 Sheets-Sheet 6



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UNITED STATES PATENT OFFICE

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The present invention relates to a new method of releasing and removing single sheets or strata of paper and the like from piles in order to deliver such sheets or strata individually to paper sheet or strata handling machines, such as for example, folding machines, stitching machines, collecting and like machines.

One object of this invention is to provide an automatic sheet-feeding arrangement whereby the method above referred to can be carried into effect, while a second object is to provide means for preventing the feed of faulty sheets to the associated sheet-handling mechanism.

According to this invention apparatus is provided to carry into effect a method of automatically segregating and removing individual sheets or strata from an obliquely disposed pile, whereby sheet gripping means and a sheet held thereby are deflected relatively to the pile and the sheet then segregated and swung away from the pile.

An automatic sheet feeding arrangement constructed on this principle in association with a collecting or agglomerating machine is represented by way of example in the accompanying drawings, in which:

Fig. 1 is a view corresponding to a section along the line I—I of Fig. 3 and shows a unit of the sheet separating mechanism together with the manner in which it is actuated.

Fig. 2 is a view corresponding to a section along the line II—II of Fig. 3 and shows a different view of mechanism equivalent to that shown in Fig. 1.

Fig. 3 is a plan view of a sheet separating and collecting machine provided with sheet-handling devices in two parallel series for automatically feeding individual sheets from their corresponding piles.

Fig. 4 shows the operative position of the sheet separating and delivering mechanism with the front sheet gripped adjacent its lower edge thereby.

Fig. 5 shows the operative position of the sheet separating mechanism after the sheet has been separated from the pile and swung away from the latter.

Fig. 6 shows the operative position of the

drive control and sheet gauging mechanism with the caliper jaws open.

Fig. 7 shows the position of the drive disengaging pawl when the caliper jaws are open.

Fig. 8 shows the arrangement of the main drive disengaging mechanism mounted on a divided shaft.

Fig. 9 shows the operative position of the sheet gauging mechanism when the caliper jaws are closed to grip a standard sheet.

Fig. 10 shows the position of the main drive disengaging mechanism when a standard sheet is gripped by the calipers.

Fig. 11 shows the position of the gauging and control mechanism with the caliper jaws closed in the absence of a sheet.

Fig. 12 shows the position of the drive disengaging mechanism when the caliper jaws are closed in the absence of a sheet, or alternatively when the gauge is closed upon a sheet of other than standard thickness.

Fig. 13 shows the vacuum pipe and suction control sleeve partly in longitudinal section and

Fig. 14 shows the vacuum pipe with suction control sleeve in transverse section.

In the following description the sheet handling mechanism for a two pile unit is more specifically described but the machine may be constructed with any desired number of such sheet handling units arranged in single or double banks.

The folded and/or single sheets, which are to be automatically fed to the collecting machine illustrated in the drawings, are piled edgewise in an inclined position to form the obliquely disposed piles 1 (Fig. 1). Assuming that a pile consists of folded sheets, the folded edges of the sheets rest on the supporting bars 2 which, in turn, are mounted in brackets on the main frame. The heads of the sheets are directed towards the conveyor device (Fig. 3) of the collecting machine. Further folded sheets or single sheets, if such are to be inserted with the folded sheets, are formed into corresponding piles. Each pile is guided laterally by side lays 3. These lays 3 are mounted on one or the other of a pair of guide bars 4 so as to be individually

- adjustable but they can also be adjusted simultaneously in groups to a narrower or wider setting between the respective lays for each pile by rotating a hand-wheel 5 (Fig. 1).
- 5 The guide bars 4 each common to alternate side lays 3, have their extremities formed as toothed racks which engage with a pinion 8 journaled between the guide bars. By rotating the hand wheel 5 and pinion 8 the
- 10 guide bars 4 are traversed in opposite directions relatively to each other. The side lays 3 are alternately connected with the upper and lower guide bars, so that by the opposed displacement of the guide bars they are simultaneously adjusted to a narrower or wider
- 15 setting according to the size of the piled sheets.
- Upper fingers 6 serve for holding the sheets down on the bars 2. These fingers also
- 20 are so arranged that they can be adjusted individually or collectively in accordance with the height of the sheet piles. The adjustment of the groups of upper fingers also is effected by a rack and pinion mechanism.
- 25 The upper fingers 6 are supported in guides 75 (Figs. 1 and 2) by upwardly extending members, the upper extremities of which are provided with the toothed racks 9. The racks 9 engage with pinions 9a which are interconnected by means of a common shaft
- 30 76 upon which is mounted also a hand wheel 77. Thus by rotating the hand wheel 77 the fingers 6 for a series of piles are adjusted as a whole.
- 35 The arrangement of each pile permits of the supply of sheets thereto without interrupting the operation of the machine.
- The removal of sheets from each pile is effected by means of suction nozzles 10 which
- 40 operate in conjunction with sheet tensioning segments 11, a sheet retaining rake 12, a sheet separating rake 13 and an oscillating rake 14 (Fig. 1). The suction nozzles 10 and tensioning segments 11 are rigidly
- 45 mounted on a common shaft 15. The shaft 15 is carried by the short arms of the two arm control levers 16. The control levers 16 are pivotally mounted at 17 on the rocking levers 18. The rollers carried by the longer
- 50 arms of the control levers 16 engage in the cam grooves of the cam levers 19. The oscillating rakes 14 as well as the oscillating levers 18, for a series of sheet handling units, are rigidly secured to a common shaft 20 on
- 55 which the cam levers 19 are loosely journaled.
- The parts 10, 11, 14, 15, 16 and 17 participate in the rocking motion of the levers 18 about the axis of the supporting shaft 20.
- 60 In the position indicated in Fig. 1 the suction nozzles 10 act on the sheet 30, which is in the operative plane 7, closely above the fold. When the suction action has taken place the cam levers 19 together with their inclined
- 65 cam tracks are rocked relatively to the engaging rollers of the control levers 16. In this manner the suction nozzles 10 and the sheet tensioning segments 11, which are in rigid connection with the control levers 16, are brought into the position shown in Fig. 4 so that the sheet 30 which has been attached to the nozzles by the suction is bent away from the pile. This bending action is assisted by the tensioning segments 11 by means of which the edge of the sheet which has been deflected is tensioned so that folds cannot occur.
- Motion is imparted to each cam lever 19, by means of a cam 21a, mounted on the driving shaft 21, engaging a follower roller carried by one arm of a bell crank lever 22, the second arm of the latter being linked, by means of a pitman 23 to the extending arm 40 of the lever 19.
- After the sheet has been engaged by the suction nozzle and the lower edge bent away from the pile (Fig. 4), the fingers of the sheet retaining rake 12 move upwardly and towards the pile from the lower position and pass closely behind the deflected edge of the sheet 30 between the latter and the operative plane 7. By means of this motion of the retaining rake the lower edge of the pile, which tends to spread and project somewhat toward the edge of the deflected sheet, is engaged by the former and brought back into the operative plane 7.
- The actuation of the retaining rake 12 is initiated by a cam 22a also mounted on the driving shaft 21, and engaging a follower roller carried by one arm of a bell crank lever 24. The other arm of the lever 24 is connected by a pitman 25 to the arm 26 of a further bell crank lever pivoted on a shaft 28 and connected by its other arm 27 to the rake 12.
- The fingers of the retaining rake 12 are pivotally connected with the arm 27 and are positively guided in the stationary guide 29. The lever 27 is connected to the shaft 28 by means of an adjustable boss (not shown) which permits of the precise adjustment of the retaining rake relatively to the edge of the sheet pile.
- When the fingers of the retaining rake 12 have attained the extreme right-hand position, the sheet 30, engaged by the suction nozzle, is separated from the pile. The separation of the sheet 30 is caused by the upward motion of the separating rake 13 co-operating with the oscillatory motion of the pivotal rake 14 away from the pile (Figs. 4 and 5). The separating rake 13 is actuated by means of a cam (not shown) also mounted on the driving shaft 21. The throw of the cam is transmitted to a bell crank lever 31 rigidly mounted on a shaft common to a quadrant member 32. The latter engages a pinion 33 which, together with a toothed segment 34, is mounted on a common shaft 74. The segment 34 engages a rack 35 to which the separating

rake is connected by means of an intermediate member 35' and thereby reciprocates the separating rake by the oscillation of the quadrant member 32.

5 The pivotal rake 14 and oscillating lever 18 are also actuated by means of a cam 36' mounted on the shaft 21 and engaging a roller carried by the bell crank lever 36 which is connected by the pitman 37 and lever 38 to the pivotal rake, the latter being thus oscillated about the shaft 20.

10 Due to the connection of the pivotal rake 14 with the oscillating levers 18 on the shaft 20, the control levers 16 which are freely rotatable about the pivot 17, traverse the cam grooves of the cam levers 19 when the pivotal rake is swung away, and in so doing return the suction nozzles 10 to the plane of the swinging rake in order that the deflected edge 20 of the sheet may be again returned to the straight position (Fig. 5). After the pivotal rake 14 has been swung back from the pile into the vertical position (Fig. 5), the sheet is released from the suction jets by 25 equalizing the air pressure within the suction nozzles to that of the atmosphere and the sheet then falls into the feed chute 39 of the collecting machine. The suction control mechanism for each unit operates as follows.

30 The suction in the suction jets 10 is positively controlled from the shaft 20. The control is effected by means of the linkage comprising levers 38, 41 and 42, the latter lever being associated with the suction control sleeve. The hub of the lever 42, constructed as a control sleeve 43, is rotatably mounted on the common vacuum pipe 44 of the suction jets. The control sleeve is provided with a connection point for the conduit connecting the vacuum pipe with the suction nozzles. The vacuum pipe 44 (Figs. 13 and 14), which is reinforced by a non-rotatable flanged sleeve 78 at the point where the control sleeve 43 operates, is provided 45 with a radially disposed suction aperture 79. The flanged sleeve has a corresponding aperture 79' and an axially disposed groove 80 which is not connected with the vacuum pipe 44. The control sleeve 43 is provided with 50 three radially disposed apertures 81 which are arranged adjacent one another on the same longitudinal line. The central aperture 81 to which the connecting conduit of the suction jet is attached lies in the radial plane of the suction aperture 79. At the 55 instant when the sheet in the working plane 7 is to be engaged by the suction head, the control sleeve 43 is positioned to register the apertures 79, 79' and central aperture 81, so that the constant vacuum provided within the vacuum pipe 44 ensures a sudden engagement of the sheet by the suction jets 10.

65 During the period that the sheet is swung out of the working plane 7, as already described, the control sleeve 43 rotates to bring

the apertures 81 towards the groove 80. In this manner the vacuum pipe 44 is first isolated due to the suction aperture 79 being closed and the sheet is still retained by the suction jets due to the vacuum still existing 70 in the connecting conduit. If the control sleeve is rotated to such an extent that the apertures 81 register with the groove 80 then the groove 80 provides an inter-connection of the outer apertures 81 which open to the atmosphere and at the desired instant the sheet is thrown off from the suction jets due to the rush of air passing into the connecting conduit and effecting the equalization of 80 the pressure.

The sheets supplied by the feeding apparatus to the collecting machine are gauged and controlled in the feed chute of the collecting machine, represented by way of example, and if faulty feed of the sheets should occur the feeding apparatus and this machine are automatically brought to rest. For this purpose calipers 45 are provided in the feed-way 39, which calipers close as soon as the sheet has passed into the feed-way. The 90 jaw 46 of the calipers is stationary and the jaw 47 mounted so as to be movable.

The actuation of the jaw 47 is effected by means of a cam (not shown) mounted on the driving shaft 21 and engaging a link 48, 95 which is connected to a bell crank lever 49, 50. The latter is connected by means of a pitman 53 to a three armed lever 51 which is connected by another pitman 54 and bell crank lever 52 to the caliper jaw 47. A gap-slide executes an up and down motion which is imparted to it from a cam (not shown) mounted on the driving shaft 21. The lower extremity of the member 55 is pivotally connected to the arm 58 of a bell crank lever 100 rigidly mounted on a shaft 58a. Also rigidly mounted on the latter shaft is a lever 57 to which the connecting lever 56 transmits the throw of the above mentioned cam.

105 The downwardly directed longer arm 59 of the last mentioned bell crank lever influences the drive disengaging device proper (Figs. 9 and 11).

110 In order to bring the machine to rest the drive disengaging device releases an expanding ring coupling, of known type, on the driving shaft 60. The disengaging device is actuated by means of a cam (not shown) also mounted on the driving shaft 21, which actuates the bifurcated arm 62 by means of 120 link 61 (Figs. 1 and 10). The arm 62 is freely mounted on a disengaging shaft 63 and carries the drive disengaging pawl 64 (Fig. 12). The shaft 63 is divided within the hub of the pawl lever 62 (Figs. 7-8), 125 and a pawl tripping lever 65 together with a blocking lever 66 are rigidly mounted on the front part thereof. The pawl tripping lever 65 is elastically maintained, by means of a tension spring 65a, against a stop on 130

the arm 62 so that the front part of the shaft 63 together with the tripping lever 65 and lever 66 participates in the positive motion of the arm and pawl 64 (Figs. 7 to 12).

Further levers 67 and 68 are rigidly mounted on the rear part of the shaft 63. The lever 67 is provided with ratchet teeth, at its upper extremity, with which the pawl 64 engages.

By means of the pitman 70 the lever 68 is connected with a drive disengaging fork 69 (Fig. 1). The disengaging fork 69 engages with and displaces a sleeve on the driving shaft 60 which sleeve in its displacement closes or opens the expanding ring coupling.

The operation of the controlling and drive disengaging mechanism is as follows: The closure of the controlling calipers 45 is limited by the thickness of the sheets which are gauged by the calipers (Figs. 1 and 6). In order to equalize the difference in stroke thus occasioned between the jaw 47 and the constant throw of the actuating cam, the pitman 53 is elastically constructed. Due to the movement of the calipers by the cam mechanism the stop lever 51 swings to beneath the gap in the apertured slide member 55. The gap in the apertured slide member is formed by jaws 71, 72. The jaw 71 is stationary while the jaw 72 is adjustably mounted so that the breadth of the gap can be adjusted. The gap is adjusted to such a width that the lug 73 of the stop lever 51 can pass through with sufficient play on the downward motion of the apertured slide member 55.

The length of the pitman 54 (Fig. 6) is adjustable so that by this means the lug 73 can be set to the center of the gap of the apertured slide member 55. This adjustment is effected when a stationary sheet such as is to be fed from the pile is disposed between the closed calipers (Fig. 9). Then when normal sheets are fed the lug 73 will always position itself to the center of the gap. In this position the apertured slide member 55 is not prevented from performing its downward motion (Fig. 9), and the locking arm 59 of the three armed member 58 will swing out from its locking position above the blocking lever 66. The swinging out of the member 59 enables the pawl tripping lever 65 to follow the arm 62 freely (Fig. 10). This motion of the lever 65 prevents the drive disengaging pawl 64 from dropping into the teeth of the disengaging lever 67 and thus prevents the machine from being disengaged.

If any non-uniformity should occur in the feeding of the sheets the caliper jaws will either close completely (Fig. 11) or remain more widely open than the standard setting allowed, so that in this manner the lug 73 of the stop lever 51 will abut the under surface of the jaw 71 or 72 and so hold the apertured slide member 55 against its downward movement. In this way the member 59

is prevented from swinging out (Fig. 12) and so prevents the pawl tripping lever 65 from moving with the arm 62, in which case the pawl 64 passes from the pawl supporting surface of the tripping lever and, urged by the spring 64a, engages the teeth provided on the lever 67, which latter in its further motion causes the machine to be brought to rest by actuating the disengaging fork 69 through the pitman 70 and lever 68.

Automatically operating units of the apparatus described above can be duplicated and arranged adjacent or one after the other, according to the desired purpose. Preferably in the latter case the arrangement in pairs is effected in such manner that the pile containers are oppositely disposed so that one sheet passes from the right and the other from the left into the collecting trough or in the collecting device constructed in any other desired manner, from which it proceeds to the further treatment. In this manner a very considerable economy in space is attained by comparison with the hitherto usual arrangement of one behind the other.

I claim:

1. Automatic sheet-handling apparatus, comprising means for positioning a sheet-pile with the front sheet in an operative working plane, a pivotal member abutting said front sheet, pivotal suction nozzles, sheet-tensioning segmental members associated with said nozzles, a sheet-separating member, means for moving said member perpendicularly to the front sheet, means for swinging the front sheet away from the pile, and means for retaining the entire following sheet in the working plane.

2. Automatic sheet-handling apparatus, comprising means for positioning a sheet-pile with the front sheet in the operative plane, a pivotal rake member abutting the said front sheet, pivotal suction nozzles engaging the lower edge of the said front sheet, sheet-tensioning members engaging the front sheet above the suction nozzles, means for deflecting the suction nozzles and attached sheet edge from the working plane, means for segregating the front sheet from the pile, and means for releasing the segregated sheet from the said segregating means.

3. Automatic sheet-handling apparatus, comprising an obliquely disposed sheet-pile container, a pivotal closure member, a cam-drive actuating said closure member, movable cam-tracks, pivotal levers engaging said cam tracks, suction nozzles pivotally supported by said levers, and means for actuating said cam-tracks.

4. Automatic sheet-handling apparatus, comprising a sheet-pile container, a pivotal closure member, oscillable arms, pivotal suction nozzles supported by said arms, means for rocking said nozzles, means for oscillat-

ing said arms, and suction controlling means for said nozzles.

5. Automatic sheet-handling apparatus, comprising a sheet-pile container, a pivotal closure member, means for actuating said member, oscillable arms, pivotal suction nozzles supported by said arms, sheet-tensioning segmental members supported by said arms, means for rocking said nozzles, means for oscillating said arms, and means for releasing a sheet held by said nozzles.

6. Automatic sheet-handling apparatus, comprising means for positioning a sheet pile with the front sheet in an operative plane, a pivotal member abutting the front sheet, sheet deflecting mechanism, a toothed segment, cam-driven mechanism actuating the said segment, a slidable toothed rack engaging said toothed segment, a sheet separating member reciprocated by said rack member, and means for retaining the entire following sheet of the said pile in the operative plane.

7. Automatic sheet-handling mechanism, comprising means for positioning a sheet pile with the front sheet in an operative plane, a pivotal rake member abutting the front sheet, sheet deflecting mechanism interengaging said rake member, a sheet separating member, a sheet retaining rake interengaging said first mentioned rake member, a cam-faced sleeve to guide the said retaining rake in its operative path, and cam-driven mechanism actuating the said retaining member.

8. In automatic sheet-handling mechanism having sheet pile mechanism and sheet segregating mechanism, periodically operating suction members comprising pivotal suction nozzles, a suction pipe common to said nozzles, suction control devices mounted on the said pipe, connecting means from said control devices to said nozzles, and means for operating the said control devices.

9. In automatic sheet-handling mechanism having sheet pile mechanism and sheet segregating mechanism, periodically operating suction members comprising pivotal suction nozzles, a suction pipe common to said nozzles, re-enforcing grooved sleeves mounted upon said pipe and having apertures communicating with said pipe, a rotatable collar mounted on each sleeve and having apertures communicating with the aperture in the sleeve and the atmosphere respectively, means for connecting said collar to a corresponding suction nozzle, and means for registering the apertures and groove provided in each suction control unit for the purpose described.

10. Automatic sheet-handling apparatus, comprising, in combination, obliquely positioned sheet-pile containers arranged in series of operative pairs side by side, adjustable side lays for each unit, adjustable upper sheet-guides for each unit, means for controlling the side lays of each series of units

from a unified control, means for controlling the upper sheet-guides of each series of units from a unified control, sheet segregating mechanism associated with each unit, and means for operating the sheet-segregating mechanism for each series of units from a single drive.

11. Automatic sheet-handling apparatus, comprising, in combination, a container for a sheet pile, a pivotal closure member for said container, periodically functioning suction nozzles engaging a horizontal edge of the front sheet of said pile, sheet tensioning members associated with said suction nozzles, means for bending outwardly the suction nozzles and sheet edge attached thereto, a reciprocating sheet-separating rake, a cam-guided sheet-retaining rake inter-engaging with the said separating rake, means for swinging the segregated sheet away from the pile, and means for releasing the outwardly swung sheet from the segregating means.

12. Automatic sheet-handling apparatus, comprising, in combination, sheet-pile containers arranged in rows of operative pairs, a sheet conveyor arranged between the rows of said containers, closure mechanism for said containers, sheet-segregating mechanism for said containers, means for operating the closure mechanism in timed relation, means for operating the segregating mechanism in timed relation, sheet-retaining mechanism and means for conveying to further sheet-handling means a sheet separated from said pile containers.

13. A method of automatically segregating and removing individual sheets or strata from a sheet pile, which includes supporting the sheet pile edgewise and inclined to the vertical plane, gripping one edge of the outer sheet of said pile, deflecting the gripping means and sheet edge held thereby relatively to the pile, engaging with an auxiliary retaining member the corresponding edge of said pile, inserting a sheet segregating member between the gripped edge of said pile and the gripped edge of the outer sheet, and swinging the latter away from the pile in an arcuate path of movement as said segregating member moves over the corresponding face of said pile.

14. In automatic sheet-handling apparatus having a sheet-pile container, the provision of sheet segregating mechanism, comprising a pivotal closure member for said container, pivotal periodically operating suction nozzles associated with said member, a slidable sheet-separating member and a separate sheet-edge retaining member interacting with said sheet-separating member.

15. Automatic sheet-handling apparatus, comprising an obliquely disposed sheet-pile container, means for guiding the sheets to an operative working plane, a pivotal front closure member for said container adapted

to move about an axial line substantially parallel to one edge of said pile, pivotal periodically operating suction nozzles associated with said front closure member, a
5 slidable sheet separating member movable perpendicularly to said container, means for swinging away from the pile a sheet held by said suction nozzles and separately operating means for retaining in the operative working
10 plane the released edge of the following sheet.

16. Automatic sheet-handling apparatus, comprising means for positioning a sheet in an operative working plane, a pivotal member
15 abutting said sheet and adapted to move about an axial line substantially parallel to one edge of said sheet, pivotal suction nozzles associated with said pivotal member to seize the sheet, a sheet-separating member movable parallel to the pivotal member,
20 means for moving the pivotal member, suction nozzles and attached sheet away from the pile, separate means for retaining in the operative plane the released edge of the following sheet of the pile, and means for releasing the segregated sheet from the suction nozzles.

17. Automatic sheet-handling apparatus including a sheet pile container arranged to support a sheet pile edgewise and inclined to the vertical, a front closure member adapted to engage the outer sheet of said pile and move to and from the plane of said pile,
30 means for engaging one edge of said outer sheet, means for deflecting said sheet edge and said engaging means away from said pile, a sheet-edge retaining member adapted to engage the freed edge of the adjacent sheet to hold the latter in the operative
40 plane, a sheet-separating member adapted to pass between said deflected sheet-edge and sheet-edge retaining member, and means for moving said front closure member together with said front sheet away from said pile.

18. Automatic sheet-handling apparatus including a sheet pile container arranged to support a sheet pile edgewise and inclined to the vertical, a front closure member
50 adapted to engage the outer sheet of said pile and move to and from the plane of said pile, means for engaging the lower edge of said outer sheet, means for deflecting said sheet edge and said engaging means away from said pile, rake members adapted to
55 engage the freed lower edge of said pile to retain the latter in the operative plane, a slidable sheet-separating rake adapted to interact with said retaining rake to move between said deflected sheet edge and the remainder of said pile, and means for moving said front closure member and said outer sheet engaged thereby away from the remainder of said pile.

60 In testimony whereof I affix my signature.
RUDOLF KLEMM.