United States Patent

[11] 3,554,532

[72] Inventors **James F. Cosgrove**
Western Springs, Ill.;
John Balla, Argo, Ill.

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[73] Assignee **Chicago Machinery Laboratory, Inc.**
Chicago, Ill.
a corporation of Illinois

[54] **SIGNATURE MACHINES**
1 Claim, 4 Drawing Figs.

[52] **U.S. Cl.** **270/54**
[51] **Int. Cl.** **B65b 39/02**
[50] **Field of Search** 270/54, 55, 56, 58

[56] **References Cited**
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2,507,281	5/1950	Spisak	270/54
2,791,421	5/1957	Schramm	270/54
3,087,721	4/1963	Mc Cain	270/54

Primary Examiner—Lawrence Charles
Attorney—Kinzer, Dorn and Zickert

ABSTRACT: A gripper finger for clamping the margin of a signature sheet may be operated from the same source of suction which enables a suction cup to be effective on the same sheet, and this is made possible by oscillating the finger through a piston responsive to suction.

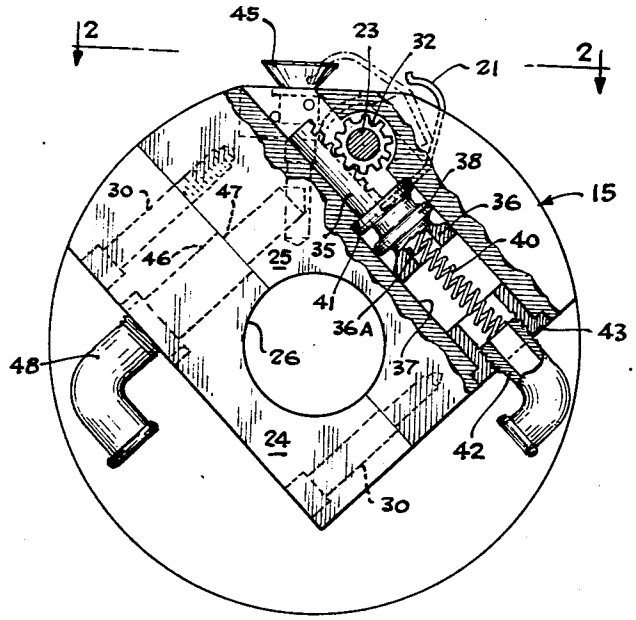


Fig.2

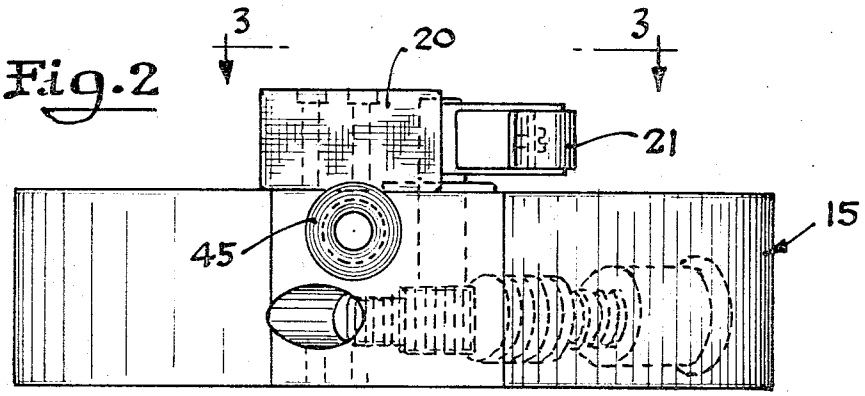
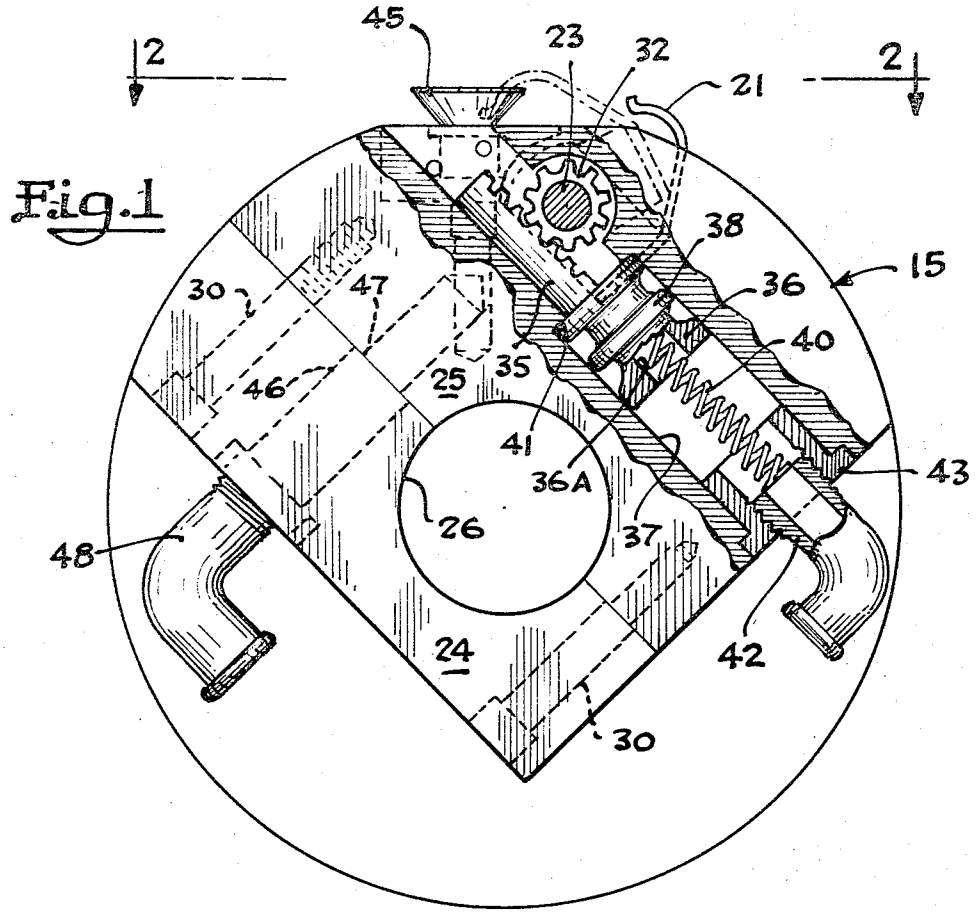


Fig.1



Inventors
James F. Cosgrove
John Balla
By Kinzer, Dorn and Zickert
Attorneys

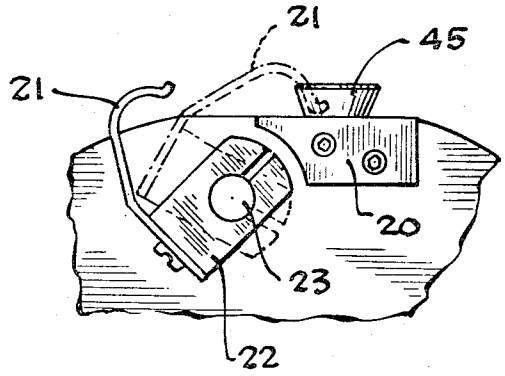
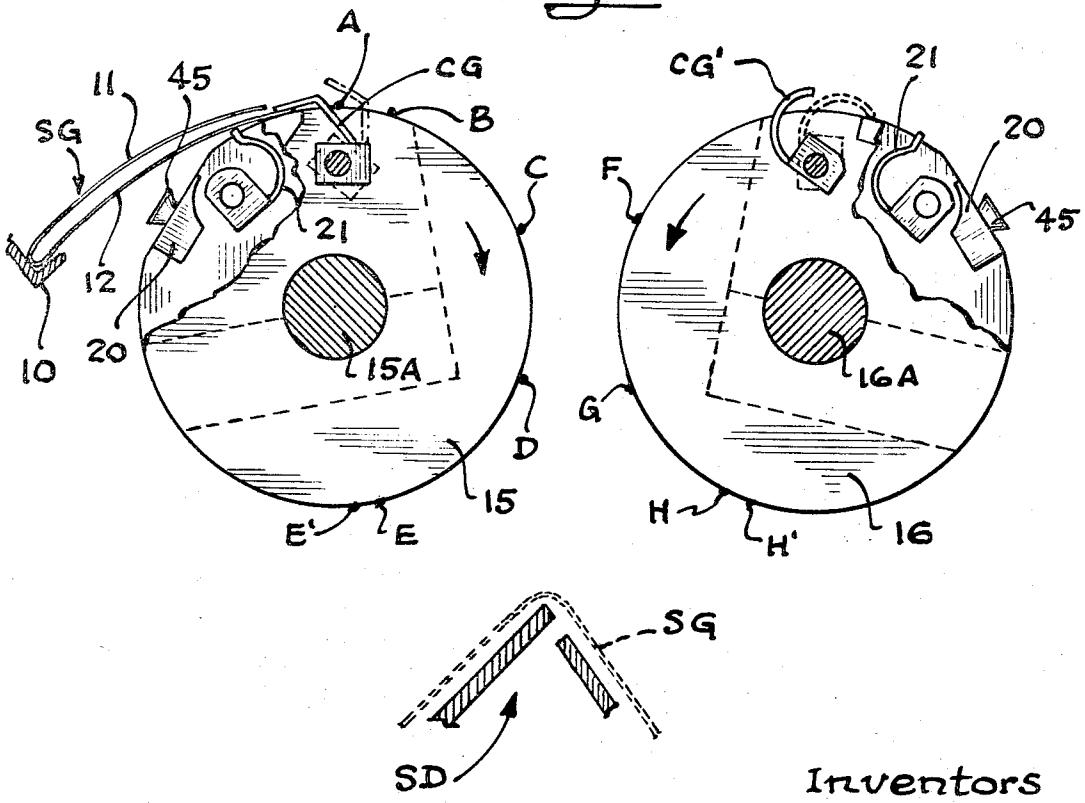


Fig.3

Fig.4



Inventors
James F. Cosgrove
John Balla
By Kinzer, Dorn and Zickert
Attorneys

SIGNATURE MACHINES

The present invention relates to signature machines of the kind wherein signatures, folded at a backbone to present opposed sheets, are transferred from and to different stations and in the course of which the sheets of the signature are to be widely spread.

Typical operations performed on a signature, especially in the instance of transferring a signature from a supply magazine to a so-called saddle, are disclosed in U.S. Pat. No. 3,087,721, granted to the present assignee, and particularly in FIGS. 4 and 5 thereof. The disclosure of the patent involves a pair of cylinders or discs which carry grippers effective to clamp portions of the free marginal edges of the folded signature, spreading the sheets incidental to depositing the opened signature on a saddle which is part of a conveyor structure. Many of operations of a machine of this kind are assisted by suction cups effective to apply suction to signature, especially in the instance of signature transfer motion. The grippers, as heretofore used, embody a finger and an associated anvil or plate between which a margin of the signature sheet is gripped upon closing the finger on the anvil. Thus if the finger is oscillated, and in doing this the prior practice has been to resort to cam-controlled segment gearing of the kind illustrated in FIG. 5 of U.S. Pat. No. 3,087,721. The primary object of the present invention is to enable a gripper finger to be operated through the source of suction available in signature machines, thereby harnessing the source of suction for a second effort and making it possible to present a second gripper finger (suction-operated) without burdening the machine with segment gears and cams for operating each of the gripper fingers. The conventional gear-operated gripper may be used to start signature transfer motion, and the suction-operated gripper may be used as an incident to and means for more positive opening or spreading the signature, especially in the instance of a 16 or 32 page signature.

While the term "suction" is only common parlance suggestive of a positive force which is really negative air pressure differential, the common term will be employed conveniently herein as a well-understood phenomenon.

Other and further objects of the present invention will be apparent from the following description and claims and are illustrated in the accompanying drawings which, by way of illustration, show a preferred embodiment of the present invention and the principle thereof and what is now considered to be the best mode contemplated for applying that principle. Other embodiments of the invention embodying the same or equivalent principles may be used and structural changes may be made as desired by those skilled in the art without departing from the present invention.

In the drawings:

FIG. 1 is a side elevational view, partly fragmented in section, showing the gripper finger disc of a signature machine constructed in accordance with the present invention;

FIG. 2 is a top plan view of the structure shown in FIG. 1;

FIG. 3 is a fragmentary side elevation substantially on the line 3–3 of FIG. 2; and

FIG. 4 is a schematic drawing further illustrative of features of the present invention.

Referring for the moment to FIG. 4, this particular FIG. is based somewhat on the disclosure in U.S. Pat. No. 3,087,721 wherein a signature SG is transferred to a register gauge which includes a stop 10, FIG. 4, serving as a backstop for the folded portion or so-called backbone of the signature, the signature itself thus presenting two sheets or pages 11 and 12. The signature SG is to be withdraw from the register gauge station by means mounted on two cylinders or discs 15 and 16 as will be described in detail below, which means are effective to spread the sheets 11 and 12 so that they will straddle a saddle SD on which are gathered superimposed signatures to complete a book. In this connection, the discs 15 and 16 are opposite one another, being supported on corresponding parallel rotary shafts 15A and 16A for rotation in opposite directions.

FIG. 1 illustrated details of the construction of the disc 15, and the other disc 16 is constructed in a similar fashion. Essentially, the disc 15 carries, for rotation therewith, an anvil 20, FIG. 2, presenting a flat upper surface, and a gripper finger 21 which is normally in an open position with respect to the anvil. The gripper finger 21 is fastened to one end of a bracket 22, FIG. 3, which in turn is clamped to one end of a shaft 23 suitably supported within the disc for rotation in opposed directions, so that the gripper finger in effect carried thereby may be shifted between closed and open positions with respect to the associated anvil 20.

The disc 15 is constructed in part from a pair of segments 24 and 25, FIG. 1. These two segments are formed with 180° recesses adapted to be aligned to afford a 360° opening 26 which fits the shaft 15A to the segments 24 and 25 are clamped so as to rotate with the shaft 15A, and in achieving this, clamping bolts as 30, FIG. 1, are employed.

The shaft 23 which carries the gripper finger bracket 22 has a pinion gear 32, FIG. 1, fixed thereto, and this gear is positioned internally of the disc structure 15 where it is meshed with a drive rack 35 which is part of a reciprocal piston 36. The piston 36 is fitted in an airtight fashion within a cylinder 37 defined by correspondingly chambering the interior of the segment block 25 which constitutes part of the disc. Such an airtight fit may be easily achieved simply by machining the piston to present a plurality of axially spaced seal rings 38 which slide in neat engagement with the bore of the cylinder 37.

The piston 36 is normally biased to a forwardmost position by a coil spring 40, which is to say that the spring 40 is normally effective to urge the piston 36 against a stop shoulder 41 at the innermost end of the cylinder 37, and under this circumstance the rack 35 (now stationary) has turned the pinion 32 to a position where the gripper finger 21 is fully retracted in an open position spaced from the cooperating anvil 20. One end of the spring 40 fits in a socket in the back of the piston, and the opposite end of the spring bears an elbow-type nipple 42 which enables suction to be communicated to the interior of the cylinder 37. In this connection, the end of the cylinder 37 remote from the stop shoulder 41 is provided with a press-fitted closure plug 43, and the plug 43 in turn has a threaded opening therein to which is mated the correspondingly threaded extension of the nipple 42.

The disc 15 also carries a suction cup 45. Suction is communicated thereto through aligned passages 46—47, FIG. 1, formed in the disc segments 24 and 25, and suction in turn is communicated to these passages by a second nipple 48 which may receive vacuum from the same source in the machine supplies the nipple 42.

It will be observed that the suction cup 45 is at the top of the disc as viewed in FIGS. 1 and 2, inboard of the anvil 20 which is secured by bolts to one side of the disc 15.

In order it will be distinctly understood that the construction of the two cylinders 15 and 16 is substantially identical, reference characters similar to those employed in identifying the parts of disc 15 have been applied to similar parts carried by disc 16, FIG. 4.

FIG. 4 illustrates circumstances which may prevail in actual practice. With disc 15 (the "lap" cylinder as termed in the art) approximately in the position of rotation shown, point A, the conventional gripper CG grips the lap or projecting margin of sheet 12 of the signature, pulling the signature out of the register gauge 10 as the disc 15 continues its clockwise travel. When the cup 45 is at point B, it applies suction to the sheet 12. At point C, gripper CG opens. At point D, gripper 21 on disc 15 closes. At point E suction for operating finger 21 on disc 15 is discontinued, and at point E′ vacuum is no longer supplied to cup 45 on disc 15.

Disc 16, FIG. 4 (the "opening" cylinder), is rotating counterclockwise. Its suction cup 45 is moving toward cup 45 on disc 15 and is activated when approximately at point F. Now, the free margins of sheets 11 and 12 are both "held" by the two suction cups 45–45, and continued rotation of the two discs 15 and 16 causes the cups 45 to separate more and more, manifest in spreading of the sheets 11 and 12. At point G,

vacuum operated gripper **21** on disc **16** closes on sheet **11**; and at A and H and H' vacuum, disc **16**, is respectively discontinued to the suction operated gripper **21** and the cup **45**.

When vacuum is supplied to each cylinder as **37**, withdrawing each piston as **36** against the return bias of spring **40**, the pinion **32** is turned by its rack gear **35**, closing the gripper fingers **21** on their anvils **20**, thereby clamping the margin of each sheet **11** and **12** to the related anvil **20**. Thus, the sheets are forcefully gripped and positively spread in an area just above the saddle SD, FIG. **4**, being positively clamped, and just before the suction cups and gripper fingers attain their bottom-most position, FIG. **4**, suction is discontinued. The suction cups become ineffective, and the springs as **40** return each piston to release the related gripper finger, whereupon the signature SG shown by dotted line in FIG. **4** drops freely onto the saddle SD.

Hence, while a preferred embodiment of the invention has been described and illustrated, it is to be understood that this is capable of a variation and modification.

I claim:

1. In a signature machine where folded signatures are to have the sheets thereof spread apart to an open state and the signature in its open state then deposited on a saddle conveyor: a pair of parallel driven shafts each supporting a disc above the saddle, one disc opposed to the other, and each shaft and disc being characterized by the following structure: a first gripper in a leading position adapted to clamp to the disc the leading edge of one of the sheets of the unopened signature; a second gripper on the disc, trailing the first gripper, for also gripping the sheet and including a gripper finger and an associated anvil carried by the disc between which a portion of the sheet is to be clamped, a pinion shaft supporting said gripper finger on the disc for movement between open and closed positions with respect to said anvil, a pinion gear on the pinion shaft within said disc and said disc having a cylinder chamber with a piston mounted therein for reciprocation in opposed directions induced at least in part by fluid subjected to a pressure differential in said chamber, a rack on the piston engaged with the pinion to translate reciprocal motion of the piston into oscillation of the finger, a suction cup on the disc substantially in alignment with said anvil, and passages in the disc for communicating pressure differential to the cylinder and the cup, each disc being constructed from a pair of segments each having a 180° recess therein fitting the shaft, one of the segments having aligned passages communicating with the cup to furnish vacuum thereto, and said gripper finger and the anvil being located outboard of the disc on one side thereof and the anvil and suction cup being in substantial alignment.