May 11, 1965 C. A. HUTH 3,182,994

GAUGING MECHANISM

Filed Feb. 26, 1962 2 Sheets-Sheet 1

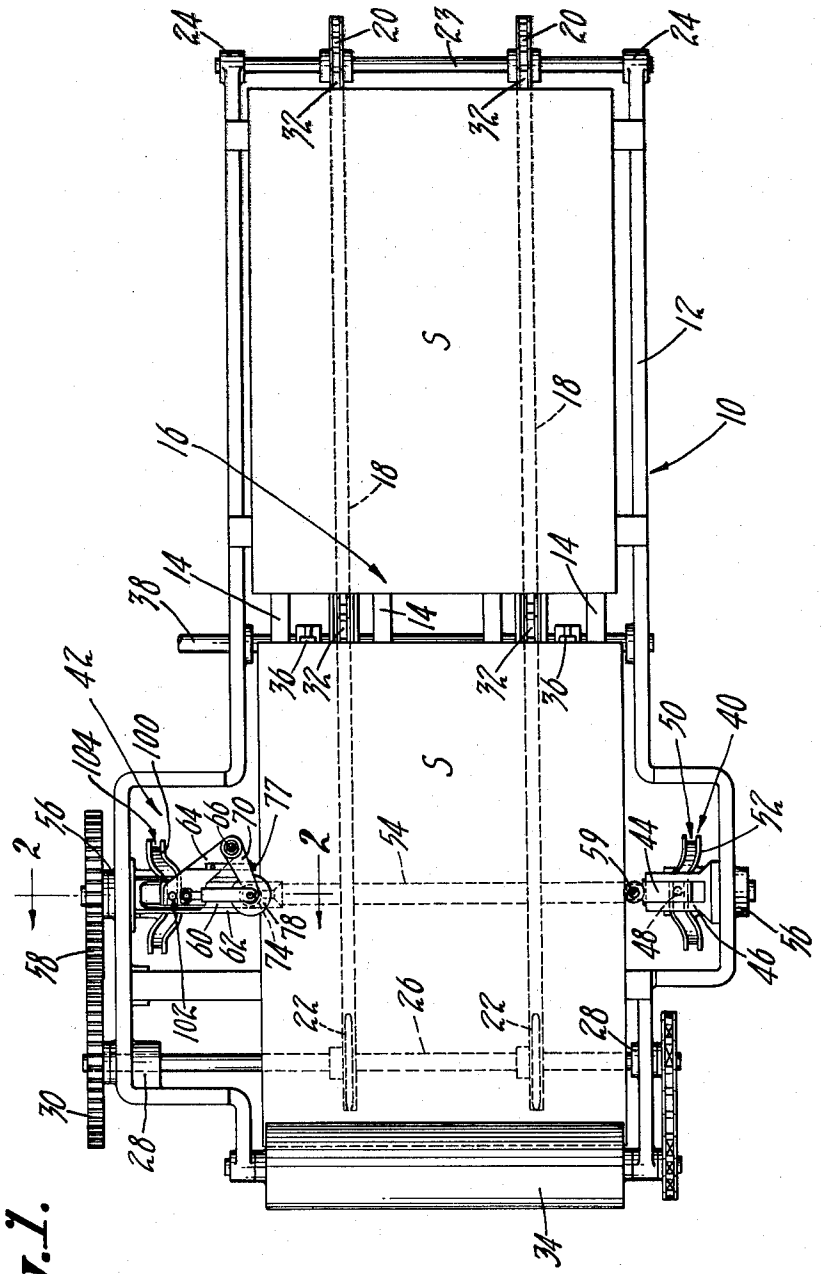

Fig. 1.

INVENTOR.
CARL ALEXANDER HUTH
BY George P. Ziehmer
George W. Reiber
ATTORNEYS

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Fig. 2.

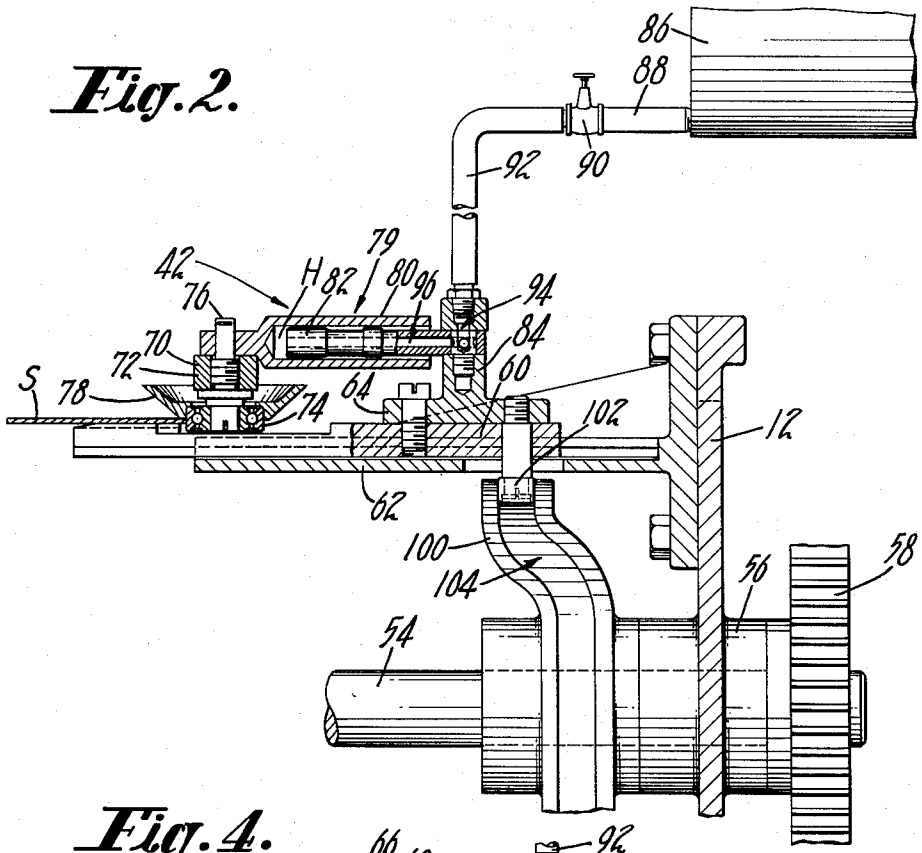


Fig. 4.

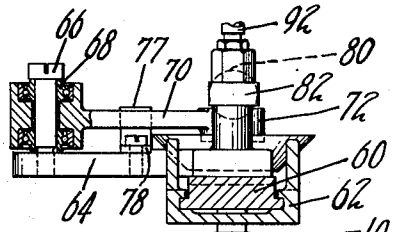
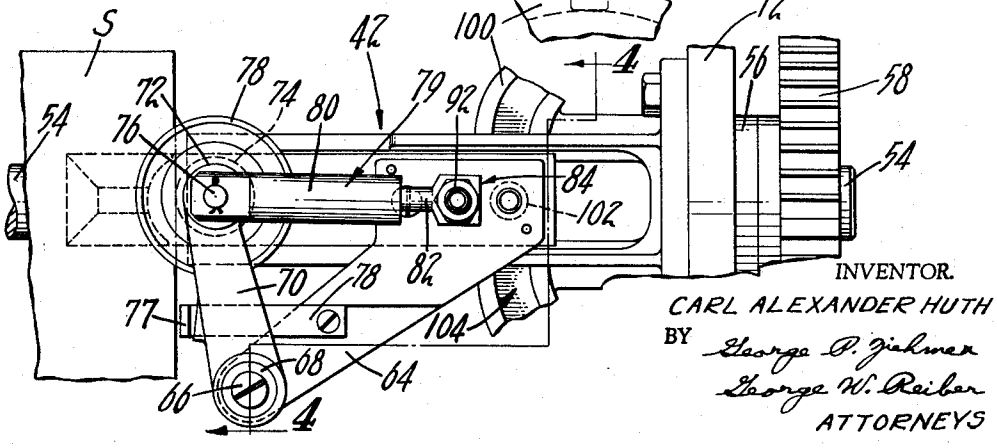


Fig. 3



INVENTOR.
CARL ALEXANDER HUTH
BY George P. Fishmer
George W. Reiber
ATTORNEYS

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3,182,994

GAUGING MECHANISM

Carl Alexander Huth, Closter, N.J., assignor to American Can Company, New York, N.Y., a corporation of New Jersey

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7 Claims. (Cl. 271—49)

The present invention relates to gauging and has particular reference to a sheet gauging mechanism which is provided with a pneumatic cushioning device which effectively prevents buckling of the sheet as it is pressed against a nonyieldable gauging element.

In many industries, it is necessary to accurately gauge sheets of fibre or metal stock preparatory to operating upon them in a treating machine such as a printing, slitting, cutting, punching or coating machine. In one of the most usual methods of sheet gauging, particularly in metal working industries such as the can manufacturing industry, a yieldable gauge element is pressed against one edge of the sheet to move the opposite sheet edge into engagement with a nonyieldable gauge element which is disposed on the opposite side of the sheet and which accurately gauges the sheet relative to the treating instrumentalities of the treating machine.

In order to maintain the sheet in pressured contact with the nonyieldable gauge element for a fixed, albeit brief, period of time to insure accurate gauging, and to compensate for minor variations in the width of the sheets, the actuating mechanism which moves the yieldable gauge element through its sheet moving stroke is caused to slightly overtravel. In order to absorb this overtravel, and to cushion the engagement between the sheet and the yieldable gauge element, a compression spring is usually interposed between the yieldable gauge element and its actuating mechanism. As this spring is compressed, the load on it builds up quite rapidly. Since this increasing pressure is exerted by the yieldable gauge element against one edge of the sheet while the opposite sheet edge is stopped by the nonyieldable gauge element, it tends to cause the sheet to buckle or bow upwardly, which results in an inaccurate gauging operation. The recent trend toward the use of thinner and lighter sheets has greatly increased this buckling problem, since such sheets buckle quite easily.

Attempts have been made to solve this buckling problem by using lighter springs which compress more easily, but this solution has not been completely satisfactory, since it results in some loss of control over the sheet. Springs are also objectionable in such applications since they are subject to fatigue, with consequent breakage and pressure variation problems.

The present invention provides a very satisfactory solution to this problem by completely eliminating the compression spring in the yieldable gauge element and substituting for it a pneumatic cushioning mechanism which is designed to avoid a substantial pressure build-up during any stage of the sheet gauging operation.

This mechanism preferably comprises a cylinder, formed with an open end, in which is mounted a piston which is undersized with respect with the cylinder, the cylinder and piston being interposed between the yieldable gauge element and its actuating mechanism. Air at a predetermined, low pressure is continuously fed into the cylinder and continuously escapes through the space between the undersized piston and the surrounding cylinder wall. As a result, the build-up of pressure within the cylinder is minimized, even during the time the piston and the cylinder are moved relative to each other during the overtravel portion of the stroke of the actuating mechanism, and buckling of the sheet is eliminated.

An object of the invention therefore is the provision of an air-cushioned sheet gauging mechanism which effectively limits the pressures exerted against the sheet during the sheet gauging operation.

Another object of the invention is the provision of a sheet gauging device which is simple in construction and in which the use of springs, which are subject to breakage, is eliminated.

Another object of the invention is the provision of an air-cushioned sheet gauging mechanism wherein the deflection resistance of the yieldable gauge element may be readily adjusted by an adjustment of the pressure of the compressed air utilized in the mechanism.

Numerous other objects and advantages of the invention will be apparent as it is better understood from the following description, which, taken in connection with the accompanying drawings, discloses a preferred embodiment thereof.

Referring to the drawings:

FIGURE 1 is a plan view of a sheet gauging apparatus embodying the principles of the instant invention;

FIG. 2 is an enlarged vertical section taken through the yieldable gauge mechanism of the apparatus of FIG. 1, the section being taken substantially along the line 2—2 in FIG. 1, parts being broken away;

FIG. 3 is a plan view of the mechanism of FIG. 2, and

FIG. 4 is a vertical section taken substantially along the line 4—4 in FIG. 3.

As a preferred and exemplary embodiment of the instant invention the drawings disclose a sheet gauging apparatus which is incorporated in a sheet treating machine, which is generally designated by the numeral **10**. The machine **10** includes a frame **12**, the upper portion of which is provided with a series of longitudinal support bars **14** which form a feed table **16** along which a procession of rectangular sheets S is fed longitudinally by the upper flights of a pair of endless chains **18** which is disposed below the level of the bars **14**. The chains **18** operate around two pairs of sprockets **20**, **22**.

The sprockets **20** are mounted on an idle shaft **23** which is mounted in bearings **24** formed at the feed-in end of the machine **10**, while the sprockets **22** are keyed to a drive shaft **26** which is mounted in bearings **28** formed in the opposite end of the frame **12**. The drive shaft **26** is provided with a drive gear **30** which is rotated by any suitable means, such as a drive motor (not shown).

The chains **18** are provided at spaced intervals with feed dogs **32** which project above the support bars **14** and engage the trailing edges of the sheets S to propel the sheets toward the sheet treating element of the machine **10**. The sheet treating element shown in FIG. 1 comprises a cylinder **34** which may be a printing or coating cylinder, the auxiliary mechanisms of which are omitted for the sake of clarity.

As the leading edge of each sheet S approaches the cylinder **34**, its trailing edge is engaged by a pair of rotary fingers **36** which advance it slightly ahead of the feed dogs **32** and provide a pair of spaced gauge points which effect a front-to-back gauging of the sheet S. The rotary fingers **36** are keyed to a rotating shaft **38** which is driven in time with the other operating parts of the machine **10** in any suitable manner. The rotary fingers **36** may be of the type disclosed in R. E. J. Nordquist et al. Patent 2,547,964. If desired, the rotating fingers **36** may be eliminated and the front to rear gauging of the sheets S performed by the feed dogs **32**.

During the time the sheet S is under the control of the rotating fingers **36**, it is side-gauged with respect to the cylinder **34** by a side gauging mechanism which comprises a nonyieldable gauging device, generally designated by

the numeral 40, and a yieldable gauging device, generally designated by the numeral 42 (see FIG. 1).

Each of the gauging devices 40, 42 is of the reciprocating type, the device 40 comprising a slide 44 which is mounted in a slideway 46 secured to the frame 12. The slide 44 is provided with a depending cam roller 48 which operates in the track 50 of a rotary cam 52 (see FIG. 1) which is keyed to a cross-shaft 54 which is mounted in bearings 56 and rotated from the drive gear 30 through a meshing gear 58. At its inner end, the slide 44 is provided with a nonyieldable gauging element which comprises a roller 59 which engages one side of the moving sheet S and forms the solid side of the gauging mechanism. The roller 59 is preferably mounted on roller bearings to reduce the frictional engagement between itself and the sheet S.

The yieldable gauging device 42 comprises a slide 60 which is mounted for reciprocation in a slideway 62 which is bolted to the machine frame 12, as best seen in FIG. 2. One end of a rearwardly and inwardly extending support bracket 64 is bolted to the outer end of the slide 60. At its opposite end, the bracket 64 carries a stud 66 on which is mounted a roller bearing 68 which carries a forwardly projecting pivot arm 70. The opposite end of the pivot arm 70 is formed into a bearing 72 in which is mounted a depending yieldable gauging element which comprises a freely rotatable roller 74 which engages the side of the sheet S which is opposite to the side engaged by the nonyieldable roller 59.

The yieldable gauging roller 74 is mounted on a stud 76 which projects upwardly above the bearing 72, and carries a flaring shield member 78, the purpose of which is to prevent the sheets S from riding upwardly on the roller 74.

The pivot arm 70 is normally held against a stop 77, which comprises the upwardly extending inner end of a small bracket 78 carried by the bracket 64, by a pneumatic unit, generally designated as 79, which comprises an open-ended cylinder 80, which is pivotally mounted on the stud 76, and a piston 82 which is disposed within the cylinder 80 and is pivotally mounted on an upwardly extending post 84 formed integral with the bracket 64. The outer diameter of the piston 82 is somewhat smaller than the interior diameter of the cylinder 80.

Low pressure air is fed into the cylinder 80 from any suitable source of supply such as a tank 86 through a pipe 88, a pressure reducing valve 90, a flexible hose 92, a vertical bore 94 formed in the post 84, and a horizontal bore 96 which is formed in the piston 82, and the pressure exerted by this air biases the cylinder inwardly to maintain the pneumatic unit in expanded position to provide a cushion between the yieldable roller 74 and the slide 60.

Because of the fact that the piston 82 is undersized with respect to the cylinder 80, the air which enters the cylinder 80 continuously escapes backwardly around the piston 82 into the atmosphere, and this escaping air serves as a lubricant or "grease" which reduces the friction between the piston 82 and the cylinder 80 to a minimum.

The slide 60 is reciprocated by a rotary cam 100 which is keyed to and rotated by the cross-shaft 54 in synchronism with the cam 52, the slide 60 being provided with a cam roller 102 which operates in the track 104 of the cam 100.

The cam tracks 50, 104 are so shaped that the slides 44, 60 are held in retracted, outward position while the forward part of each sheet S is fed between them. Thereafter, the cam rollers 48, 102 enter the high portions of the cam tracks 50, 104 with the result that the slides 44, 60 move inwardly and carry the gauging rollers 59, 74 toward the opposite edges of the sheet S.

The sheet S is initially positioned on the feed table 16 so that it is closer to the yieldable gauge mechanism 42 than it is to the nonyieldable gauging mechanism 40. As a result the sheet S is first engaged by the yieldable gauging roller 74 as the latter moves inwardly, and is forced laterally of the table toward the nonyieldable gauging roller 59. The initial impact between the sheet S and the yieldable roller 74 is cushioned by the pneumatic unit 79, the degree of cushioning depending on the pressure of the air which is fed into the cylinder 80.

It has been found in practice that air at a pressure of between 3 and 4 pounds per square inch gives excellent results, but the optimum pressure is of course, dependent on numerous factors, such as the size and weight of the sheets S and the speed of operation of the machine 10. When these factors necessitate a variation in air pressure, the required pressure can easily be obtained by a change in the setting of the pressure control valve 90.

The cam track 50 is contoured so that the slide 44 reaches its innermost position prior to the time the slide 60 reaches its innermost position and is maintained in this position for a fixed period of time during which the nonyieldable gauging roller 59 provides a fixed side gauging point. During this period, the inward movement of the yieldable gauging roller 74 moves the sheet S into engagement with the nonyieldable gauging roller 59 and holds it there for a very short time to complete the side gauging operation.

To insure firm contact between successive sheets S, which may vary in width, and the roller 59, the cam track 104 is so designed that stroke of the slide 60 is made somewhat longer than that which would be required to move a normal sheet S against the roller 59. The length of this overtravel is deliberately made greater than the greatest variation in width which is normally encountered in the sheets S, so that each sheet S engages against and has its lateral movement stopped by the nonyieldable gauging roller 59 prior to the time the slide 60 finishes its inward stroke.

As a result, the arm 70 is forced away from the stop 77 (see FIG. 4) during the final portion of the stroke of the slide 60 and the cylinder 80 is moved axially along the piston 82, thus decreasing the internal volume of the headspace H of the cylinder 80. However, because of the space between the piston 82 and cylinder 80, most of the displaced air in the headspace H escapes backwardly around the piston 82, and there is very little rise in compression of the air in this headspace H, and consequently very little increase in the pressure which is exerted against the sheet S by the yieldable roller 74. In fact, any small increase in pressure that may be encountered is quickly dissipated by the escape of the air from the cylinder. As a result, there is substantially no danger of having the sheet S bow or bulge upwardly due to the overtravel of the slide 60.

The cam tracks 50, 104 are shaped to hold the slides 44, 60 in their innermost positions until such time as the front edge of each sheet S reaches the cylinder 34 and is brought under its control, the gauging rollers 59, 74 offering little resistance to the forward motion of the sheet S while they are in their "in" position because of the fact that they are rotated by the sheet S.

Once the sheet comes under the control of the cylinder 34, the cam tracks 50, 104 move the slides 44, 60 outwardly, thereby withdrawing the gauging rollers 59, 74 from engagement with the sheet S and repositioning them for the next gauging operation.

It is thought that the invention and many of its attendant advantages will be understood from the foregoing description and it will be apparent that various changes may be made in the form, construction, and arrangement of the parts without departing from the spirit and scope of the invention or sacrificing all of its material advantages, the form hereinbefore described being merely a preferred embodiment thereof.

I claim:

1. A yieldable gauging mechanism for moving an article to be gauged into engagement with a non-yieldable gauging element to effect a gauging operation, compris-

ing a yieldable gauging element, means for actuating said yieldable gauging element, and pneumatic cushioning means operatively interposed between said yieldable gauging element and said actuating means, said cushioning means comprising a cylinder having a closed end and being connected to said yieldable gauging element, a piston disposed within said cylinder and being connected to said actuating means, and means for supplying air at a predetermined pressure to said cylinder between said closed end thereof and the adjacent end of said piston, the internal diameter of said cylinder being greater than the external diameter of said piston so that pressurized air entering said cylinder at said closed end thereof escapes between said cylinder and said piston to the opposite end of said cylinder.

2. The yieldable gauging mechanism as recited in claim 1 wherein said piston is hollow, and wherein pressurized air is supplied through said piston to said closed end of the cylinder.

3. The mechanism of claim 1 wherein said actuating means comprises a cam controlled slide and wherein said yieldable gauging element comprises a roller.

4. The mechanism of claim 3 wherein said slide is movable toward said article through a stroke in excess of that necessary to move said article into engagement with said nonyieldable gauging element, whereby said roller moves into engagement with said article and in the excess portion of the stroke said piston continues to move toward said article and said cylinder remains stationary relative to said article, whereby the pressure of the air escaping between said cylinder and said piston maintains the force of said roller against said article at a substantially constant value.

5. A yieldable gauging mechanism for moving an article to be gauged into engagement with a non-yieldable gauging element to effect a gauging operation, comprising a slide mounted adjacent said article, means for selectively moving said slide toward and away from said article, a hollow piston mounted on said slide for movement therewith, means for supplying air at a predetermined pressure to one end of said piston, an open-ended cylinder surrounding said piston and having a closed end adjacent the other end of said piston, the internal diameter of said cylinder being greater than the external diameter of said piston so that pressurized air entering said cylinder from said other end of said hollow piston escapes between said cylinder and said piston to the open end of said cylinder, means connected to said slide and movably supporting said cylinder for movement relative to said slide, and a roller connected to said cylinder and positioned to engage said article and move it into engagement with the nonyieldable gauging element when said slide is moved toward said article.

6. The apparatus of claim 5 wherein said slide is movable by said moving means toward said article a distance in excess of that required to move said article into engagement with said nonyieldable gauging element, whereby after said article engages said nonyieldable gauging element said piston continues to move toward said article and said cylinder remains stationary relative to said article, the pressure of the air escaping between said cylinder and said piston maintaining the force of said roller against said article at a substantially constant value.

7. A yieldable gauging mechanism for moving an article to be gauged into engagement with a non-yieldable gauging element to effect a gauging operation, comprising a yieldable gauging element, means for actuating said yieldable gauging element, and pneumatic cushionin means operatively interposed between said yieldable gauging element and said actuating means, said cushioning means comprising a cylinder member having a closed end, a piston member disposed within said cylinder, and means for supplying air at a predetermined pressure to said cylinder member between said closed end thereof and the adjacent end of said piston member, one of said members being connected to said yieldable gauging element and the other of said members being connected to said actuating means, the internal diameter of said cylinder member being greater than the external diameter of said piston member so that pressurized air entering said cylinder member at said closed end thereof escapes between said cylinder member and said piston member to the opposite end of said cylinder member.

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SAMUEL F. COLEMAN, *Primary Examiner.*

WILLIAM B. LA BORDE, *Examiner.*