July 7, 1936. J. C. DAWSON 2,046,728

SHEET FEEDING MECHANISM

Filed Feb. 4, 1933 2 Sheets-Sheet 1

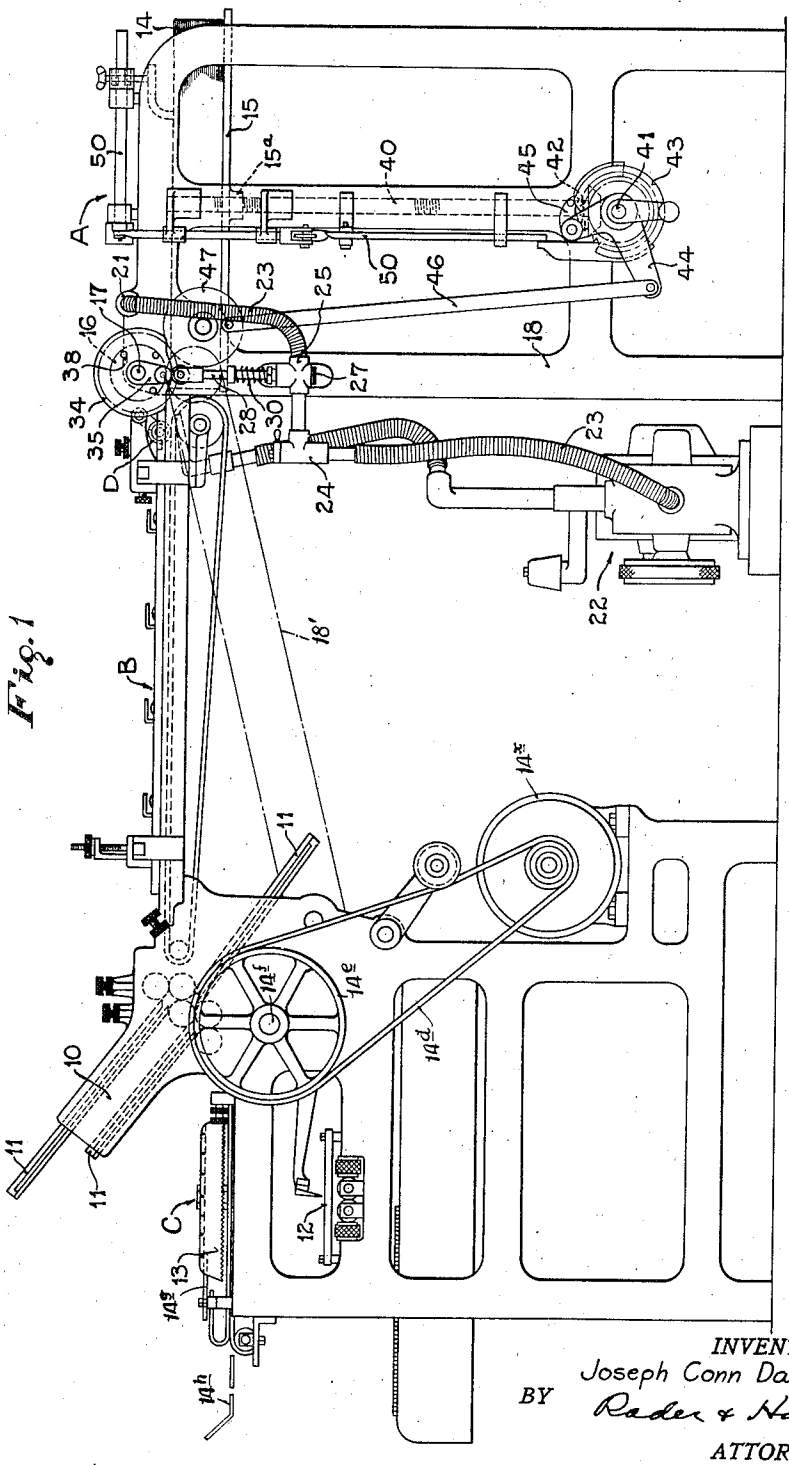


Fig. 1

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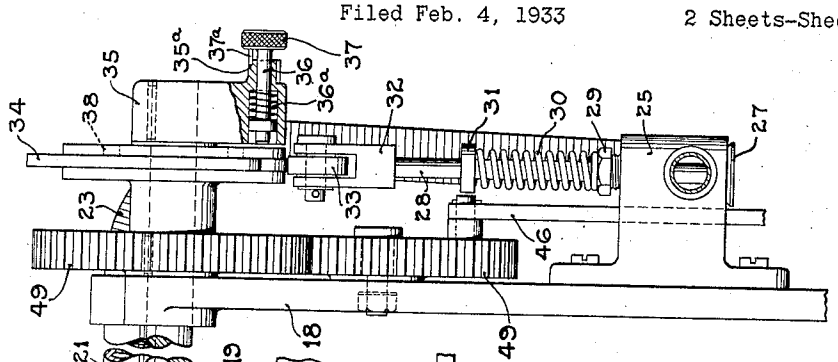


Fig. 3.

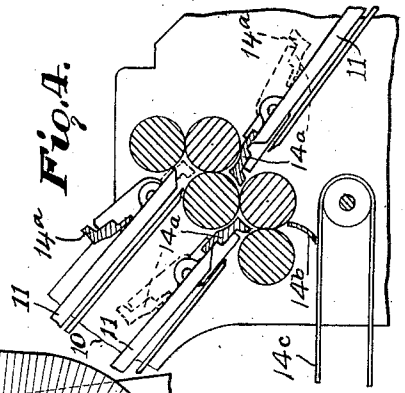


Fig. 4.

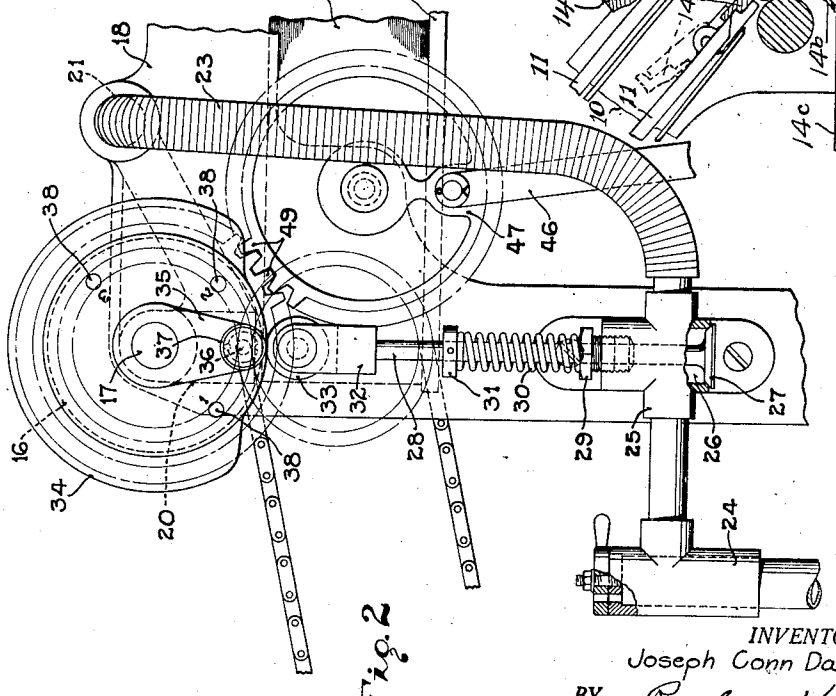


Fig. 2

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2,046,728

UNITED STATES PATENT OFFICE

2,046,728

SHEET FEEDING MECHANISM

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Application February 4, 1933, Serial No. 655,225
In Great Britain February 9, 1932

14 Claims. (Cl. 270—62)

This invention relates to sheet feeding mechanism for use in conveying paper or like sheets to sheet operating machines of all kinds and it has for its object to provide mechanism enabling the feed of the sheets to be performed in one and the same machine in a timed or untimed manner as may be required under accurate automatic control. For example in the conveyance of sheets to what are generally known as mixed folding machines, which embody the two principles of folding known as knife and buckle folding by the presence therein both of knife fold and buckle fold sections in any desired order it is important when sheets are to be folded in such a machine by both buckle fold and knife fold sets or by the latter alone that the sheets fed thereto should be properly timed, whereas no timing is required or necessary when buckle fold sets of the machine alone are taken into use.

With that object in view the invention consists broadly speaking in the provision of an adjustable controlling device which is associated with the feed mechanism proper so that by a suitable pre-adjustment the time interval a sheet takes in travelling to a particular sheet operating device or through a number of such devices may be properly controlled whereby in the case of a mixed folding machine for instance the sheets would be timed to synchronize with the knife action when the latter alone or both principles of folding are used or the device may be rendered inoperative when no timing of the sheets is required.

In order that the invention may be more clearly understood a constructional embodiment thereof will now be described by reference to the accompanying drawings in which:

Fig. 1 shows in a side elevational view its application by way of example to a "mixed" sheet folding machine embodying buckle fold sections and knife fold sections as now in frequent use.

Figs. 2 and 3 are part sectional detail views of an adjustably controlled feeding mechanism according to this invention as shown in Fig. 1 but drawn to a larger scale.

Fig. 4 is an enlarged fragmentary sectional view of the buckle fold mechanism shown in Fig. 1.

The machine illustrated in Fig. 1 includes a sheet-pile feed table A, a sheet feed table B and sheet folding devices C. The sheet folding devices comprise a buckle-fold section 10 having one or a plurality of fold plates 11, for producing one, two or three so-called parallel or legal folds and knife fold sections 12 and 13 for effecting consecutive cross folds in the sheets which are singly conveyed thereto over the feed table B through a caliper D thereon being initially fed from the sheet pile 14. The buckle and knife fold sections are of well known construction and require no detailed description herein. It is pointed out, however, that in order to selectively produce one, two or three parallel folds by the buckle fold section 10, as desired, the fold plates 11 may be slidably mounted and have pivoted thereon deflectors, as disclosed, for example, in United States Patent No. 1,534,885. These deflectors are indicated in Fig. 4 at 14a, and there is also shown therein a guide 14b for directing the sheets from the buckle fold section 10 to the belts or tapes 14c of the knife fold section 13. The sheet pile 14 is supported upon a pile table 15 which is automatically raised in known manner in accordance with the feed of the sheets as will hereinafter be briefly described. The feed of the sheets one by one from the sheet pile 14 to the conveyor table B is effected by sheet feed mechanism of the rotary suction type which in the instance shown comprises a rotary suction head 16 of the well known type as fully shown and described in United States Patent No. 1,672,412. The suction head is mounted upon a shaft 17 which is journalled in bearings in the side frames 18 and extends transversely of the machine immediately above the sheet pile 14.

The movable parts of the machine may be driven from any suitable source of power herein shown as an electric motor 14x the rotor of which is connected by a belt 14d with a pulley 14e that is fixed on a drive shaft 14f having suitable driving connections, including a chain 18', with the shaft 17. The rollers of the knife fold sections 12 and 13 are driven by any suitable means from shaft 14f. The folding knives of said sections derive their operation in one direction from the shaft 14f through the usual cam operated means for this purpose, and are spring operated in the opposite direction as customary in this type of mechanism. When the buckle fold section only is employed, the knife of fold section 13 is held up in an inoperative position by a stop 14g and the folded sheets are delivered by the belts or tapes 14c onto a stacking table or pan 14h secured to the machine in any suitable manner. The stop 14g is pivoted on said machine to swing inwardly under the head for said knife and hold it in inoperative position, as shown in Fig. 1, and to swing outwardly from said head and enable the knife to operate when the fold section 13, including said knife, is employed.

To cause the rotary suction head to seize and comb off the topmost sheet of the pile 14 an intermittent suction effect is produced in the orifices 19 of the suction head 16, Fig. 3. For this purpose the suction head communicates with a valve-controlled chest 20 which is connected to a main suction pipe 21 the latter being exhausted by a suction pump 22, Fig. 1, of usual type. The pump 22 is connected to the suction pipe 21 by flexible connectors 23 between which are interposed a manually operated air relief valve 24 and an automatically operated air relief valve 27.

As shown in greater detail in Figs. 2 and 3 the housing 25 of the valve 27 is mounted on a limb of the table frame 18 below the corresponding extremity of the suction head shaft 17 and in vertical alignment with the latter. The housing 25 is provided with connections to the suction pipe 21 and air relief valve 24 respectively and also an air inlet 26 which is controlled by the valve 27 which in the instance shown is a spring loaded mushroom valve. The stem 28 of the valve 27 extends upwardly through an air-tight packing gland 29 and serves to carry the loading spring 30 which comprises a helical compression spring held between a nut of the gland 29 and a retaining collar 31 which is pinned to the valve stem 28. The valve 27 is thus normally held closed as shown in the drawings. The valve stem 28 extends upwardly beyond the collar 31 and at its upper extremity carries a bifurcated bearing bracket 32 in which is journalled a cam-follower or runner 33 adapted to engage the contour of a cam disc 34 the latter being loosely mounted on the shaft 17 adjacent the extremity thereof. The cam 34 is provided in its outer face with a series of holes or notches 38 here corresponding to the number of buckle fold plates present (in the instance shown three) spaced at equal radial distances from the center of the cam and if desired indexed or numbered say: 1, 2, 3 as shown in Fig. 2. Each of these holes 38 by its position bears a definite relationship to the operating faces on the cam and its use predetermines a definite function of the latter as will be hereinafter more fully explained.

A crank-like bracket 35 is keyed to the extremity of the shaft 17 adjacent to the cam disc 34; at a point offset from the axis of the shaft the bracket carries a spring plunger pin 36 which is adapted to register with the holes 38 in the cam 34. As shown more particularly in Fig. 3, the plunger pin 36 under the influence of a helical spring 36a is urged to enter any of the holes 38 when in register therewith and is provided with a knurled disc or knob 37 whereby the pin may be withdrawn from the hole in which it is plugged. An inwardly extending pin or lug 37a is secured to the knob 37 and, when the pin 36 is withdrawn from the hole in the cam, the lug or pin 37a may be caused to engage a recess or dimple 35a suitably positioned in a projecting boss forming part of the bracket 35. Thus the pin 36 is withheld from engagement with any one of the holes 38 when it is desired to operate the sheet feed mechanism in an untimed manner as hereinafter explained.

The sheet pile table 15 is raised automatically by known mechanism in accordance with the feed of the sheets from the pile and the mechanism for effecting the automatic adjustment of the table 15 is controlled from the suction head shaft 17 in the following manner. The table 15 is carried by threaded brackets 15a which engage vertical threaded shafts 40 one of which is shown in Fig. 1. The latter at their lower extremities carry bevelled pinion wheels adapted to engage corresponding crown gears mounted upon a shaft 41. The last mentioned shaft also has keyed thereto a toothed ratchet wheel 42 and carries a loosely mounted cam edged tripping plate or disc 43. A bell crank lever 44 also loosely mounted on the stub shaft 41 has pivotally mounted on one arm thereof a ratchet finger or pawl 45 which is adapted to engage the teeth of the ratchet wheel 42 when permitted to do so by the rotation of the tripping plate 43. The other arm of the bell crank lever 44 is linked to a crank disc 47 by means of a connecting rod 46 and the crank disc 47 is driven from the shaft 17 by means of the gears 49 (Fig. 3).

The movement of the tripping plate 43 is controlled by the linkage indicated by the numeral 50 so that the ratchet pawl or finger 45, which is regularly oscillated through the crank disc 47 and connecting rod 46, is caused intermittently to rotate the ratchet wheel 42 thereby actuating the mechanism above described to raise the pile table 15 and sheet pile 14 resting thereon.

The adjusting mechanism for the sheet pile just described does not form part of the present invention and has been briefly explained merely to illustrate a means for its operation from the shaft 17 which carries the suction head and serves to actuate the automatic control thereof.

In the operation of the sheet feed control device above described the timing mechanism the subject of this invention, is set as indicated in the drawings when it is desired to run the machine in an untimed manner, i. e. when using buckle fold sections only. The plunger pin 36 is shown withdrawn from engagement with the holes 38 and by means of the pin or lug 37a which rests in the dimple 35a is held inoperative so that the controlling cam disc 34 is disconnected from the shaft 17 and remains idle. The cam disc is positioned so that its deepest point registers with the cam follower or runner 33 and thus the relief valve 25 remains closed and continuous suction is applied to the rotary suction head or heads subject to control by the manually operated relief valve 24. Sheets are thus fed in a continuous untimed manner from the pile 14 to the sheet feed table B and from the latter to the buckle fold sections 10 for final delivery.

The shaft 17 is driven in timed relation to the operation of the knife fold sections of the machine. When now it is desired to operate the machine for mixed buckle and knife folding the cam disc 34 is clutched in, i. e. coupled, by means of the plunger pin 36, with the suction head shaft 17. If only one buckle fold plate 11 is to be utilized prior to the knife fold sections being taken into use the plunger pin is plugged into the hole indexed 1 in the cam 34. In this case, the uppermost fold plate 11 could be utilized, the deflector thereon being turned back to its inoperative position and the deflectors on the remaining fold plates being turned to their operative positions, as shown in full lines in Fig. 4 of the drawings. As the suction head is actuated by the rotation of the shaft 17 the cam disc 34 is also rotated and at intervals predetermined by the setting of the cam 34 just described opens the valve 27 against the action of the spring 30 and thus provides intermittent air relief to the suction pump and suction head thereby timing the operative periods of the said suction head and consequently the feed of the individual sheets from the sheet pile in proper relation to

the operation of the knife fold sections employed.

Now if two or all of the three fold plates 11 shown in this construction are actually utilized in the buckle fold section 10 of the machine the period of time occupied by such buckle folding will be correspondingly lengthened and if therefore the buckle-folded sheets are to accurately register in the knife folding positions at correctly timed intervals they must initially be fed from the pile at correspondingly advanced time intervals to compensate for the delay occasioned by the passage of the sheets through the additional buckle fold plates.

Therefore, when more than one buckle fold plate is to be used the plunger pin 36 is plugged into an indexed hole 38 corresponding in number to the number of fold plates 11 used in succession so that the position of the cam disc 34 is altered relatively to the shaft 17 and the timing of the suction periods of the suction head 16 correspondingly advanced by the cooperation of the working faces of the cam with the valve actuating follower 33 relatively to the periodic operation of the knife folding devices. If, for example, only the first two fold plates are employed, the pin 36 would be plugged in the hole indexed 2 in the cam 34. In this case, the deflectors on the two fold plates at the left of Fig. 4 of the drawings would be turned to their full line positions and the deflector on the right hand fold plate would be turned to its dotted line position. If, for example, all three fold plates are employed, the pin 36 would be plugged in the hole indexed 3 in cam 34. In this case, and again referring to Fig. 4 of the drawings, the deflector on the uppermost fold plate would be turned to its full line position and the deflectors on the remaining fold plates would be turned to their dotted line positions. It will, of course, be understood that in order to turn the deflectors 14a to and from their operative and inoperative positions, the fold plates 11 are shifted as disclosed in Patent No. 1,534,885 above referred to.

It will be obvious to those skilled in the art that the embodiment of the invention above particularly described has been illustrated merely by way of example and that constructional details thereof can be varied or modified and equivalent means may be employed for its performance without departing from the spirit of the invention as herein defined.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:

1. In apparatus of the character described, timed mechanism for acting on sheets, untimed mechanisms for similar use and one or more of which may be employed with or without the timed mechanism, sheet feeding means for the timed and untimed mechanisms and adapted to be operated in timed or untimed manner in accordance with the particular mechanism or mechanisms employed, and means for controlling said sheet feeding means and advancing or retarding the timing of feed of the sheets thereby in relation to the cycle of operation of said timed mechanism.

2. In apparatus of the character described, timed mechanism for acting on sheets, untimed mechanisms for similar use and one or more of which may be employed with or without the timed mechanism, a sheet feeding device for the timed and untimed mechanisms and adapted to be operated in timed or untimed manner determined by the particular mechanism or mechanisms employed, and a control member for the sheet feeding device adapted to be operatively associated therewith in a plurality of positions, the control member serving to vary the timing of feed of the sheets by said device in accordance with the operative position of said member and the number of untimed mechanisms selected for use with said timed mechanism.

3. In apparatus of the character described, timed mechanism for acting on sheets, untimed mechaninsms for similar use and one or more of which may be employed with or without the timed mechanism, a sheet feeding device for the timed and untimed mechanisms and normally operated to feed sheets in a continuous or untimed manner, and a member for controlling the sheet feeding device adapted by adjustment and connection therewith to vary said untimed feed in a manner timed to control the travel of the sheets from said sheet feeding device to mechanisms preselected for particular use and including said timed mechanism.

4. In apparatus of the character described, timed mechanism for acting on sheets, untimed mechanisms for similar use and one or more of which may be employed with or without the timed mechanism, a continuously driven rotary sheet feeding device for the timed and untimed mechanisms and normally operated to feed sheets in a continuous or untimed manner, and a member for controlling the continuously driven rotary sheet feeding device adapted to be connected therewith in a number of distinct and different positions in each of which the untimed feed of said rotary feed device is modified by said member to control the travel of a sheet from the rotary feed device to mechanisms preselected for particular use and including said timed mechanism.

5. In apparatus of the character described, timed mechanism for acting on sheets, untimed mechanisms for similar use and one or more of which may be employed with or without the timed mechanism, a continuously driven rotary sheet feeding device for the timed and untimed mechanisms and normally operated to feed sheets in a continuous or untimed manner, a device for modifying the action of the rotary sheet feeding device, and a cam for operating the modifying device and thereby controlling the rotary sheet feeding device, said cam being adapted for coupling with the rotary sheet feeding device in different operative positions whereby said modifying device is influenced to vary the action of said rotary sheet feeding device in accordance with the operative position of the cam and a predetermined number of mechanisms selected for particular use and including said timed mechanism.

6. In apparatus of the character described, timed knife mechanism for folding sheets, untimed buckle mechanisms for similar use and one or more of which may be employed with or without the knife mechanism, means for feeding sheets in continuous or untimed manner for folding by one or more of the buckle mechanisms only and for feeding sheets in timed manner for folding by said buckle mechanism or mechanisms and said knife mechanism, and means for controlling the sheet feeding means adapted to vary the timing of feed of the sheets thereby in relation to the timed operation of the knife

mechanism and the time required for travel of sheets thereto through the buckle mechanism or mechanisms selected for use therewith.

7. In apparatus of the character described, timed knife mechanism for folding sheets, untimed buckle mechanisms for similar use and one or more of which may be employed with or without the knife mechanism, a suction device for feeding sheets in continuous or untimed manner for folding by one or more of the buckle mechanisms only and for feeding sheets in timed manner for folding by said buckle mechanism or mechanisms and said knife mechanism, means for modifying the action of the suction sheet feeding device, and a control device for the modifying means constructed for coupling with the suction sheet feeding device in a preselected position and adapted to automatically govern the action of said modifying means in relation to the timed operation of the knife mechanism and the time required for travel of sheets thereto through a predetermined number of buckle mechanisms selected for use therewith.

8. In apparatus of the character described, timed knife mechanism for folding sheets, untimed buckle mechanisms for similar use and one or more of which may be employed with or without the knife mechanism, a rotary suction head for feeding sheets in continuous or untimed manner for folding by one or more of the buckle mechanisms only and for feeding sheets in timed manner for folding by said buckle mechanism or mechanisms and said knife mechanism, means for modifying the action of the rotary suction head, a cam for controlling the action of the modifying means and loosely mounted on the shaft of the rotary suction head, and means for locking the cam on said shaft at any of a number of predetermined positions in each of which the action of said modifying means is governed by said cam in relation to the timed operation of the knife mechanism and the time required for travel of sheets thereto through a predetermined number of buckle mechanisms selected for use therewith.

9. In apparatus of the character described, timed knife mechanism for folding sheets, untimed buckle mechanisms for similar use and one or more of which may be employed with or without the knife mechanism, a rotary suction head for feeding sheets in continuous or untimed manner for folding by one or more of the buckle mechanisms only and for feeding sheets in timed manner for folding by said buckle mechanism or mechanisms and said knife mechanism, a relief valve for modifying the action of the rotary suction head, a cam for controlling the action of the relief valve and loosely mounted on the shaft of the rotary suction head, and means for locking the cam on said shaft at any of a number of predetermined positions in each of which the relief valve is intermittently operated by said cam and the suction head is intermittently rendered effective in relation to the timed operation of the knife mechanism and the time required for travel of the sheets through a predetermined number of buckle mechanisms selected for use therewith.

10. In apparatus of the character described, timed knife mechanism for folding sheets, untimed buckle mechanisms for similar use and one or more of which may be employed with or without the knife mechanism, a rotary suction head for feeding sheets in continuous or untimed manner for folding by one or more of the buckle mechanisms only and for feeding sheets in untimed manner for folding by said buckle mechanism or mechanisms and said knife mechanism, a relief valve for modifying the action of the rotary suction head, a cam loosely mounted on the shaft of the rotary suction head and provided with a plurality of openings disposed in spaced relation, a bracket fixed on said shaft to rotate therewith, and a plunger pin on said bracket engageable in said openings selectively for locking the cam on the shaft at a number of predetermined positions in each of which the relief valve is intermittently operated by said cam and the suction head is intermittently rendered effective in relation to the timed operation of the knife mechanism and the time required for travel of sheets thereto through a predetermined number of buckle mechanisms selected for use therewith.

11. In apparatus of the character described, timed knife mechanism for folding sheets, untimed buckle mechanisms for similar use and one or more of which may be employed with or without the knife mechanism, a rotary suction head for feeding sheets in continuous or untimed manner for folding by one or more of the buckle mechanisms only and for feeding sheets in timed manner for folding by said buckle mechanism or mechanisms and said knife mechanism, a relief valve for modifying the action of the rotary suction head, a cam loosely mounted on the shaft of the rotary suction head and provided with a plurality of openings disposed in spaced relation, a bracket fixed on said shaft to rotate therewith, a plunger pin on said bracket engageable in said openings selectively for locking the cam on the shaft at any of a number of predetermined positions in each of which the relief valve is intermittently operated by said cam and the suction head is intermittently rendered effective in relation to the timed operation of the knife mechanism and a predetermined number of buckle mechanisms selected for use therewith, and means for preventing engagement of the plunger pin in any of the cam openings whereby said cam remains stationary and the relief valve remains closed during operation of said suction head.

12. In apparatus of the character described, timed knife mechanism for folding sheets, untimed buckle mechanisms for similar use and one or more of which may be employed with or without the knife mechanism, an elevating mechanism for a pile of sheets, means for feeding sheets from the pile in continuous or untimed manner for folding by one or more of the buckle mechanisms only and for feeding sheets from the pile in timed manner for folding by said buckle mechanism or mechanisms and said knife mechanism, means actuated and controlled by the sheet feeding means and controlling the operation of said elevating mechanism, and means for controlling the sheet feeding means adapted to vary the feeding operation thereof relative to the timed operation of the knife mechanism and the time required for travel of sheets thereto through the buckle mechanism or mechanisms selected for use therewith.

13. In apparatus of the character described, timed mechanism for acting on sheets, untimed mechanisms for similar use and one or more of which may be employed with or without the timed mechanism, means for feeding sheets continuously for action thereon by an untimed mech-

anism or mechanisms only and for feeding sheets in timed manner for action thereon by one or more of the untimed mechanisms and the timed mechanism, and means for varying the time of feed of sheets by said sheet feeding means with relation to the cycle of operation of the timed mechanism and the time required for travel of sheets thereto through an untimed mechanism or mechanisms selected for use therewith, whereby sheets to be acted upon by said untimed mechanism or mechanisms and the timed mechanism will arrive at the timed mechanism in proper time for operation of said timed mechanism thereon.

14. In apparatus of the character described, timed knife mechanism for folding sheets, untimed buckle mechanisms for similar use and one or more of which may be employed with or without the knife mechanism, means for feeding sheets continuously for folding by one or more of the buckle mechanisms only and for feeding sheets in timed manner for folding by one or more of the buckle mechanisms and the knife mechanism, and means for advancing or retarding the time of feed of sheets by said sheet feeding means with relation to the cycle of operation of the knife mechanism and the time required for travel of sheets thereto through a buckle mechanism or mechanisms selected for use therewith, whereby sheets to be acted upon by said buckle mechanism or mechanisms and the knife mechanism will arrive at the knife mechanism in proper time for operation of said knife mechanism thereon.

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