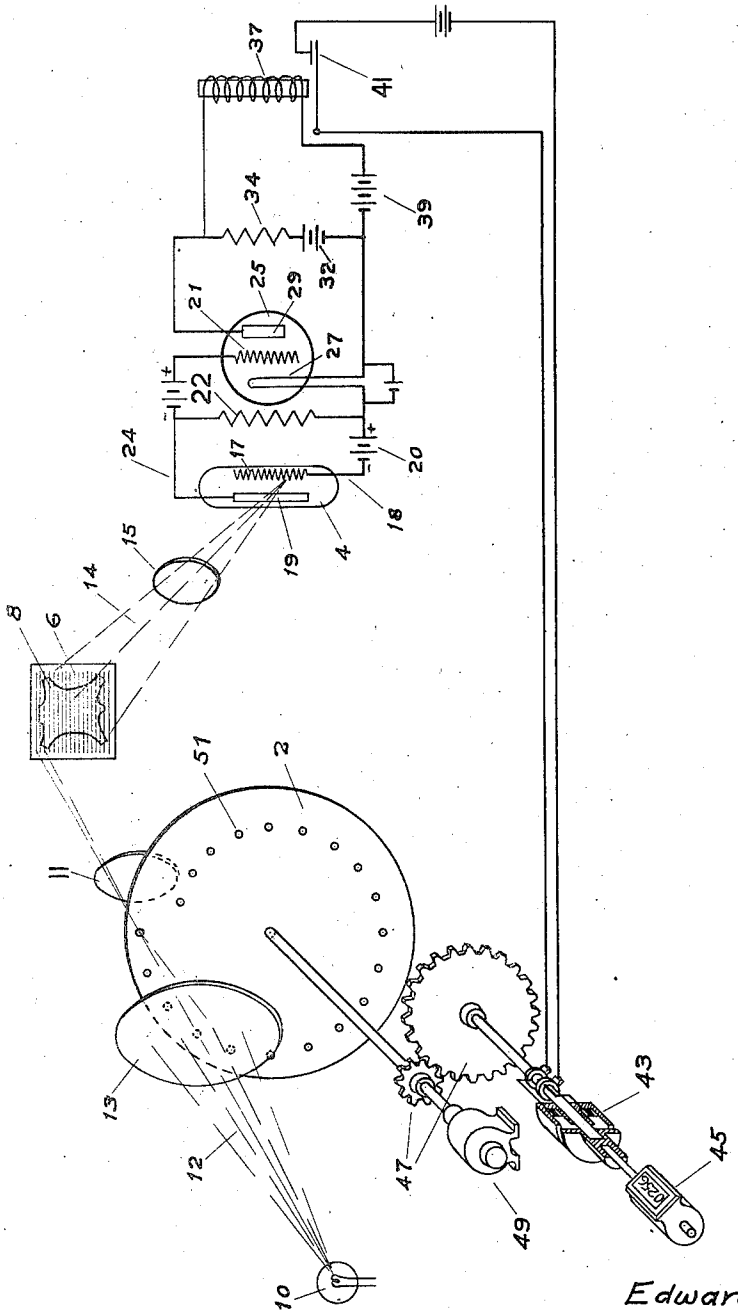
Dec. 19, 1939. E. L. BOWLES 2,184,156

AREA MEASURING APPARATUS AND METHOD

Filed May 6, 1931



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Patented Dec. 19, 1939 2,184,156

UNITED STATES PATENT OFFICE

2,184,156

AREA MEASURING APPARATUS AND METHOD

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Application May 6, 1931, Serial No. 535,405

26 Claims. (Cl. 33—123)

The present invention relates to the art of measuring areas, and more particularly to the areas of hides.

The invention will be explained in connection with the accompanying drawing, the single figure of which is a diagrammatic view illustrating the principle of the invention.

A scanning disk 2 is interposed between a reflecting support or background 6 for a hide 8, or other article the area of which it is desired to measure, and a lamp or other source 10 of preferably constant illumination. The rays 12 of light from the source 10 are caused to pass through a lens or lens system 13 and, after passing through the scanning disk 2, and through a lens or lens system 11, strike the hide 8 and become absorbed, or strike the uncovered portion of the background 6 and are reflected as at 14. The rays 14 reflected from the unobstructed portion of the background 6 are concentrated by a condensing lens 15 and strike the electron-emitting cathode 17 of a light-sensitive cell 4.

The rays striking the cell 4 may be caused to effect the indication of the area of the hide through the combination with the cell 4 of an amplifier 25, a relay contact member 41, a clutch 43 and a register or counter 45.

During the scanning process the area-registering instrument 45 will integrate the area of the hide since it will operate only when the reflected light 14 is reduced by the presence of some elemental area of the hide. When the incident light 12 strikes the background, which may deliberately be made a much better reflector, the integrating mechanism 45 is momentarily disconnected during the period of incidence. The indication of the calibrated registering mechanism will be a direct measure of the area of the hide.

The support 6 and the hide 8 are shown vertically disposed, in order that the grease from the hide shall fall to the floor, and not upon the support, thus preventing dirt or foreign matter of substantially different reflection properties from collecting on the support 6.

The anode 19 of the photo-electric cell 4 is connected by a conductor 24 with the grid 21 of the amplifier tube 25, which is provided also with the usual filament 27 and plate 29. The cathode 17 of the cell 4 is connected by a conductor 18, in series with a battery 20, with the filament or cathode 27. A resistor 22 is connected between the filament 27 and the grid 21. A resistor 34 with resistance of large value compared with the resistance of the relay coil 37 is disposed in the output circuit of the amplifier tube 25, in series with the plate battery 32, so that substantially all of any change of plate current will pass through the relay coil 37. The coil 37 is connected, in series with a battery 39, across the resistor 34 for the purpose of balancing the steady plate current of the tube 25 out of the coil 37 and operates the relay contact member 41 for controlling the magnetic clutch 43. The clutch, in turn, operates the calibrated counter 45 that may be driven, as by gearing 47, from the same motor 49 that drives the scanning disk 2. It is assumed, for simplicity, that the motor is operated at constant speed.

Assuming, by way of example, the area of illumination of the projection on the background 6 of each aperture 51 of the scanning disk to have a unit width, and the average distance of the horizontal projection between successive slots, at the time that they occupy their uppermost position, in front of the lens 13, as d units, then the projection on the background 6 of each aperture 51 will travel d units at each excursion of an aperture across the field of light rays in front of the lens 13. A unit bundle of rays will thus move pivotally from the lamp 10 across the support 6 a distance d units, and thus scan a strip $1 \times d$ units in area. The background 6, then, will be scanned in terms of element strips d units in area, one such strip for each aperture of the scanning disk 2. It is of course understood that there are many methods of scanning an image and the one selected is only for illustration. The photo-electric cell 4 will, therefore, be subjected substantially wholly to light passing through each aperture and reflected from the background 6. There will be a negligible amount of reflected light from the hide. The photo-cell as shown may be assumed to be so connected that with appreciable light incident upon its cathode 17, corresponding to no (hide) obstruction on the background 6, there will be no appreciable current in relay coil 37. Thus, the relay contact member 41 would remain open and the magnetic clutch 43 would not engage the register 45 with the motor and scanning disk. If there were no hide or other relatively non-reflecting surface 8 on the reflecting background 6, the object-free area 6 in being scanned would cause the relay contacts 41 to remain open and thus quite properly no area would be registered. Suppose, however, that a hide 8 is in position; then, as the scanning-area light moves across the background 6, the relay contacts 41 will remain open until the light

area strikes the hide surface. When it strikes this relatively non-reflecting surface the photo-cell current will decrease, increasing the voltage on the grid 21 positively, thus increasing the plate current and increasing the current in the relay winding 37. This will cause the contact member 41 to close, thus engaging the register 45 through the relay energization of the magnetic clutch 43. During the traverse of an individual scanning aperture, the magnetic clutch will engage the register so long as there is a relatively non-reflecting area in the path of this corresponding scanning light spot. For example, if the entire distance *d* of a single traverse is occupied by part of a hide, the calibrated register 45 will register *d* units of area. If the hide only intercepts a portion of this elemental traversed path, the clutch will engage the register only when this hide area is present. Thus, in a complete scanning, the register will have recorded the area of the hide in a very accurate manner, having measured or integrated it in terms of small increments. The integration, thus effected in terms of small, finite elements, yields a total summation for the area of much greater accuracy than would be obtained were the photo-electric cell 4 to be subjected to the action of the reflection of radiant energy from the complete area 8 in one operation.

It should be emphasized that a feature of the present invention depends on differences in the light reflected from the background 6 and the surface 8 to be measured held against this background. The relay contact member 41 is either open or closed, and the magnetic clutch is either connected or disconnected, depending on whether the light is reflected from the background 6 or from the surface 8 to be measured. The difference in intensity of the light reflected from the background and that reflected from the area 8 to be measured is such that the cell 4 will cause the relay contacts 41 to be actuated only when a relatively small amount of light strikes it, that is, when the surface 8 to be measured is the source of the reflected light. This implies, of course, that the light reflected from the area 8 to be measured is relatively small compared to the light reflected from the background 6. In fact, the difference in intensity of the reflected light must be such that, when it comes from the background 6, the relay contact member 41 opens, and when it comes from the area to be measured the relay contact member 41 closes.

The photo-electric cell may be subjected to any desired color of light rays, as by use of a light filter (not shown) or it may be used with artificial light or daylight.

Modifications will readily occur to persons skilled in the art, and all such are considered to fall within the spirit and scope of the present invention, as defined in the appended claims.

What is claimed is:

1. Area-measuring apparatus having, in combination, a source of rays, a background against which is held the article the area of which is to be measured, means for subjecting the article and the background to the rays from the source, means for causing rays from continuously successive portions of the article to produce effects, means for adding the said effects, and means for rendering negligible the effect produced by the background.

2. Area-measuring apparatus having, in combination, a source of light, a substantially reflecting background against which is held a substantially nonreflecting article the area of which is to be measured, a light-sensitive element, means for directing light along a path from the source to the background and the article and from the background and the article to the light-sensitive element, a scanning disk interposed in the said path, and means for integrating the effects produced upon the light-sensitive element to measure the area of the article.

3. Area-measuring apparatus having, in combination, a source of light, a light-sensitive element, means for directing light along a path from the source to the article the area of which is to be measured and from the article to the light-sensitive element, movable scanning means interposed in the path, means for moving the scanning means to subject successive portions of the article continuously to the action of rays from the source, and means for integrating the effects produced by the said light upon the light-sensitive element to measure the area of the article.

4. Area-measuring apparatus having, in combination, a source of light, a light-sensitive element, means for directing light along a path from the source to the article the area of which is to be measured and from the article to the light-sensitive element, movable scanning means interposed in the path, means for moving the scanning means to subject successive portions of the article continuously to the action of rays from the source, a counter, and means controlled by the light-sensitive element for actuating the counter to measure the area of the article.

5. Area-measuring apparatus having, in combination, means for supporting an article the area of which is to be measured, a source of light, a light-sensitive element, means for directing light along a path from the source to the article the area of which is to be measured and from the article to the light-sensitve element, movable scanning means interposed in the said path, means for moving the scanning means to subject successive portions of the article continuously to the action of rays from the source, means for connecting the light-sensitive element in an electric circuit, and means controlled by the circuit for measuring the area of the article.

6. A method of measuring a substantially continuous area that comprises subjecting continuously successive portions of the continuous area to the action of rays until the whole area has been subjected to the rays, causing the rays from the continuously successive portions of the area to produce like effects and adding the like effects to measure the area.

7. A method of measuring a substantially continuous area that comprises subjecting successive portions of the continuous area to a unit bundle of rays until the whole area has been subjected to the rays, causing the continuously successive portions of the area so subjected to the rays to produce equal effects, and adding the effects so produced to measure the area.

8. Area-measuring apparatus having, in combination, a source of rays, means for subjecting the area to be measured to the rays from the source, means for causing the rays from continuously successive portions of the area to produce effects, and means for adding the effects so produced to measure the area.

9. Area-measuring apparatus having, in combination, a source of rays, means for causing a unit bundle of rays from the source to travel over continuously successive portions of the area until

the whole area has been subjected to the rays, means controlled by the continuously successive portions of the area so subjected to the rays to produce effects, and means for adding the effects so produced to measure the area.

10. Area-measuring apparatus having, in combination, a source of light, a light-sensitive element, means for directing light along a path from the source to the article the area of which is to be measured, and from the article to the light-sensitive element, scanning means interposed in the said path, a motor for driving the scanning means, means for operating the motor at constant speed, means for connecting the light-sensitive element in an electric circuit, means for obtaining the area of the article, and a clutch controlled by the circuit for connecting the area obtaining means to the motor.

11. A method of measuring a substantially continuous area that comprises subjecting the continuous area to the action of rays, causing the rays from continuously successive portions of the area to produce effects, and adding the effects so produced to measure the area of the article.

12. Apparatus for measuring an area having, in combination, means for subjecting continuously successive portions of the area to the action of rays until the whole area has been subjected to the rays, means for causing the rays from the continuously successive portions of the area to produce like effects, and means for adding the like effects to measure the said area.

13. Apparatus for measuring an area having, in combination, means for subjecting continuously successive portions of the area to a unit bundle of rays until the whole area has been subjected to the rays, means for causing the continuously successive portions of the area so subjected to the rays to produce equal effects, and means for adding the effects so produced to measure the area.

14. Area-measuring apparatus having, in combination, a source of rays, a ray-sensitive element, scanning means, means for causing the scanning means to subject successive portions of the area to be measured continuously to the action of the rays from the source, and means for integrating the effects produced by the scanning means upon the light-sensitive element to measure the said area.

15. A method of measuring the area of an article having a substantial and continuous area that comprises holding the article against a background, subjecting the article and the background to the action of rays, causing the rays from continuously successive portions of the continuous area of the article and the background to produce effects, adding the said effects, and rendering negligible the effect of the background upon the sum.

16. The herein described method comprising the steps of moving a beam of light at a constant speed across a surface to be examined and thereby scanning a strip of known width across said surface, repeating said scanning operation on successive strips of said surface until substantially the entire area to be examined has been scanned, and causing the movement of said beam across portions of said area having given characteristics to control a counting operation in accordance with said characteristics.

17. That improvement in methods of measuring the area of a surface which consists in moving a beam of light at a predetermined speed across the surface to be measured and thereby scanning a strip of known width across said surface, repeating said scanning operation on successive strips of said surface until substantially the entire area to be measured has been scanned, and causing the movement of said beam on and off said surface to control a counting operation.

18. A method of measuring the area of a relatively non-reflecting surface that comprises superposing the surface over a relatively reflecting background, scanning incremental strips of the surface by causing light beams of predetermined width to travel over the background and the superposed surface, and causing the light beams to control area-integrating operations only when they travel over the said strips, as contrasted to the background.

19. A method of measuring the area of a surface that comprises moving a scanning beam of radiant energy across the surface along incremental strips of the surface to scan the said incremental strips, causing the movement of the radiant energy on and off the surface to control a counting operation, thereby to determine the lengths of the scanned strips, and integrating the said lengths in terms of units of area.

20. A method of measuring the area of a surface that comprises moving a scanning beam of radiant energy across the surface along an incremental strip of the surface to scan the said incremental strip, causing the movement of the radiant energy on and off the surface to control a counting operation, thereby to determine the length of the scanned strip, repeating the scanning operation on other incremental strips of the surface, and integrating the lengths of the scanned strips in terms of units of area.

21. A method of measuring the area of a relatively non-reflecting surface that comprises interposing the surface before a relatively reflecting background, moving a scanning beam of radiant energy of predetermined width over the background and the surface from one side of the background, and then across the surface along incremental strips of the surface to the other side of the background, to scan the said incremental strips, causing the movement of the radiant energy on and off the surface to control a counting operation, thereby to determine the lengths of the scanned strips, and calibrating the counting operation in terms of the area of scanned strips to cause the counting operation to serve as a measure of the area of the surface traversed by the radiant energy.

22. Apparatus for measuring the area of a surface having, in combination, radiant energy means for scanning incremental portions of the surface, means controlled by the scanning means for determining a dimension of the scanned strips, and means controlled by the dimension-determining means for integrating the said dimension in terms of units of area.

23. Apparatus for measuring the area of a surface having, in combination, radiant energy means for scanning incremental strips of the surface, means controlled by the scanning means for determining the lengths of the scanned strips, and means controlled by the length-determining means for integrating the said lengths in terms of units of area.

24. Apparatus for measuring the area of a surface having, in combination, means for moving a scanning beam of light across the surface along incremental strips of the surface to scan

the said incremental strips, photoelectric means for determining the lengths of the scanned strips, and means controlled by the photoelectric means for integrating the said lengths in terms of units of area.

25. Area-measuring apparatus having, in combination, means for causing a scanning beam of light to impinge upon successive portions of a surface the area of which is to be measured to scan the said successive portions, a light-sensitive device positioned to be responsive to the presence or absence of light reflected from the said surface, an amplifier controlled by the light-sensitive device, a relay controlled by the amplifier, a counter calibrated in terms of area controlled by the relay, and means for synchronizing the operation of the first-named means and the counter.

26. The method of measuring the area of a surface which comprises scanning said surface with light beams, in such manner that the light beams trace successive substantially parallel lines on the surface, photoelectrically detecting the lengths of said scanned lines, and integrating the lengths into an expression of the area of the surface.

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