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MAGNETIC CALIPERING DEVICE

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Fig. 1.

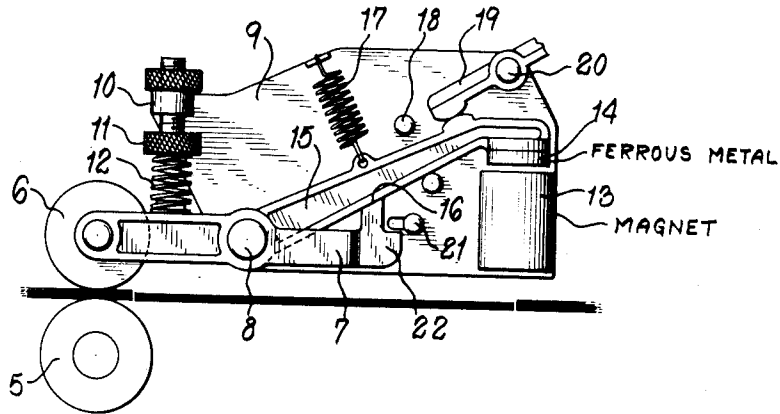
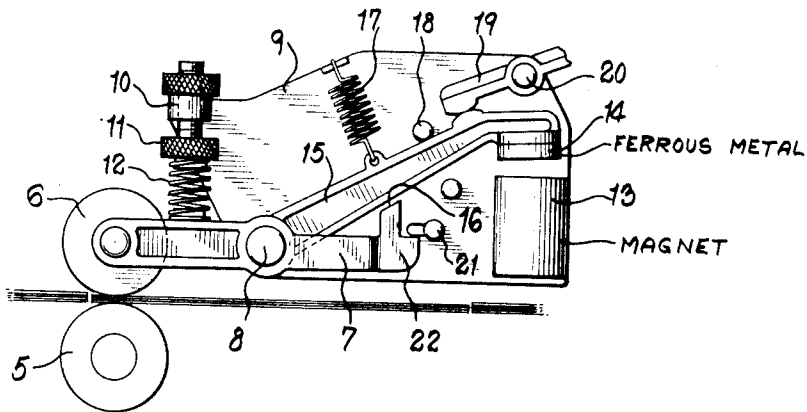


Fig. 2.



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2,697,281

MAGNETIC CALIPERING DEVICE

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Original application April 3, 1950, Serial No. 153,520, now Patent No. 2,637,115, dated May 5, 1953. Divided and this application July 29, 1952, Serial No. 301,583

12 Claims. (Cl. 33—143)

This invention relates to calipers and refers more particularly to magnetic calipering devices designed to detect an abnormal condition capable of causing movement of a feeler, as for instance, an insufficient thickness of sheet material being fed to a machine.

This application is a division of my copending application Serial No. 153,520, filed April 3, 1950, now Patent No. 2,637,115 for "Magnetic Calipering Device."

It is recognized that the broad concept of utilizing a magnet in connection with a sheet caliper or excess thickness detector is old. However, as far as known, magnets have not been used in the past to trigger a relatively strong force capable of producing a considerably magnified motion upon detection of a decrease in the thickness of sheet material being calipered, or upon the absence of a sheet at a time when and at a place where a sheet should normally be present.

The purpose of this invention thus is to provide a sheet caliper or calipering device wherein the magnetic force of a magnet couple normally overpowers the force normally overpowers the force of a spring or other motion producing device to restrain the same and thereby prevent actuation of the mechanism which is operated by the spring or other motion producing device as long as a predetermined normal condition exists under a feeler, but to effect release of the force of the spring or other motion producing device upon a reduction in the magnetic force brought about by a separation of the elements of the magnet couple resulting from a decrease in the thickness of a sheet being calipered, or the absence of a sheet in calipering position.

Hence, it is possible with this invention to not only magnify the slight motion produced by response of a feeler to an abnormal condition to be detected, but to also release a strong force with a snap action.

With the above and other objects in view, which will appear as the description proceeds, this invention resides in the novel construction, combination and arrangement of parts substantially as hereinafter described and more particularly defined by the appended claims, it being understood that such changes in the precise embodiment of the hereindisclosed invention may be made as come within the scope of the claims.

The accompanying drawing illustrates one example of the physical embodiment of the invention constructed according to the best mode so far devised for the practical application of the principles thereof, and in which:

Figure 1 is a side view of a sheet calipering device embodying the principles of this invention; and

Figure 2 is a view similar to Figure 1 but showing the mechanism tripped in response to a decrease in the thickness of the material being calipered.

Referring now to the drawings, there is shown, by way of example, one form of sheet calipering device constructed and operated in accordance with the present invention, which is well adapted for use on signature gathering machines designed to feed individual signatures and groups of signatures to a signature stitching machine, as well as on sheet feeding machines designed to feed sheets in lapped relation or singly one after another in spaced relation to printing presses and the like, said calipering device acting to trip control instrumentalities of said machines upon the detection of a decrease in the thickness of a signature or group of signatures, or of a stream of underlapped sheets, and upon the absence of a signature or sheet at calipering position when one should be present.

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As herein shown, the sheet calipering device comprises cooperating lower and upper feeler rollers 5 and 6, respectively, between which the above mentioned sheet material is advanced by a suitable conveyor (not shown) forming part of the machine upon which the calipering device is used and with which said device is associated. The lower feeler roller 5 is mounted for rotation about a fixed axis. The upper feeler roller 6 is journaled on a medially pivoted lever 7 which rocks upon its fulcrum 8 in response to changes in the thickness of the sheet material passing between and engaged by the rollers 5 and 6. The fulcrum 8 about which the lever 7 rocks is carried by a bracket 9 which constitutes a fixed part of the mechanism, or at least in operation is fixed with respect to the axis of the feeler roller 5.

The bracket 9 provides an anchor 10 for an adjustable spring stop 11 against which a spring 12 reacts to urge the lever 7 counter-clockwise about its fulcrum 8. The force of the spring 12 is opposed by the magnetic attraction between the elements of a magnet couple which consists of a permanent magnet 13 fixed to the bracket 9 and an armature element 14 which is fixed to the outer end of a second lever 15. This lever 15 is arranged to swing about the fulcrum 8, and a unidirectional driving connection is established between the two levers 7 and 15 by an abutment 16 on the lever 7 bearing against the underside of the lever 15. Thus, the magnetic attraction between the elements 13, 14 of the magnet couple tends to separate the feeler rollers 5 and 6 in opposition to the spring 12. In operation, the tension of the spring 12 is adjusted so that it is sufficient to move the upper feeler roller 6 toward the lower feeler roller 5 against the magnetic attraction of the magnet couple 13, 14.

Upon detection of a decrease in the thickness of the sheet material passing between the feeler rollers 5 and 6, as for instance where less than a predetermined number of sheets in a signature or in a stream of lapped sheets is detected, the resulting slight rocking movement of the lever 7 in a counter-clockwise direction about its fulcrum 8 by the spring 12 separates the elements 13, 14 of the magnet couple beyond the critical spacing for which the device is set, whereupon the magnetic attraction between the elements of the magnet couple is reduced and another spring 17 acting only upon the lever 15 overpowers the magnet and snaps the lever 15 upwardly against a fixed stop 18. This snap movement of the lever 15, which is considerably greater than the slight movement imparted to the feeler roller 6 as a result of the detection of a decrease in the thickness of the sheet material, may be utilized to actuate any desired control instrumentalities, and in the illustrated embodiment rocks a control lever 19 fixed to a rock shaft 20.

When the signatures or sheets are advanced between the feeler rollers 5 and 6 in substantially edge-to-edge relation, the feeler roller 6 will ride off a preceding signature or sheet and onto a succeeding one, and any decrease in the thickness of a signature or sheet, or break in the procession of the signatures or sheets due to the absence of a signature or sheet, will result in actuation of the control lever 19, as hereinbefore described. When a stream of lapped sheets of a predetermined number is advanced between the feeler rollers 5 and 6, a decrease in the thickness of said stream due to the failure of the sheet feeder to feed a sheet and the absence of said sheet in the stream, will likewise result in actuation of the control lever 19.

A manually movable inhibitor or lock-out stop 21 is provided to lock the movable feeler roller 6 against spring produced downward movement when said stop is moved into operative position over a shoulder 22 on the lever 7. Such locking of the feeler roller 6 inactivates the mechanism and is desirable during periods when the machine upon which the device is used is being prepared for a production run.

The lock-out stop 21 may be mechanically operated in timed relation with the passage of the sheet material between the feeler rollers 5 and 6 in a manner well understood in the art. This timing of the operation of the movable feeler roller 6 is desirable when the sheet material is advanced between the feeler rollers 5 and 6 in timed relation and spaced from one another, and when a stream of lapped sheets is acted upon.

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From the foregoing description taken in connection with the accompanying drawing it will be readily apparent to those skilled in this art that the present invention provides a sheet caliper device which possesses many advantages over sheet caliper devices heretofore available.

What is claimed is:

1. In a magnetic caliper of the character described, a pair of cooperating feeler members between which material to be calipered is passed, said feeler members directly engaging opposite faces of said material, and one of said members being movable toward and away from the other, support means for said feeler members, biasing means operably connected with the movable feeler member for continuously urging the same toward the other feeler member, a magnet couple comprising a magnetized element and an armature element magnetically attracted toward one another, one of said elements being fixed and the other of said elements being operably connected with the movable feeler member and so positioned with respect to the fixed element that the magnetic attraction between said elements tends to move the movable feeler member in a direction away from the other feeler member, said biasing means having a strength sufficient to move the movable feeler member in opposition to the magnetic attraction of the magnet couple, and acting to move the movable element of the magnet couple through the movable feeler member an initial distance away from the fixed element so as to reduce the effective force of magnetic attraction of the magnet couple upon movement of the movable feeler member toward the other feeler member beyond a predetermined position with respect to said other feeler member, and other biasing means operably connected with the movable element of the magnet couple for continuously urging said element away from the fixed element, said other biasing means having the strength thereof increased by the magnetic attraction of the movable element toward the fixed element and being normally constrained by the force of magnetic attraction of the magnet couple from moving the movable element away from the fixed element, movement of the movable element by the movable feeler member said initial distance rendering said other biasing means effective to overpower the reduced force of magnetic attraction of the magnet couple and impart an additional movement to the movable element away from the fixed element.

2. Apparatus as defined in claim 1, comprising control means responsive to the additional movement of the movable element of the magnet couple away from the fixed element.

3. Apparatus as defined in claim 1 wherein the feeler members each comprises a roller.

4. Apparatus as defined in claim 1 wherein the magnetized element is fixed and the armature element is movable.

5. Apparatus as defined in claim 1 wherein the magnetized element comprises a permanent magnet.

6. Apparatus as defined in claim 1 wherein the first- and second-named biasing means each comprises a spring.

7. Apparatus as defined in claim 1, comprising operable means for releasably locking the movable feeler member against movement toward the other feeler member by the biasing means connected therewith.

8. In a magnetic caliper of the character described, a magnet couple comprising a magnetized element and an armature element magnetically attracted toward one another, one of said elements being movable toward and away from the other, support means for said elements, a spring operably connected with the movable element for continuously urging said movable element in a direction to separate the elements of the magnet couple, said elements being held by the force of magnetic attraction against spring produced separation as long as the spacing between the same is less than a critical distance at which the spring overpowers the force of magnetic attraction, a pair of cooperating feeler members between which material to be calipered is passed, said feeler members directly engaging opposite faces of said material, and one of said feeler members being movable toward and away from the other feeler member, support means for said feeler members, means operably connecting the movable feeler member with the movable element of the magnet couple, a spring operably connected with the movable feeler member for continuously

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urging the same toward the other feeler member, said last-named spring having a force sufficient to oppose the magnetic attraction of the magnet couple and to effect movement of the movable element of said magnet couple at least said critical distance upon movement of the movable feeler member toward the other feeler member beyond a predetermined position with respect to said other feeler member, movement of the movable element said critical distance resulting in a reduction of the force of magnetic attraction of the magnet couple sufficiently to enable the first-named spring to operate and effect further separation of the elements of the magnet couple thereby, and control means actuated in response to said further separation of the elements of the magnet couple.

9. Apparatus as defined in claim 8, comprising operable means for releasably locking the movable feeler member against movement by the second-named spring toward the other feeler member.

10. In a magnetic caliper of the character described, a pair of cooperating feeler rollers between which material to be calipered is passed, said feeler rollers directly engaging opposite faces of said material, and one of said feeler rollers being mounted in a fixed position, a pivoted lever mounting the other of said feeler rollers, a second lever mounted for pivotal movement about the axis of said first-named lever, an abutment on one of said levers and engaging the other of said levers, a magnet couple comprising a magnetized element and an armature element magnetically attracted toward one another, one of said elements being mounted on said second lever and the other of said elements being mounted in a fixed position, said elements being so arranged that the magnetic attraction between the same tends to move the first-named lever and the feeler roller thereon away from the fixed feeler roller, a spring operably connected with said second lever for continuously urging the same in a direction to separate the elements of the magnet couple, a control member positioned for actuation by said second lever, said elements of the magnet couple being held by the force of magnetic attraction against spring produced separation as long as the spacing between the same is less than a critical distance at which the spring overpowers the force of magnetic attraction and swings said second lever and in turn actuates said control member, and a spring operably connected with said first-named lever for continuously urging the same and the feeler roller thereon toward the fixed feeler roller in opposition to the magnetic attraction of the magnet couple and for moving said second lever and the element thereon at least said critical distance whenever the spacing between the feeler rollers is less than a predetermined distance.

11. Apparatus as defined in claim 10, comprising a lock-out device movable into engagement with one of the levers for preventing movement of the movable feeler roller toward the fixed feeler roller.

12. In a caliper of the character described, an operable control member, a magnet couple consisting of a magnetized element and a companion armature element magnetically attracted toward one another, one of said elements being fixed and the other being movable toward and away from the fixed element and arranged to engage and operate said control member, the movable element being adapted to normally occupy a first position close to but spaced from the fixed element in which position the force of magnetic attraction between said elements is of increased intensity and to occupy a second position spaced farther away from the fixed element in which position said force of magnetic attraction is of reduced intensity, a spring acting upon the movable element and at all times urging the same away from the fixed element, said spring having a tension insufficient to overpower the increased force of magnetic attraction with the movable element occupying said normal first position but sufficient to overpower the reduced force of magnetic attraction with the movable element occupying said second position and move said movable element from said latter position farther away from the fixed element and thereby operate said control means, a pair of cooperating feeler members between which material to be calipered is passed, said feeler members directly engaging opposite faces of said material, one of said feeler members being fixed, the other of said feeler members being movable toward and away from the fixed member and engaged with the movable element of the magnet

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couple whereby movement of said movable feeler member toward the fixed feeler member beyond a predetermined position with respect to said fixed feeler member will impart movement to said movable element from said first position to at least said second position, and a spring acting upon the movable feeler member and at all times urging the same toward the fixed feeler member, said last-named spring having a tension sufficient to move the movable feeler member and the movable element of the magnet couple toward the fixed feeler member and away from the fixed element, respectively, in opposition to

the increased force of magnetic attraction of the magnet couple.

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