

Dec. 17, 1957

W. P. DONALD
SHEET STAGGERING DEVICE

2,816,762

Filed Sept. 30, 1954

3 Sheets-Sheet 1

Fig. 1.

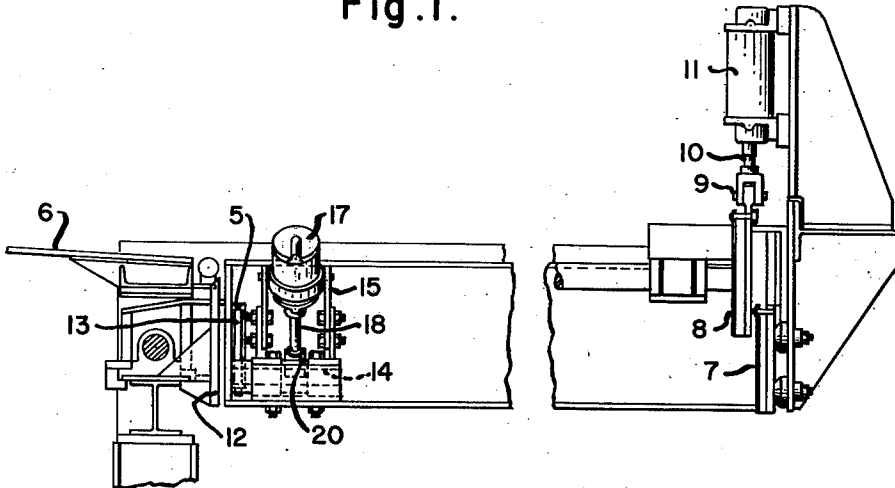


Fig. 2.

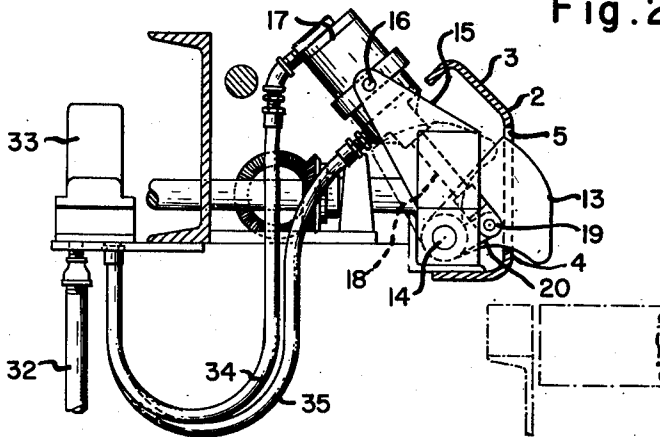
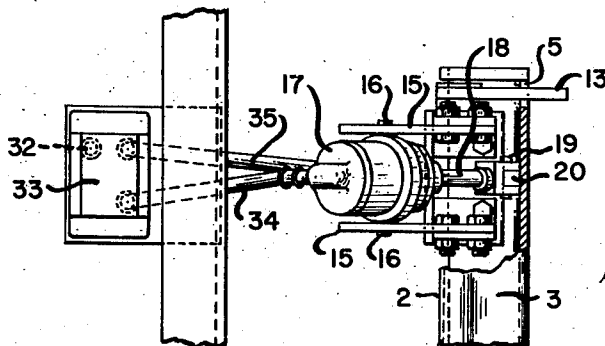


Fig. 3.



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3 Sheets-Sheet 2

Fig. 4.

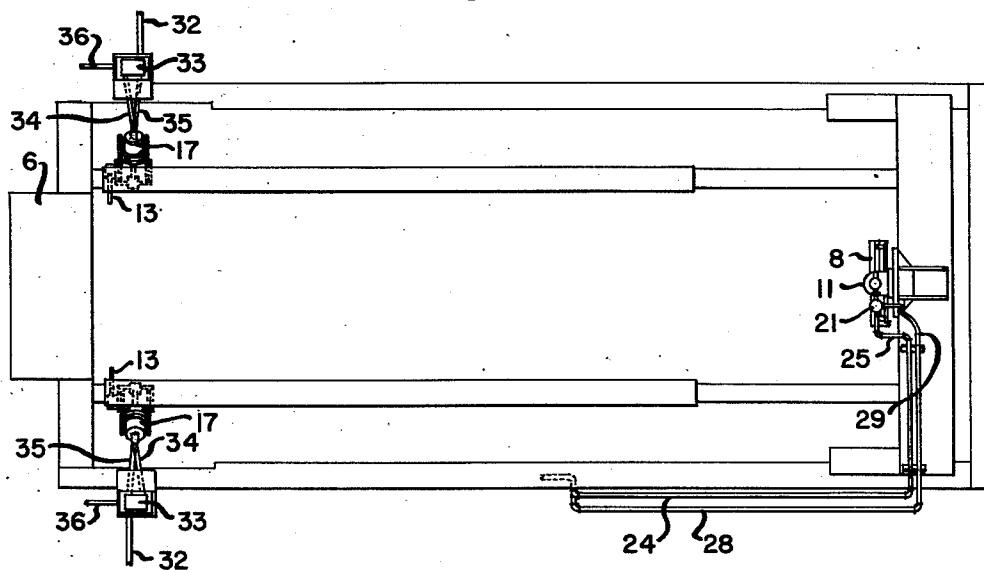
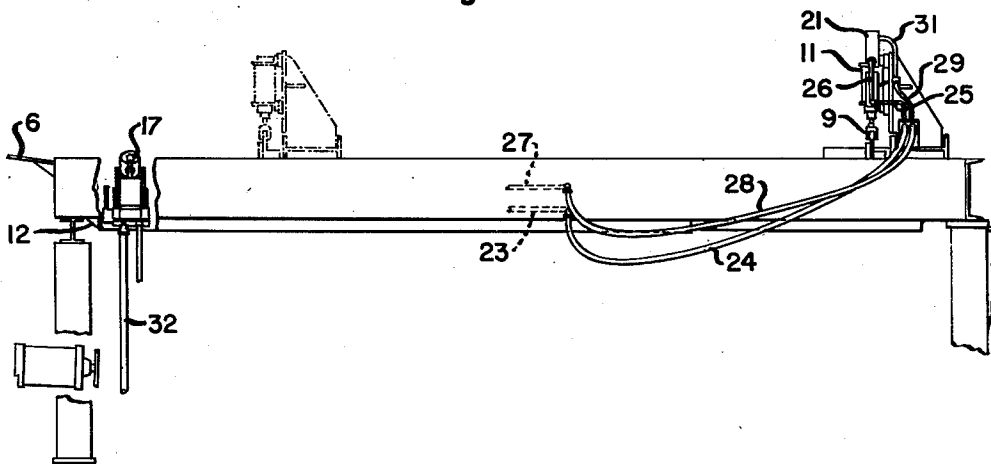


Fig. 5.



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3 Sheets-Sheet 3

Fig. 6.

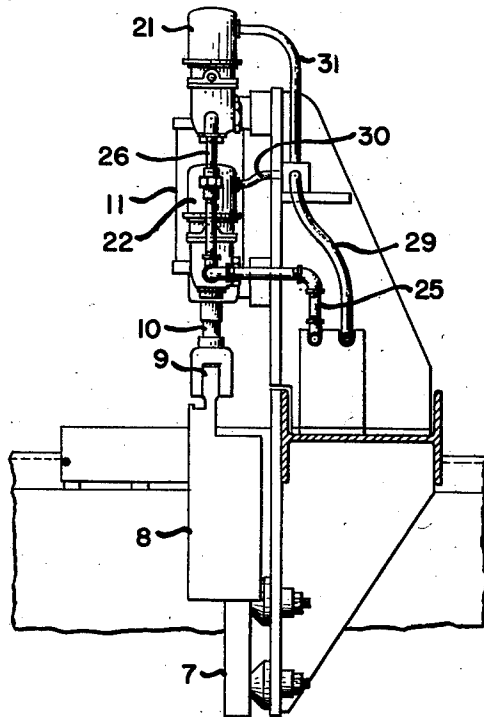
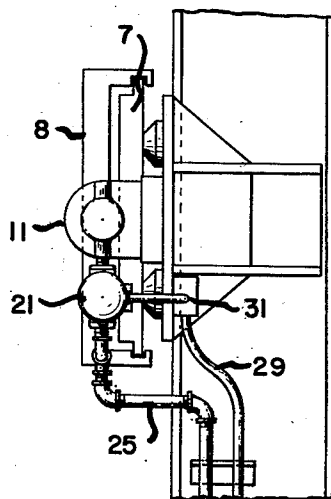


Fig. 7.



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2,816,762

SHEET STAGGERING DEVICE

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Application September 30, 1954, Serial No. 459,428

12 Claims. (Cl. 271—86)

This invention relates to a sheet staggering device which stacks sheets in staggered relationship more accurately and with less manual labor than sheet staggering devices heretofore devised.

In the stacking of sheets, such, for example, as metal sheets, it is sometimes desirable to arrange the sheets in the stack in staggered relationship; indeed, this is a standard practice in many sheet mills. When stacking sheets in staggered relationship a predetermined number of sheets, as, for example, ten, are stacked in a uniform pile and the next ten sheets are stacked in a uniform pile but offset horizontally from the first ten sheets. The third group of ten sheets are stacked in a uniform pile in direct vertical alignment with the first ten sheets and the fourth group of ten sheets are stacked in a uniform pile in direct vertical alignment with the second ten sheets. That method of stacking is continued throughout the formation of the pile.

It has heretofore been proposed to provide a sheet staggering device comprising a first front stop, a second front stop, means for moving the second front stop between an operative position generally in front of the first front stop and a withdrawn inoperative position and a rear stop facing the front stop and disposed at substantially sheet length distance from the second front stop when the second front stop is in operative position. Automatic means have been provided for operating the means for moving the second front stop so that it is disposed in operative position while a predetermined number of sheets are delivered to the pile, then in inoperative position while a predetermined number of sheets are delivered to the pile, then in operative position again, etc. Consequently in use of such a sheet staggering device a group of sheets are first delivered against the first front stop, then a group of sheets are delivered against the second front stop, etc., producing a staggered pile.

The sheets have a tendency to bounce back from the front stops. In the use of the sheet staggering device just referred to the sheets delivered against the second front stop have been quite accurately piled vertically above one another since their bouncing back has been inhibited by the rear stop which, as above stated, has been disposed at substantially sheet length distance from the second front stop when the second front stop is in operative position. However, when the second front stop has been in inoperative position and sheets have been delivered against the first front stop the tendency of those sheets to bounce back has been uninhibited. The sheets do not all bounce back an equal distance and the result has been a staggered pile with alternate groups of sheets relatively accurately piled and intermediate alternate groups of sheets relatively inaccurately piled. It has been necessary to manually adjust the positions of the inaccurately piled sheets to produce a commercially acceptable staggered pile. The purpose of the sheet staggering device has been defeated because of the ne-

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cessity of such manual adjustment since the purpose is to produce a staggered pile automatically.

I have devised an improvement in sheet staggering devices of the type above referred to which enables the automatic production of a staggered pile of sheets with each of the staggered groups of sheets in the pile accurately positioned and in relatively predetermined relationship to each other and with the sheets of each such group piled substantially directly atop one another. I accomplish the result by inhibiting the tendency to bounce back of all of the sheets of the staggered pile regardless of which front stop the sheets may be positioned against. I provide a second rear stop and means for moving the second rear stop between an operative position facing the front stops at substantially sheet length distance from the first front stop and a withdrawn inoperative position. The additional rear stop which I provide may be rendered operative when the second front stop is inoperative and may be rendered inoperative when the second front stop is operative. Thus each sheet delivered to the pile will be delivered between front and rear stops spaced apart at substantially sheet length distance. The first group of sheets may be delivered against the first front stop and their tendency to bounce back will be inhibited by the additional rear stop which I provide. The next group of sheets may be delivered against the second front stop and their tendency to bounce back will be inhibited by the previously provided rear stop. Thus each of the groups of sheets is accurately piled in a staggered pile whereas heretofore only alternate groups of sheets have been accurately piled in a staggered pile without the use of manual labor to straighten up the sheets of the other alternate groups as above explained.

The sheets are delivered to the pile by any suitable means such as an endless conveyor or pinch rolls. They may be delivered in a generally horizontal direction so that they fall due to gravity as their front edges approach the front stop against which they are to be positioned. The sheets fall upon a piling platen which, as known to those skilled in the art, may be initially elevated to the pass line and automatically progressively lowered as the pile is built up. The device is provided with side guides which are spaced apart a distance very slightly greater than the width of the sheets so that each sheet as it is positioned on the pile is accurately positioned sideways by the side guides regardless of whether it is positioned endwise against the first front stop or against the second front stop. The front and rear stops may be adjusted longitudinally of the device so that the device may be adapted for the production of staggered piles of sheets of different lengths and also for altering the extent of overlap between adjacent groups of sheets in the staggered pile. It is customary for each group of sheets to project about 2" beyond the groups above and below it in the staggered pile but that distance may be controlled by relative adjustment of the stops.

The second front stop is movable between operative and inoperative positions by any suitable means, as, for example, a fluid operated piston. It is convenient to mount an air cylinder generally above the second front stop and to couple the piston rod of a piston operating in the cylinder with the second front stop, the movement of the piston in the cylinder moving the second front stop up and down between operative and inoperative positions, respectively.

The added rear stop which I provide may, if desired be mounted and operated similarly to the second front stop as above described, but because the sheets may be delivered generally above the position of the added rear stop when the latter is operative I find it desirable to move the added rear stop generally laterally. I may em-

ploy a single added rear stop member although I prefer to provide two stop members constituting collectively the added rear stop and to move those members generally toward each other and toward the center line of the device to operative position and withdraw them away from each other to inoperative position. I may provide one or both side guides with an opening and move the added rear stop member or members through such opening or openings. The added rear stop member or members may be mounted for generally transverse swinging movement. They may be moved by piston and cylinder means which may be connected with the means for moving the second front stop so that the added rear stop is always operative when the second front stop is inoperative and is always inoperative when the second front stop is operative.

Other details, objects and advantages of the invention will become apparent as the following description of a present preferred embodiment thereof proceeds.

In the accompanying drawings I have shown a present preferred embodiment of the invention in which:

Figure 1 is a side elevational view with a portion cut away of a sheet staggering device;

Figure 2 is a transverse elevational view of a portion of the device, showing one of my added rear stop members and the mechanism for operating it, it being understood that a similar rear stop member and operating mechanism may be provided at the opposite side of the device;

Figure 3 is a top plan view of the mechanism shown in Figure 2;

Figure 4 is a plan view of the device showing the control mechanism;

Figure 5 is an elevational view of the device showing the control mechanism;

Figure 6 is an elevational view to enlarged scale of the front end of the device showing the control mechanism; and

Fig. 7 is a top plan view of the mechanism shown in Figure 6.

Referring now more particularly to the drawings, my sheet staggering device comprises opposed side guides 2 which may be adjustably mounted at opposite sides of the longitudinal center line of the device as known to those skilled in the art. Each of the side guides 2 has an upwardly and outwardly inclined upper portion 3 and a vertical lower portion 4, the portions 4 of the side guides aligning transversely all of the sheets delivered to the pile. Each of the vertical lower portions 4 of the side guides 2 is provided with an opening or slot 5 adjacent the rear end of the device for a purpose to be presently described.

Sheets to be piled in a staggered pile are fed from left to right upon a conveyor or table 6 by any suitable means as known to those skilled in the art. The sheets are delivered one by one longitudinally between the side guides and fall between the side guides onto a suitable pile support or piling platen which, as mentioned above, may, as known to those skilled in the art, be initially elevated to the pass line and automatically progressively lowered as the pile is built up. Each sheet as it is delivered to the device is stopped by a front stop. There are two front stops. The first front stop is designated by reference numeral 7 and is mounted in fixed position although it is adjustable longitudinally of the device as may be desired. The second front stop is designated by the reference numeral 8 and in the form shown in the drawings is mounted for generally up and down movement in front of the stop 7, although it could be arranged for generally horizontal movement between operative and inoperative positions. The stop 8 is connected at 9 to the piston rod 10 of a piston operating in an air cylinder 11 mounted generally above the stop 8. Movement of the piston in the cylinder 11 downwardly moves the stop 8 to operative position while movement of the piston upwardly moves the stop 8 to withdrawn inopera-

tive position. When the stop 8 moves downwardly it will come to rest upon the top sheet of the pile of sheets already formed and will serve as the stop for the succeeding groups of sheets until it is withdrawn. The device has a stationary rear stop 12.

The apparatus thus far described, except for the slots 5 in the side guides 2, is known to those skilled in the art. The rear stop 12 has been positioned at sheet length distance from the front stop 8 so that when the front stop 8 has been operative the sheets delivered thereagainst have been accurately piled. However, when the front stop 8 has been inoperative the sheets delivered against the front stop 7 have been free to bounce back with the undesirable result explained above.

In the embodiment of my invention shown in the drawings I provide two added rear stop members 13 which collectively form an added rear stop. Each of the rear stop members 13 is mounted for pivotal movement about the axis of a longitudinally extending stub shaft 14 so that as the stop partakes of such pivotal movement it is movable through the slot 5 in the corresponding side guide 2 between an operative position shown in full lines in Figure 2 and an inoperative position shown in dotted lines in that figure. When each stop member 13 is in its operative position a portion of it projects through the corresponding slot 5 into the space between the side guides 2 so as to face the front stops. The stop members 13 are positioned so that their effective faces, i. e., their faces which face the front stops, are disposed at sheet length distance from the front stop 7 and behind the piling platen. Thus sheets delivered when the front stop 8 is inoperative and the rear stop constituted by the rear stop members 13 is operative are piled accurately between that rear stop and the front stop 7 since the rear stop members 13 inhibit bouncing back of the sheets delivered against the front stop 7. Consequently the addition of the stop members 13 to the pre-existing sheet staggering device enables the production of an accurate staggered pile of sheets without the employment of manual labor.

In the claims each of the stop members 13 is comprehended by the term "first rear stop" and the stop 12 is comprehended by the term "second rear stop."

The mechanism for operating the respective stop members 13 is the same at both sides of the device if two such stop members are employed so description of such mechanism at one side of the device will suffice for both sides. At each side of the device is mounted a bracket 15 to which is trunnioned at 16 a cylinder 17 in which operates a piston whose piston rod 18 is pivoted at 19 to a projection 20 fixed to the shaft 14. The corresponding stop member 13 is also fixed to the shaft 14. Consequently when the piston in one of the cylinders 16 moves generally downwardly the corresponding stop member 13 is swung through the corresponding slot 5 into operative position as shown in solid lines in Figure 2. When the piston moves generally upwardly the stop member is retracted by a swinging movement which withdraws it entirely from the space between the side guides to inoperative position as shown in dotted lines in Figure 2.

As well known to those skilled in the art, an electronic sheet counter is used to count the sheets delivered to the staggered pile. Connections are provided from the electronic sheet counter for periodically alternately (1) rendering the stop 8 operative and the stop members 13 inoperative and (2) rendering the stop 8 inoperative and the stop members 13 operative to form a staggered pile with a predetermined number of sheets in each group.

As explained above the stop 8 is operated by a piston in an air cylinder 11. The air cylinder 11 has ports at its top and bottom respectively. The upper port is normally closed by a solenoid air valve 21, i. e., a valve which is maintained closed by a spring when no current

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is applied to its solenoid. The lower port is normally open, being controlled by a normally open solenoid air valve 22, i. e., a valve which is maintained open by a spring when no current is applied to its solenoid. Compressed air is delivered from a suitable source of compressed air through a pipe 23 and a flexible conduit 24 to a pipe 25 which leads to the lower solenoid air valve 22 and also to a pipe 26 which leads to the upper solenoid air valve 21. Electrical leads extend from the electronic sheet counter through conduits 27, 28, 29, 30 and 31 to the respective solenoid air valves 21 and 22.

Compressed air is delivered from the source of compressed air through pipes 32 to three-way solenoid air valves 33, there being two such valves respectively for controlling the supply of air to the respective cylinders 17. Flexible conduits 34 and 35 lead from each of the valves 33 to the corresponding cylinder 17, the conduit 34 leading to the upper end of the cylinder and the conduit 35 leading to the lower end of the cylinder. Electrical leads 36 extend from the electronic sheet counter to the respective solenoid air valves 33.

A cycle of operations will now be described. When no current is supplied to the solenoid air valves 21, 22 and 33 the valve 21 is maintained closed by its spring and the upper end of the cylinder 11 is open to exhaust, the valve 22 is maintained open by its spring and the stop 8 is in its raised or inoperative position, and the valves 33 are by their springs maintained in position to admit compressed air to the conduits 34 and the conduits 35 are open to exhaust, the stop members 13 being in operative position. Upon operation of the electronic sheet counter the four solenoid air valves 21, 22 and 33 are simultaneously operated. The valve 21 is opened against the action of its spring and the valve 22 is closed against the action of its spring and compressed air is admitted above the piston in the cylinder 11, the lower end of the cylinder being opened to exhaust when the valve 22 is closed. When the valves 33 are operated the conduits 34 are opened to exhaust and compressed air is admitted to the conduits 35, moving the stop members 13 to inoperative position. Upon the next operation of the electronic sheet counter the circuits to the valves 21, 22 and 33 are all simultaneously opened and the springs return those four valves to their original positions with the result that the stop 8 moves to inoperative position and the stop members 13 move to operative position. This completes the cycle.

While I have shown and described a present preferred embodiment of the invention it is to be distinctly understood that the invention is not limited thereto but may be otherwise variously embodied within the scope of the following claims.

I claim:

1. A sheet staggering device comprising a first front stop, a second front stop, means for moving the second front stop between an operative position generally in front of the first front stop and a withdrawn inoperative position, a first rear stop, means for moving the first rear stop between an operative position facing the first front stop and a withdrawn inoperative position and a second rear stop behind the first rear stop when the first rear stop is in operative position, the second rear stop being rendered operative when the first rear stop moves to inoperative position.

2. A sheet staggering device comprising a first front stop, a second front stop, means for moving the second front stop between an operative position generally in front of the first front stop and a withdrawn inoperative position, laterally opposed cooperative first rear stop members constituting collectively a first rear stop, means for moving the first rear stop members generally toward and away from each other between an operative position of the first rear stop facing the first front stop and a withdrawn inoperative position of the first rear stop and a second rear stop behind the first rear stop when

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the first rear stop is in operative position, the second rear stop being rendered operative when the first rear stop members move generally away from each other to inoperative position.

3. A sheet staggering device comprising a first front stop, a second front stop, means for moving the second front stop between an operative position generally in front of the first front stop and a withdrawn inoperative position, a first rear stop mounted for generally transverse swinging movement, means for swinging the first rear stop between an operative position facing the first front stop and a withdrawn inoperative position and a second rear stop behind the first rear stop when the first rear stop is in operative position, the second rear stop being rendered operative when the first rear stop swings to inoperative position.

4. A sheet staggering device comprising a first front stop, a second front stop, means for moving the second front stop between an operative position generally in front of the first front stop and a withdrawn inoperative position, a first rear stop, means for moving the first rear stop between an operative position facing the first front stop and a withdrawn inoperative position, a second rear stop behind the first rear stop when the first rear stop is in operative position, the second rear stop being rendered operative when the first rear stop moves to inoperative position, and means for operating the first mentioned means and the second mentioned means to substantially simultaneously move the second front stop to operative position and the first rear stop to inoperative position and substantially simultaneously move the second front stop to inoperative position and the first rear stop to operative position.

5. A sheet staggering device comprising opposed side guides, a first front stop disposed transversely of the side guides, a second front stop, means for moving the second front stop between an operative position generally in front of the first front stop and a withdrawn inoperative position, at least one of the side guides having an opening therein, at least one first rear stop, means for moving the first rear stop through the opening in said side guide between an operative position facing the first front stop and a withdrawn inoperative position and a second rear stop behind the first rear stop when the first rear stop is in operative position, the second rear stop being rendered operative when the first rear stop moves to inoperative position.

6. A sheet staggering device comprising a first front stop, a second front stop, means for moving the second front stop between an operative position generally in front of the first front stop and a withdrawn inoperative position, laterally opposed cooperative first rear stop members constituting collectively a first rear stop, means for moving the first rear stop members generally toward and away from each other between an operative position of the first rear stop facing the first front stop and a withdrawn inoperative position of the first rear stop, a second rear stop behind the first rear stop when the first rear stop is in operative position, the second rear stop being rendered operative when the first rear stop members move generally away from each other to inoperative position, and means for operating the first mentioned means and the second mentioned means to substantially simultaneously move the second front stop to operative position and the first rear stop members generally away from each other to inoperative position of the first rear stop and substantially simultaneously move the second front stop to inoperative position and the first rear stop members generally toward each other to operative position of the first rear stop.

7. In a sheet staggering device comprising a first front stop, a second front stop, means for moving the second front stop between an operative position generally in front of the first front stop and a withdrawn inoperative position and a rear stop facing the front stops and disposed at

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substantially sheet length distance from the second front stop when the second front stop is in operative position, the combination with the elements recited of another rear stop and means for moving said other rear stop between an operative position facing the front stops at substantially sheet length distance from the first front stop and a withdrawn inoperative position.

8. In a sheet staggering device comprising a first front stop, a second front stop, means for moving the second front stop between an operative position generally in front of the first front stop and a withdrawn inoperative position and a rear stop facing the front stops and disposed at substantially sheet length distance from the second front stop when the second front stop is in operative position, the combination with the elements recited of laterally opposed cooperative rear stop members constituting collectively a rear stop other than the first mentioned rear stop and means for moving said rear stop members generally toward and away from each other between an operative position of the second mentioned rear stop facing the front stops at substantially sheet length distance from the first front stop and a withdrawn inoperative position of the second mentioned rear stop.

9. In a sheet staggering device comprising a first front stop, a second front stop, means for moving the second front stop between an operative position generally in front of the first front stop and a withdrawn inoperative position and a rear stop facing the front stops and disposed at substantially sheet length distance from the second front stop when the second front stop is in operative position, the combination with the elements recited of another rear stop mounted for generally transverse swinging movement and means for swinging the same between an operative position facing the front stops at substantially sheet length distance from the first front stop and a withdrawn inoperative position.

10. In a sheet staggering device comprising a first front stop, a second front stop, means for moving the second front stop between an operative position generally in front of the first front stop and a withdrawn inoperative position and a rear stop facing the front stops and disposed at substantially sheet length distance from the second front stop when the second front stop is in operative position, the combination with the elements recited of another rear stop, means for moving said other rear stop between an operative position facing the front stops at substantially sheet length distance from the first front stop and a withdrawn inoperative position and means for operating the first mentioned means and the second mentioned means to substantially simultaneously move the second

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front stop to operative position and the second mentioned rear stop to inoperative position and substantially simultaneously move the second front stop to inoperative position and the second mentioned rear stop to operative position.

11. In a sheet staggering device comprising opposed side guides, a first front stop disposed transversely of the side guides, a second front stop, means for moving the second front stop between an operative position generally in front of the first front stop and a withdrawn inoperative position and a rear stop facing the front stops and disposed at substantially sheet length distance from the second front stop when the second front stop is in operative position, the combination with the elements recited of means providing an opening in at least one of the side guides and another rear stop together with means for moving the same through the opening in said side guide between an operative position facing the front stops at substantially sheet length distance from the first front stop and a withdrawn inoperative position.

12. In a sheet staggering device comprising a first front stop, a second front stop, means for moving the second front stop between an operative position generally in front of the first front stop and a withdrawn inoperative position and a rear stop facing the front stops and disposed at substantially sheet length distance from the second front stop when the second front stop is in operative position, the combination with the elements recited of laterally opposed cooperative rear stop members constituting collectively a rear stop other than the first mentioned rear stop, means for moving said rear stop members generally toward and away from each other between an operative position of the second mentioned rear stop facing the front stops at substantially sheet length distance from the first front stop and a withdrawn inoperative position of the second mentioned rear stop and means for operating the first mentioned means and the second mentioned means to substantially simultaneously move the second front stop to operative position and said rear stop members generally away from each other to inoperative position of the second mentioned rear stop and substantially move the second front stop to inoperative position and said rear stop members generally toward each other to operative position of the second mentioned rear stop.

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