Jan. 21, 1964 R. E. HARTSOCK 3,118,232

SHEET COUNTER

Filed Dec. 5, 1960

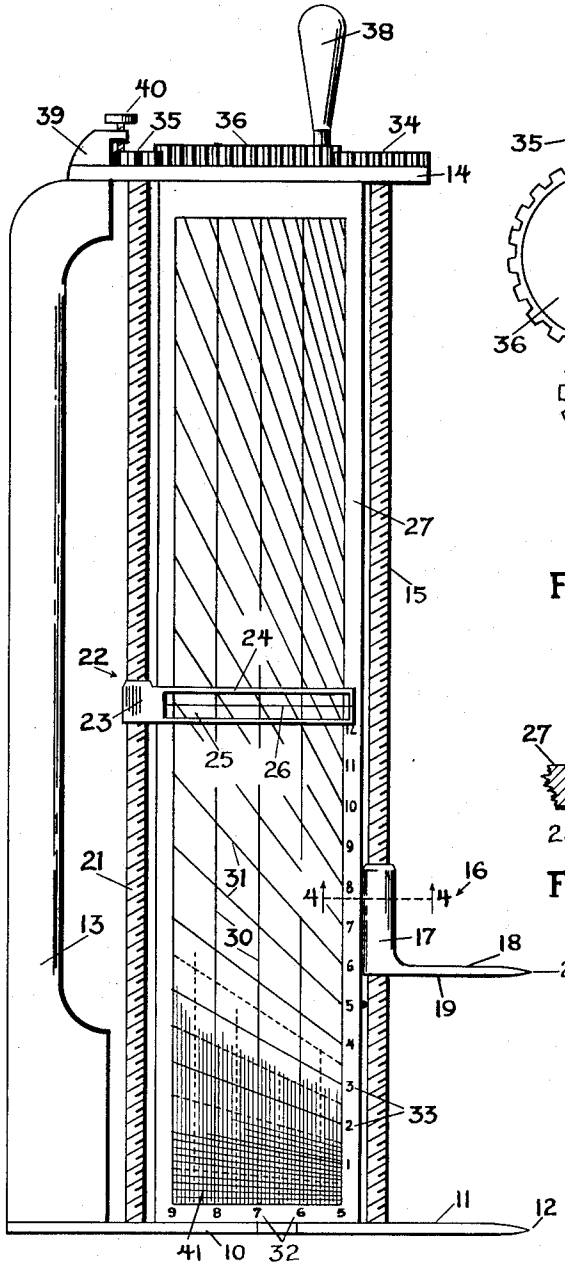


FIG. 1

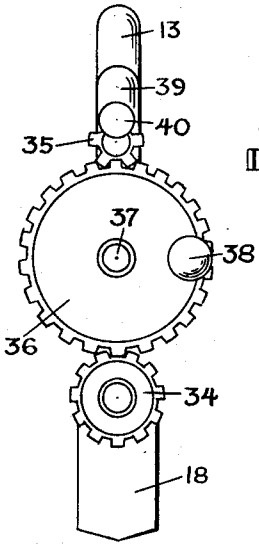


FIG. 3

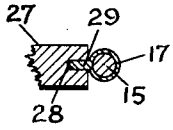


FIG. 4

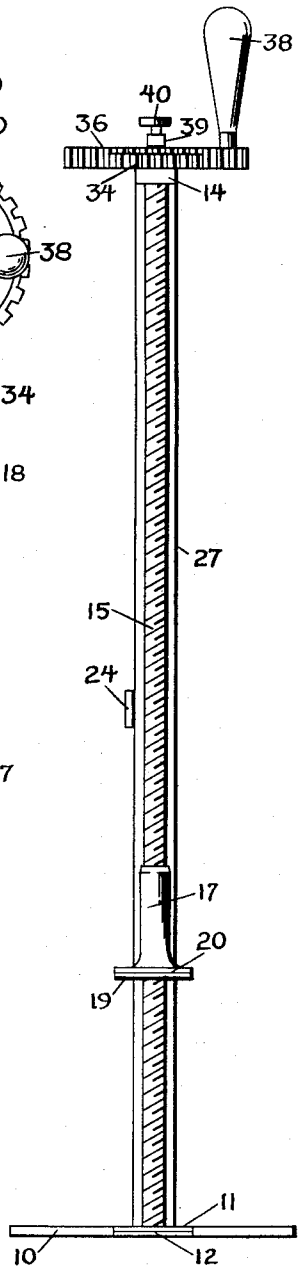


FIG. 2

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SHEET COUNTER

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The present invention relates to a device broadly for measuring thickness, but specifically intended primarily for use as a sheet counter. In many industries, relatively deep stacks of thin sheet material are handled in one way or another and it is desirable to be able to determine the number of sheets in a stack without laboriously handling the individual sheets. In the printing industry, for instance, sheets of paper are continually being handled in stacks, and it is important to know the number of sheets in any given number of stacks. Ordinarily, the sheets in any stack are of closely uniform thickness and that thickness is known. In other instances, the individual sheet thickness may be unknown, in which case the device of the present invention may be used to determine the individual sheet thickness in a stack comprising a known number of sheets.

The primary object of the invention, then, is to provide a device whereby a stack of sheets of uniform thickness may be quickly and accurately counted without individually handling the separate sheets, and whereby the thickness of individual sheets in a stack containing a known number of sheets may be quickly and accurately determined.

A further object of the invention is to provide, in a simple, rugged, inexpensive device, means whereby the above objectives can be accomplished with respect to stacks in which the individual sheet thickness may be any one of a plurality of different values.

Further objects of the invention will appear as the description proceeds.

To the accomplishment of the above and related objects, my invention may be embodied in the form illustrated in the accompanying drawings, attention being called to the fact, however, that the drawings are illustrative only, and that change may be made in the specific construction illustrated and described, so long as the scope of the appended claims is not violated.

FIG. 1 is a side elevation of a sheet counter constructed in accordance with the present invention;

FIG. 2 is a front elevation thereof, as viewed from the right of FIG. 1;

FIG. 3 is a top plan view; and

FIG. 4 is a fragmentary section taken substantially on the line 4—4 of FIG. 1.

Referring more particularly to the drawings, it will be seen that I have shown a base 10 formed to provide an upwardly facing platform 11 which terminates in a sharpened edge 12. Fixed to the rear end of the base 10 is an upright frame element 13, and a cap element 14 is fixedly secured to the upper end of the upright 13.

A screw shaft 15 has its opposite ends journalled respectively in the base 10 and the cap element 14, whereby said shaft is arranged for rotation about its own axis but is restrained against axial movement relative to the base 10. A feeler, indicated generally by the reference numeral 16, comprises a sleeve 17 internally threaded and threadedly engaged on the shaft 15, and a forwardly projecting finger 18 which presents a downwardly facing horizontal surface 19 and which terminates in a sharpened edge 20. The finger 18 preferably will be substantially identical in shape and dimensions with the forwardly projecting portion of the base 10.

A second screw shaft 21 has its opposite ends journalled respectively in the base 10 and the cap element 14 whereby said screw shaft is mounted, in substantial

parallelism with the shaft 15, for rotation about its own axis but is restrained against axial movement relative to the base 10. An indicator generally designated by the reference numeral 22 comprises a sleeve 23 internally threaded and threadedly mounted on the shaft 21, and a frame 24 projecting toward the shaft 15 but somewhat offset from the plane common to the shafts 15 and 21. As shown, the frame 24 is centrally open as at 25 and is traversed by a cross-hair 26. Alternatively, the frame 24 may carry a transparent panel in the opening 25 and said panel may be scored to define the equivalent of the cross-hair 26. Additionally, if desired, such a transparent panel may be formed to act as a magnifying lens. Wherever, in the present specification or the claims appended hereto, reference is made to a "cross-hair" it will be understood that the expression is intended to include such an alternative arrangement.

Fixedly secured between the base 10 and the cap element 14 is a gauge panel 27, and as is clearly illustrated in FIG. 1, the frame 24 of the indicator 22 spans the width of the panel 27. Means must be provided, of course, to restrain the sleeves 17 and 23 against rotational movement about the axes of their respective screw shafts; and as shown that function is accomplished in the manner illustrated in FIG. 4. The adjacent edge of the panel 27 is formed with a longitudinally extending slot 28 in which rides a fin 29 integral with, or suitably secured to, the sleeve 17. The opposite edge of the panel is provided with a similar slot (not shown) which correspondingly receives a similar fin associated with the sleeve 23.

The face of the panel 27 adjacent the indicator frame 24 is calibrated to define vertical indicia 30 and transverse indicia 31. For the purposes of the primary use of the disclosed device, each vertical line 30 represents an individual sheet thickness such as, for instance, 0.005", 0.006", 0.007" etc.; and a scale indicated at 32 preferably appears at the bottom and at the top of the gauge to indicate the value of each such line. Each transverse line 31 represents a thickness or depth corresponding to that of a specified number (such as 100) of sheets of uniform individual thickness; and an appropriate scale 33 is arranged at one or both sides of the gauge. It will be apparent that the indicia 31 will incline upwardly and to the left at a uniformly progressively increasing angle. Preferably, the space between adjacent vertical lines 30 will be divided into ten sections and the space between adjacent transverse lines 31 will likewise be divided into ten equal spaces by lighter lines indicated by the reference numeral 41 in FIG. 1.

At its upper end, and above the cap element 14, the screw shaft 15 carries a gear 34, and a gear 35 is similarly carried on the screw shaft 21. A drive pinion 36 is journalled upon a suitable trunnion 37 carried by the cap element and is preferably provided with an operating handle 38, said pinion 36 meshing with the gears 34 and 35. It will be apparent that, upon operation of the pinion 36 in one direction or the other, the shafts 15 and 21 will be driven in a common direction so that, since the sleeves 13 and 23 cannot rotate with their shafts, said sleeves will be caused to travel in common directions longitudinally of their respective shafts.

In order to facilitate reading of the indicator against the gauge, I prefer so to arrange the parts that the rate of travel of the indicator 22 will exceed that of the feeler 16; and, in the illustrated form of my invention, I accomplish that result by making the pitch diameter of the gear 35 one-half the pitch diameter of the gear 34 so that the shaft 21 will rotate at twice the speed of the shaft 15 in response to rotation of the pinion 36. The same result could be attained, of course, by making the pitch of the thread of the shaft 21 twice the pitch of the thread of the shaft 15. It will be apparent that any de-

sired ratio between the rates of travel of the feeler 16 and the indicator 22 can be achieved by proper selection of the ratios between the gears 34 and 35; and, depending upon the individual sheet thickness of the average stack to be measured, I prefer to select differing ratios. For instance, for sheet thicknesses below 0.005", I prefer to provide a three to one ratio, for individual sheet thicknesses between 0.005" and 0.010" I prefer a two to one ratio and for thicknesses above 0.010" I prefer a one to one ratio.

Now, it will be apparent that the angle of inclination of the indicia lines 31, as well as the rate of progressive increase of that angle, will be dependent not only upon the spacing and the values of the indicia lines 30 but also upon the ratio between the rates of travel of the feeler 16 and the indicator 22. However, for any given set of conditions, the progressive rate of change of the angle of inclination of the indicia 31 will be constant and will be proportional to the ratio between said rates of travel.

It will be seen that the element 13 is so shaped that it may be readily used as a handle for transporting and/or manipulating the illustrated device. In use, the handle 33 will be manipulated to move the feeler 16 away from the platform 11 far enough to permit the insertion of a stack of sheets therebetween. Assuming that the individual sheet thickness of the stack is known, the handle 38 will then be rotated in the opposite direction to lower the surface 19 into solid engagement with the upper surface of the stack whose lower surface is resting on the platform 11. Now, assuming that the sheet thickness of the stack is 0.005", and that the parts of the device have stopped in the position illustrated in FIG. 1, the cross-hair 26 will be read against the vertical line numbered "5" and it will be seen that the instrument indicates that the stack contains 1230 sheets.

If, however, the individual sheet thickness of the stack is, for instance, 0.008", the cross-hair 26 will be read against the vertical line numbered "8," and it will be seen that the instrument indicates that there are 780 sheets in the stack.

In case the stack thickness is greater than the capacity of the instrument, the handle 38 may be manipulated to set the indicator 22 and the feeler 16 at points corresponding to a round number of sheets of the thickness of those comprising the stack and the parts of the counter may be locked in that position. To that end, I provide means manipulable to block the gears 34 and 35 against rotation. In the illustrated embodiment of the invention, that means comprises a bracket 39 fixedly secured to the cap plate 14 and having a portion overlying the gear 35, said bracket adjustably threadedly mounting a screw 40 which may be turned down into braking engagement with said gear 35. With the parts so locked in positions corresponding to a stack depth of, for instance, 1000 sheets, the instrument may be moved toward the stack to insert the edge 12 under the bottom of the stack. The edge 20 of the feeler 16 will simultaneously enter the stack just above the one thousandth sheet. The position of the one thousandth sheet may then be marked and the instrument may be withdrawn from the stack and reentered therein with the edge 12 entering the stack just above the one thousandth sheet, whereupon the edge 20 will enter the stack just above the two thousandth sheet. This operation may be continued until, when the edge 12 enters the stack at a point near the top thereof, the feeler is disposed at some point above the top of the stack. Now, the base extension will be pressed home, the screw 40 will be backed away from the gear 35 and the handle 38 will be manipulated to bring the surface 19 of the feeler 16 firmly into engagement with the top sheet of the stack, whereupon the indicator position can be read to determine the odd number of sheets at the top of the stack.

If the individual sheet thickness of a batch of sheets is not known, a number of sheets may be hand counted and that known number of sheets may then be clamped between the surfaces 11 and 19. By following the transverse line 31 corresponding to the number of sheets in the stack to the point where that line meets the cross-hair 26, a reading of the vertical line underlying the cross-hair at that point may be followed down to the scale 32 which will indicate the thickness of the individual sheets in the stack.

Whether reading individual sheet thickness or the number of sheets in a given stack, if vertical and transverse lines do not meet precisely under the cross-hair 26, visual interpolation will provide a very accurate determination.

I claim as my invention:

1. A device of the character described comprising a gauge panel calibrated to provide uniformly-spaced, laterally-separated upright indicia and to provide transverse indicia uniformly spaced upwardly from each other at one side of said panel but respectively inclining upwardly toward the other side of said panel at a uniformly progressively increasing angle, a screw shaft arranged adjacent one side of said panel for rotation about its own axis but restrained against axial movement relative to said panel, a feeler threadedly mounted on said screw shaft for axial travel therealong and restrained against rotary movement about the axis of said screw shaft, a second screw shaft arranged adjacent the other side of said panel for rotation about its own axis but restrained against axial movement relative to said panel, an indicator threadedly mounted on said second screw shaft for axial travel therealong and restrained against rotary movement about the axis of said second screw shaft, said indicator substantially spanning said calibrated panel, and means for simultaneously rotating said screw shafts, said shafts and said means being so proportioned and designed that, upon such simultaneous rotation of said shafts, said indicator will be caused to travel along the axis of said second screw shaft at a rate bearing a ratio to the rate of travel of said feeler along the axis of said first screw shaft which is constantly proportional to the rate of increase of said angle.

2. In a device of the class described, a base, an upstanding frame element secured to said base, a cap element secured to said frame element, a first screw shaft extending between and journalled from said base and said cap element and restrained against axial movement relative thereto, a second screw shaft extending between and journalled from said base and said cap element substantially in parallelism with said first screw shaft and restrained against axial movement relative thereto, a gauge panel fixedly mounted between said shafts and substantially in the plane common to said shafts, a feeler threadedly mounted on one of said shafts and providing a downwardly facing surface extending substantially horizontally away from the other of said shafts, an indicator threadedly mounted on the other of said shafts and projecting toward said one shaft to traverse a face of said panel, and means for simultaneously rotating said screw shafts, said feeler and said indicator being held against rotation with their associated shafts, said shaft and said means being so constructed and arranged that such rotation of said shafts will cause said indicator to travel along its shaft in a common direction with, but at a rate exceeding that of, the travel of said feeler along its shaft.

3. The device of claim 2 in which said indicator comprises a threaded sleeve mounted on said other shaft and a centrally-transparent frame carried by said sleeve and laterally traversed by a cross-hair.

4. In a device of the class described, a base, an upstanding frame element secured to said base, a cap element secured to said frame element, a first screw shaft extending between and journalled from said base and said cap element, a second screw shaft extending between and journalled from said base and said cap element substantially in parallelism with said first screw shaft, a gauge panel

fixedly mounted between said shafts and substantially in the plane common to said shafts, a feeler threadedly mounted on said first screw shaft and providing a downwardly facing surface remote from said second shaft, an indicator threadedly mounted on said second shaft and projecting toward said first shaft to traverse a face of said panel, and gear means providing an operative connection enforcing rotation of said second shaft at a speed higher than that of said first shaft upon rotation of said first shaft.

5. In a device of the class described, a base, an upstanding frame element secured to said base, a cap element secured to said frame element, a first screw shaft extending between and journalled from said base and said cap element, a first gear carried by said first shaft, a second screw shaft extending between and journalled from said base and said cap element substantially in parallelism with said first screw shaft, a second gear carried by said second shaft, the pitch diameter of said second gear being less than that of said first gear, a gauge panel fixedly mounted between said shafts and substantially in the plane common to said shafts, a feeler threadedly mounted on said first screw shaft and providing a downwardly facing surface remote from said second shaft, an indicator threadedly mounted on said second shaft and projecting toward said first shaft to traverse a face of said panel, and means providing a driving connection between said gears.

6. The device of claim 5 including brake means operatively engageable with one of said gears to hold said shafts temporarily against rotation.

7. The device of claim 5 including bracket means carried by said top plate and overhanging one of said gears, and a screw threadedly mounted in said bracket and selectively actuable to a position blocking said one gear against rotation.

8. In a device of the class described, a base, an upstanding frame element secured to said base, a cap element secured to said frame element, a first screw shaft extending between and journalled from said base and said cap element, a first gear carried by said first shaft, a second screw shaft extending between and journalled from said base and said cap element substantially in parallelism with said first screw shaft, a second gear carried by said second shaft, the pitch diameter of said second gear being less than that of said first gear, a gauge panel fixedly mounted between said shafts and substantially in the plane common to said shafts, a feeler threadedly mounted on said first screw shaft and providing a downwardly facing surface remote from said second shaft, an indicator threadedly mounted on said second shaft and projecting toward said first shaft to traverse a face of said panel, and a pinion journalled on a fixed axis and meshing with both of said gears.

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