

Aug. 13, 1968

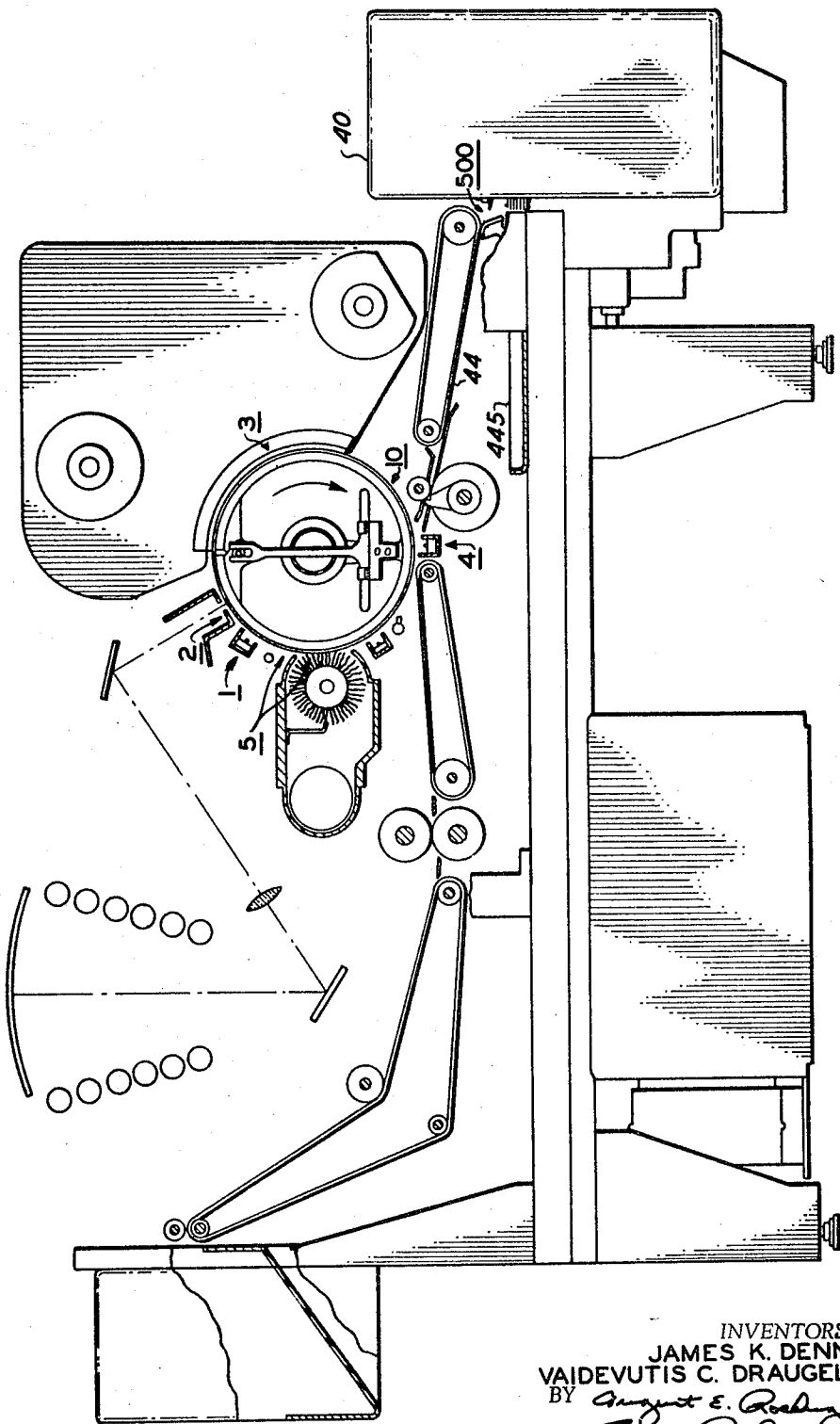
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3,396,965

SENSOR GAUGE

Filed Oct. 11, 1966

4 Sheets-Sheet 1



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4 Sheets-Sheet 2

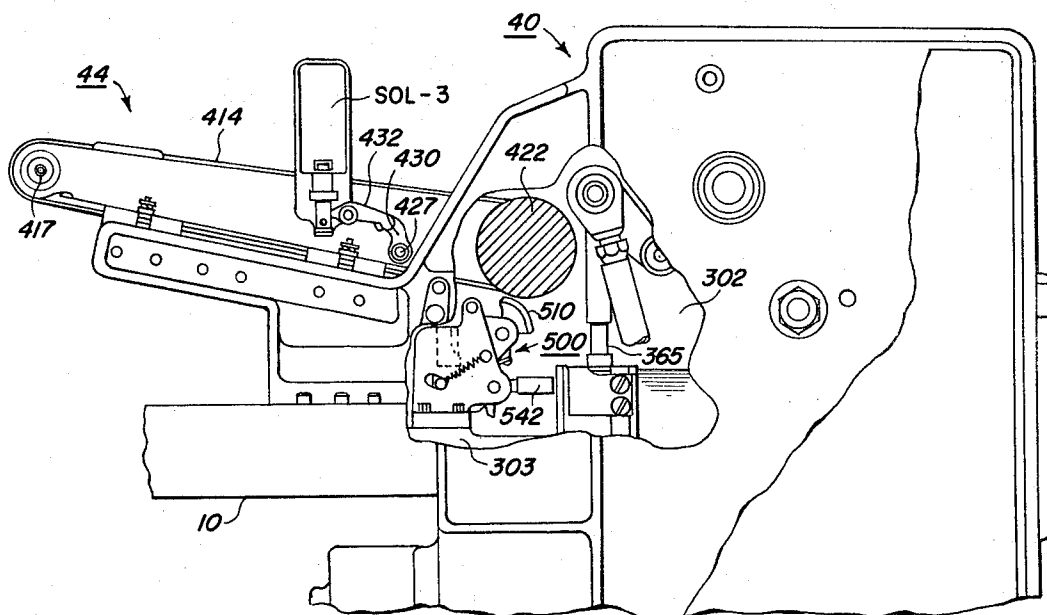


FIG. 2

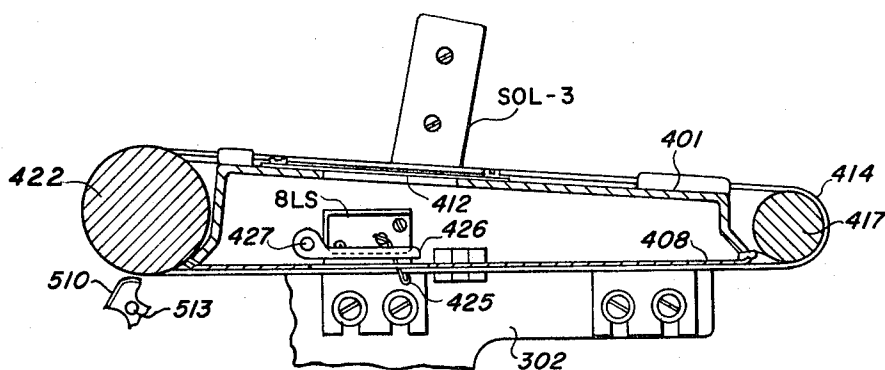


FIG. 4

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4 Sheets-Sheet 4

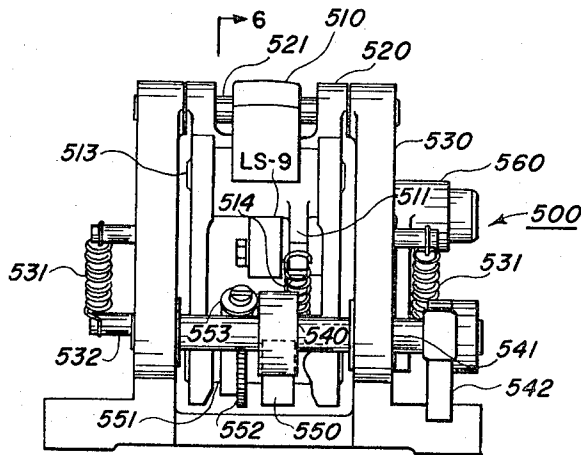


FIG. 5

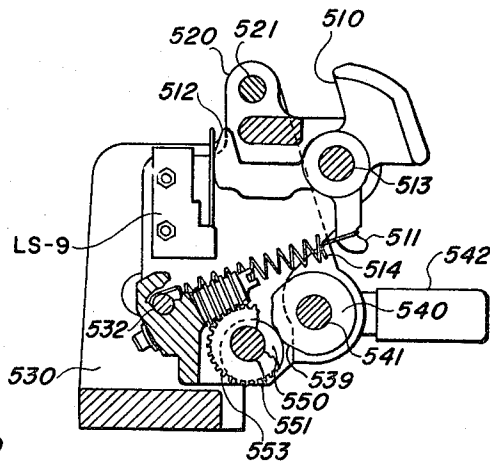


FIG. 6

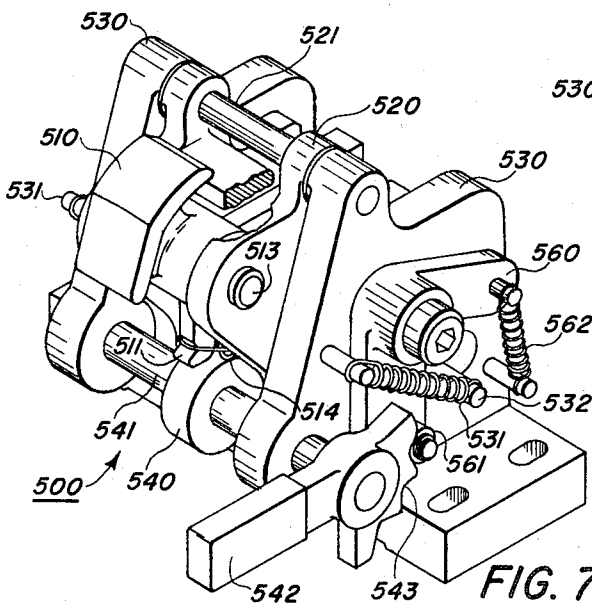


FIG. 7

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3,396,965

SENSOR GAUGE

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Rochester, N.Y., a corporation of New York
Filed Oct. 11, 1966, Ser. No. 585,884
2 Claims. (Cl. 271-64)

ABSTRACT OF THE DISCLOSURE

Apparatus for detecting superposed sheets fed by a sheet transport. The apparatus employs a sensor shoe rotatably supported in a frame member to define a spaced relationship between the sensor shoe and the sheet transport. The frame is rotatably supported in a stationary base member. The rotational position of the frame member relative to the base member may be changed through a cam and eccentric in controlled increments to adjust the aforementioned spaced relationship.

This invention relates to thickness gauges and, in particular, to a thickness gauge adapted to detect the passing of overlaid sheets advanced by a sheet feed mechanism.

More specifically, this invention relates to an improved adjustable superposed sheet detecting device for use in a sheet feed mechanism capable of feeding sheet material of various thicknesses, and adapted to be actuated by the presence of superposed sheets in accordance with the various thicknesses of sheet material fed by the sheet feed mechanism to thereby actuate a sheet diverting mechanism to divert such sheets from the normal path of sheet travel.

In feeding sheet material through a path of movement it is desired in many applications to forward single sheets to a processing station and to prevent the forwarding of those sheets which may be superposed. Various superposed sheet sensors have been developed to insure that only single sheets are fed through a path of movement whereby upon actuation of the superposed sheet sensor a suitable diverting mechanism is actuated to divert those sheets superposed from the normal path of movement. These superposed sheet sensors have heretofore been of the type wherein the sensor is pre-set to a specified tolerance wherein only single sheets within one range of thicknesses are passed through the path of paper movement and those superposed are diverted; or the superposed sheet sensor have been of the type wherein the sensing member is continuously regulated by the machine operator for each thickness of sheet material to sheets advanced by a sheet feed mechanism.

The invention of this application comprises a superposed sheet sensing device having pre-set adjustments for sensing various ranges of sheet material thicknesses fed by a sheet feed mechanism.

It is, therefore, an object of this invention to improve superposed sheet detecting devices for detecting overlaid sheets advanced by a sheet feed mechanism.

Another object of this invention is to improve superposed sheet detecting devices by adapting the sensor for adjustment to predetermined positions for the handling of various thicknesses of sheet material.

These and other objects are attained in accordance with the present invention wherein there is provided an adjustable superposed sheet sensor adapted to be adjusted to predetermined positions for the sensing of various thicknesses of sheet material.

Further objects of this invention, together with additional features contributing thereto and advantages accruing therefrom, will be apparent from the following

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description of one embodiment of the invention when read in conjunction with the accompanying drawings wherein:

FIG. 1 illustrates a superposed sheet detecting device constructed in accordance with the invention, being utilized in a xerographic reproducing apparatus;

FIG. 2 is an enlarged front view of a portion of a sheet feed mechanism and paper transport with parts of the sheet feed mechanism broken away to better illustrate the superposed sheet sensing device;

FIG. 3 is a top view of a paper transport mechanism utilized in cooperation with the superposed sheet sensor;

FIG. 4 is a sectional view of the paper transport mechanism taken along line 4-4 of FIG. 3;

FIG. 5 is an enlarged view of the superposed sheet sensing device;

FIG. 6 is a section view of FIG. 5 taken along line 6-6 and

FIG. 7 is a perspective view of the superposed sheet sensor.

For convenience of illustration, the invention is disclosed with reference to its use in an automatic xerographic reproducing machine but is not intended to be limited thereto. As shown schematically in FIG. 1, the automatic xerographic reproducing apparatus comprises a xerographic plate 10 including a photoconductive layer or light receiving surface on a conductive backing and formed in the shape of the drum, which is mounted on a shaft journaled in a frame to rotate in the direction indicated by the arrow to cause the drum surface sequentially to pass a plurality of xerographic processing stations.

For the purpose of the present disclosure, the several xerographic processing stations in the path of movement of the drum surface may be described functionally, as follows:

A charging station 1 at which a uniform electrostatic charge is deposited on or in the photoconductive layer of the xerographic drum;

An exposure station 2, at which a light or radiation pattern of copy to be reproduced is projected onto the drum surface to dissipate the drum charge in the exposed areas thereof to thereby form a latent electrostatic image of the copy to be reproduced;

A developing station 3, at which a xerographic developing material including toner particles having an electrostatic charge opposite to that of the electrostatic latent image are cascaded over the drum surface, whereby the toner particles adhere to the electrostatic latent image to form a xerographic powder image in the configuration of the copy being reproduced;

A transfer station 4, at which the xerographic powder image is electrostatically transferred from the drum surface to a transfer material or support surface; and

A drum cleaning and discharge station 5, at which the drum surface is brushed to remove residual toner particles remaining thereon after image transfer, and at which the drum surface is exposed to a relatively bright light source to effect substantially complete discharge of any residual electrostatic charge remaining thereon.

It is believed that the foregoing description is sufficient for the purposes of this application to show the general operation of a xerographic reproducing apparatus using a superposed sheet detecting device constructed in accordance with the invention. For further details concerning the specific construction of the xerographic apparatus shown, reference is made to the copending application, Ser. No. 400,363, filed on Sept. 30, 1964, in the name of Robert F. Osborne et al.

Referring now to the subject matter of the invention, sheets separated by the vacuum feet 365 of the sheet feed device 40 are advanced by the vacuum feet into the pinch

between the idler rollers 420 and the belts of paper transport 44. Rollers 420 and idler rollers suitably supported between the frame plates 301 and 302 of the sheet feed device 40. The frame plates 301 and 302 are held in spaced relation by cross bar 303, which also supports the superposed sheet sensing device of this invention, and these plates are secured to the base plate of the xerographic apparatus.

Paper transport 44 includes a transport casing 401 closed on top by cover plate 412 and partially closed on the bottom by vacuum shoe 408 to form a vacuum chamber connected by an adaptor 413 to a vacuum conduit and motor MOT-7 operated vacuum pump, not shown. The upper surface of transport casing 401 is provided with front and rear belt guides 402 and 403, respectively, projecting upward in pairs from the casing surface to guide endless belts 414 which are supported and driven by idler roller and drive shaft 420 and 417, respectively, journaled in bearing assemblies 405 mounted in transport casing extensions 404. Endless belts 414 are driven by chain 419 engaging sprocket 418 fixed to the end of the drive shaft 417, the chain being driven through an appropriate drive system. Transport casing 401 is secured to the frame plates 301 and 302 of the sheet feed mechanism 40 in a position whereby the belts 414 are in cooperating relation with the idler rollers 420 of the sheet feed mechanism to advance the sheet of transfer material delivered thereto by the vacuum feet 365 of the paper feed mechanism 40.

Idler roller 420 is provided with a raised belt support portion 423 for supporting the endless belts 414 and a raised center index portion 422 having a radius equal to or greater than the radius of the belt roller portion plus the maximum thickness of the belt webbing, for a purpose to be hereinafter described. The undercut portions 421, between belt support portions 423, of the idler roller 420 permit the vacuum feet of sheet feed mechanism 40 to advance between the belt support portions to advance sheets into contact with the belts and idler rollers. Multiple parallel rows of apertures 409 are provided in the vacuum shoe 408 in the path of travel of endless belts 414. The belts 414 are provided with suitable apertures 415 whereby as the belts travel over the multiple rows of apertures 409 in the vacuum shoe 408, a sheet will be held to the belts on the underside of the paper transport by the vacuum system and be advanced thereby.

The vacuum shoe 408 is provided with a suitable slot opening 410 for the extension of actuator lever 425 of limit switch 8LS. Elongated finger slots 411 are provided in the vacuum shoe 408 between and parallel to the path of travel of the belt 414 to permit extension of reject fingers 426 into the path of travel of sheets in order to eject the sheets from the normal path of sheet travel.

The reject fingers 426 are secured to reject shaft 427 journaled at its outboard end by bearings 431 positioned in the outboard side of transport casing 401 and in bracket 428, the latter being secured to the inner surface of vacuum shoe 408. The reject fingers are normally biased out of the path of paper travel by torsion spring 429 encircling the reject shaft 427, the spring being secured at one end to the shaft and at its other end to bracket 428.

Movement of the reject fingers 426 into the path of travel of sheets conveyed by endless belts 414 is effected by reject solenoid SOL-3 provided with a lever 432 to contact reject arm 430 secured to the outboard end of reject shaft 427.

To prevent the delivery of overlaid or superposed sheets of transfer material to the xerographic drum, the reject solenoid SOL-3 is energized to rotate the reject fingers 426 into the path of sheet movement through multi-sheet sensing switch 9LS, the closure of which is effected by a superposed sheet sensing device, generally referred to by reference numeral 500.

The superposed sheet sensor 500 is secured on cross bar 303 of the sheet feed mechanism 40 with the gauge

portion or sensor shoe 510 in cooperating relationship with the index portion 422 of idler roller 420 to define a spaced relationship between the shoe and the roller.

In normal operation, single sheets of paper are forwarded by means of the vacuum sheet feeder 40 to the vacuum transport 44, and pass over the index portion 422 of the idler roller 420 adjacent to the sensor shoe 510 of the superposed sheet sensor 500. However, in the event superposed sheets are fed to the transport 44, the superposed sheet sensor 500 will actuate the reject fingers 426 to divert the sheet material from the transport into an abort or reject tray 445 located beneath paper transport 44.

To define the spaced relationship between the sensor shoe 510 and the index portion of the roller 420, the sensor shoe 510 is secured to a shaft 513 journaled for rotation in bifurcated portions of frame 520. The frame 520 is rotatably supported by a shaft 521 secured in upright portions of the base 530 to allow the frame to be rotated relative thereto. Springs 531, secured at one end to studs extending from base 530 and at the other end to a tie rod 532 secured to and extending through frame 520 and extending through openings in base 530, are provided to normally bias sensor frame 520 in a counterclockwise direction, as seen in FIG. 6, into operative engagement with adjusting cam 540. An eccentric 550, secured to shaft 551, rotatably supported in frame 520 and turned by means of a spur gear 552 secured to the shaft co-acting with a worm gear 553 supported in base 530. The eccentric is provided to control the initial positioning of the sensor shoe 510 in relation to the roller 420 to define the initial spaced relationship therebetween. Rotation of the worm gear 553 drives the spur gear 552 to rotate the eccentric 550 to control the position of the sensor frame 520 in relation to the base 530 to thereby define the spaced relationship between the sensor shoe 510 and the index portion of the idler roller 420.

The adjusting cam 540 is secured to shaft 541, rotatably supported in the upturned portions of base 530. Shaft 541 extends through the base 530 and has secured to the extended portion, a lever 542 for rotating the adjusting cam relative to the eccentric 550 thereby changing the relative rotational position of the sensor frame 520 with respect to the base 530 to vary the space defined by the sensor shoe and roller 420.

As shown in FIG. 6, adjusting cam 540 is formed with a plurality of stepped portions 539 adapted to co-act with eccentric 550 to readily change the spaced relationship between the sensor shoe 510 and the index portion 422 of roller 420. By operation of lever 542, the stepped portions 539 of adjusting cam 540, which contact eccentric 550, co-act therewith to change the aforementioned spaced relationship of the sensor shoe and index portion in accordance with a predetermined spacing defined by the magnitude of the rise of the stepped portions 539. Detents 543 in lever 542 are positioned in accordance with the stepped portions of the adjusting cam to co-act with roller 561 of bell crank 560, rotatably mounted on one side of base 530, to maintain the adjusting cam in the desired position. The roller is rotatably mounted on a stud secured to one arm of bell crank 560 and provides a force through the center of shaft 541 by means of the spring 562 secured at one end to base 530 and at its other end to a stud on the bell crank to bias the roller into contact with the detents.

In the event superposed sheets are passed between the sensor shoe 510 and the index portion 422, the sensor shoe, normally biased against the sensor frame 520 by means of a spring 514 secured at one end to tie rod 532 and at its other end to a spring arm 511 of the sensor shoe, is rotated in a counterclockwise direction as seen in FIG. 6 to open normally closed limit switch LS-9. The opening of limit switch LS-9 secured to sensor frame 520 in cooperative relation with actuator arm 512 of the sensor shoe, de-actuates reject solenoid SOL-3 to rotate

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the reject fingers 426 into interference relationship with the path of sheet material movement along transport 44 to divert the superposed sheets into the tray 445. After the misfed sheets have passed between the sensor shoe 510 and index portion 422, the sensor shoe rotates to its original position with actuator arm 512 closing limit switch LS-9 to actuate the solenoid SOL-3 returning the reject fingers 426 to their initial position within transport 44.

While there has been shown and described one embodiment of the invention, it is obvious that changes in form could be made without departing from the invention; and it is intended, therefore, that the invention be not limited to the exact form shown and described nor to anything less than the whole of the invention as set forth in the appended claims.

What is claimed is:

1. An adjustable thickness gauge for use in sensing the thickness of material passing between the gauge and a reference member including

gauge means adapted to be positioned adjacent a reference member to define a spaced relationship between said gauge means and said reference means, said gauge means supported by a frame member rotatably supported by a base member,

a limit switch positioned in cooperative relationship with said gauge means to be actuated thereby, an eccentric rotatably supported by said frame member, and

an adjusting cam having stepped portions and being rotatably supported by said base member in a cooperative relation with said eccentric to vary the spaced relationship defined between said gauge means

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and said reference member in relation to said stepped portions.

2. An adjustable thickness gauge for use in sensing the thickness of material passing between the gauge and a reference member including

gauge means adapted to be positioned adjacent a reference member to define a spaced relationship between said gauge means and said reference member, said gauge means supported by a frame member rotatably supported by a base member,

a limit switch positioned in cooperative relationship with said gauge means to be actuated thereby,

a first adjustment surface on said frame member,

a second adjustment surface on said base member, resilient means to urge said second adjustment surface into contact with said first adjustment surface to retain the angular orientation between said frame member and said base member fixed, and

means to adjust the area of contact between said first and second adjustment surfaces to thereby vary the angular orientation between said frame member and said base member and resultantly vary the spaced relationship between said gauge means and said reference member.

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