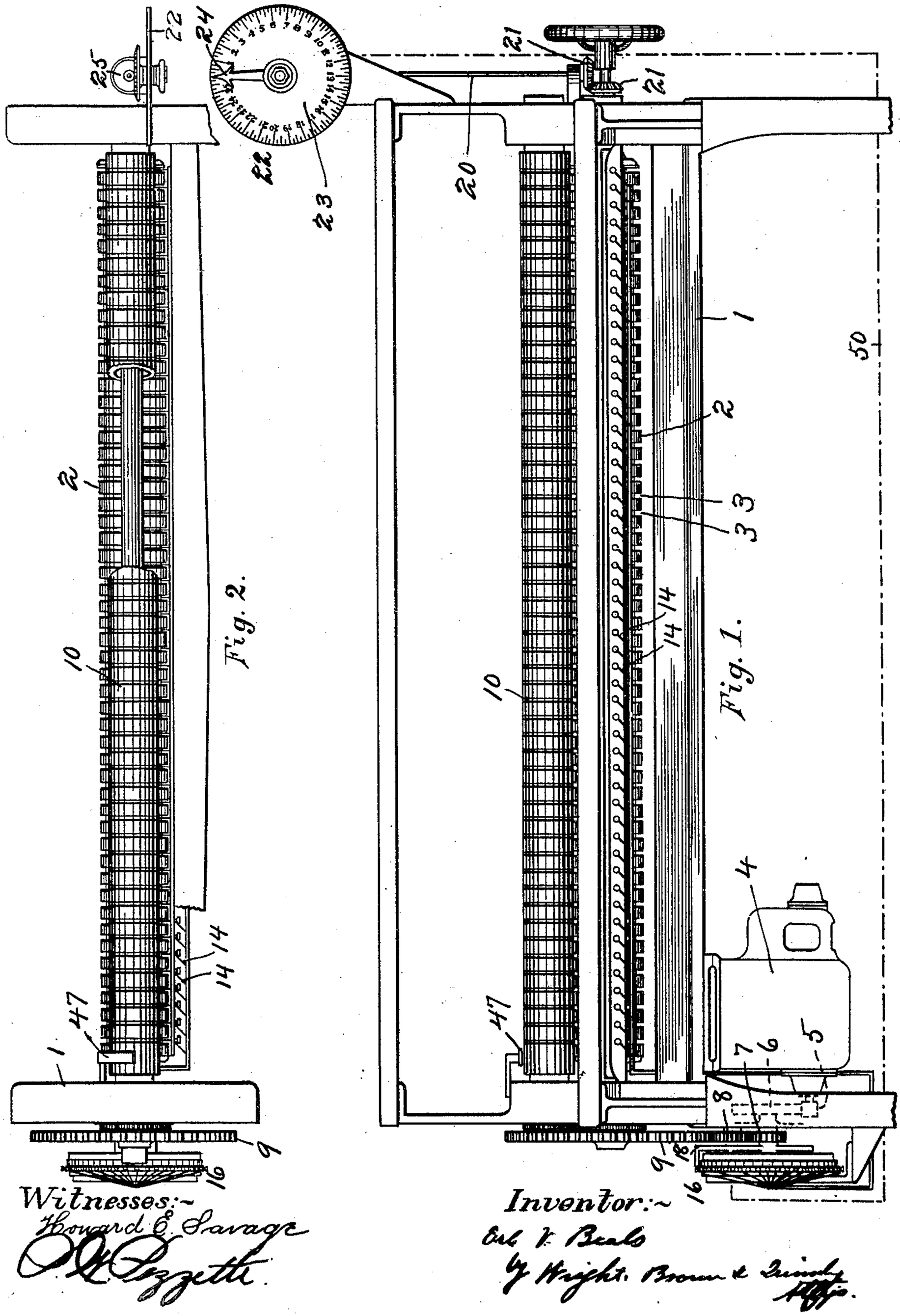
No. 674,953. Patented May 28, 1901.

E. V. BEALS.

AREA METER.

(Application filed June 6, 1900.)

(No Model.) 2 Sheets—Sheet 1.



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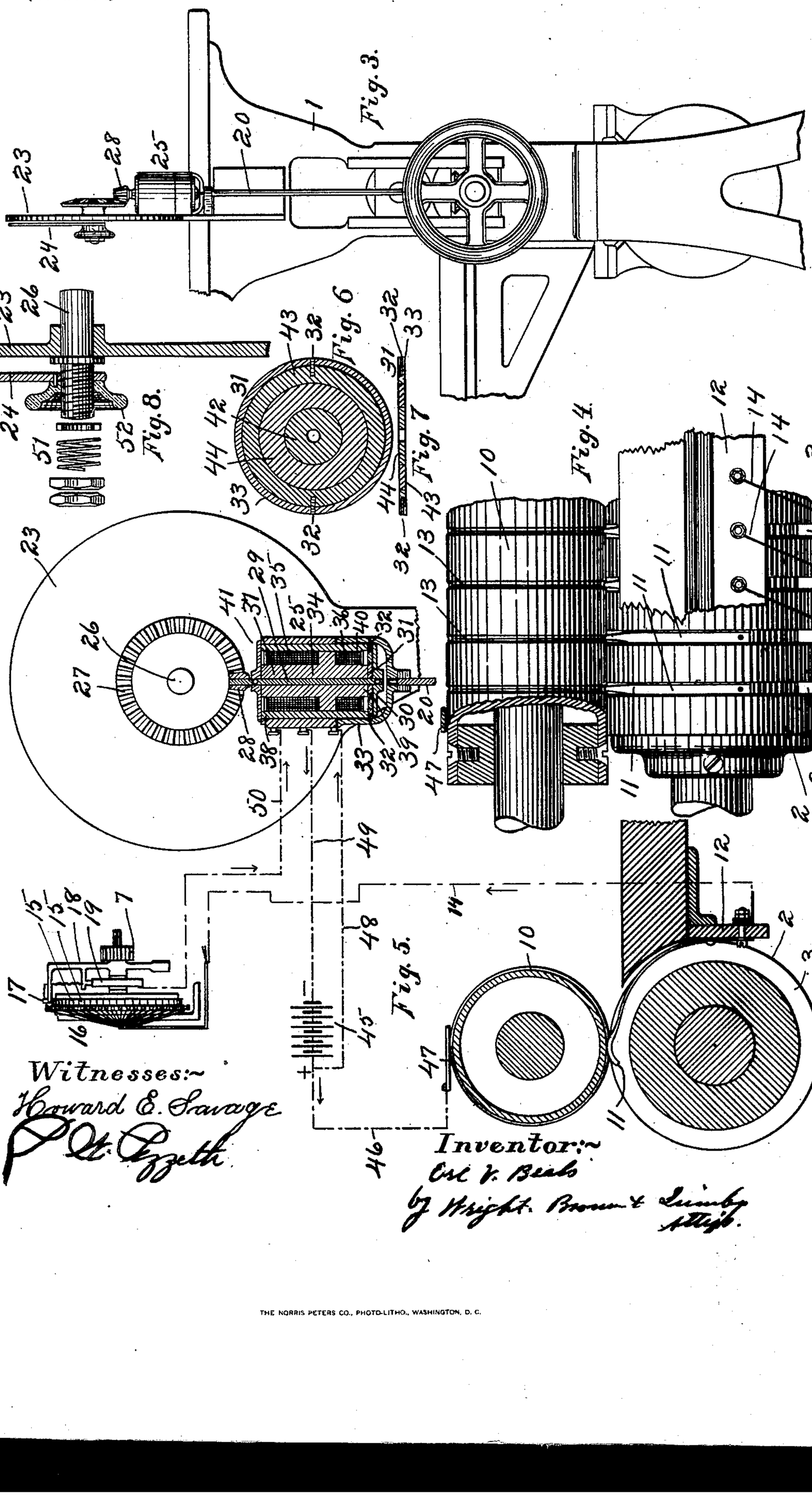

UNITED STATES PATENT OFFICE.

ERL V. BEALS, OF BOSTON, MASSACHUSETTS.

AREA-METER.

SPECIFICATION forming part of Letters Patent No. 674,953, dated May 28, 1901.

Application filed June 6, 1900. Serial No. 19,257. (No model.)

To all whom it may concern:

Be it known that I, ERL V. BEALS, of Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Area-Meters, of which the following is a specification.

This invention relates to machines for measuring the surface area of any web, such as a piece of leather or cloth.

Among the objects sought to be attained by the invention are simplicity of construction and certainty and delicacy of operation.

The invention consists in certain novel features of construction and arrangement, which I shall now proceed to describe and claim.

Of the accompanying drawings, forming a part of this specification, Figure 1 represents a front elevation of a web-measuring machine constructed in accordance with my invention. Fig. 2 represents a plan view thereof, partly broken away. Fig. 3 represents a right-hand end elevation. Fig. 4 represents an enlarged front elevation, partly broken away and in section, of the propelling-rolls and adjacent parts. Fig. 5 represents a view in section and elevation and partly in diagram, showing the circuit arrangement. Fig. 6 represents an enlarged horizontal section of a portion of the electromagnetic clutch. Fig. 7 represents an enlarged vertical section thereof. Fig. 8 represents an enlarged section of a portion of the indicator.

The same reference characters indicate the same parts in all of the figures.

Heretofore it has been common in web-measuring machines to employ a series of rolls of predetermined circumference placed side by side across the machine or according to units of width and to rotate these rolls by the frictional passage of the web, the amount of rotation of the rolls included in the width of the web being summed up and indicated on a dial as the area measurement of the web. I propose to depart from this arrangement and actuate the indicator positively or independently of the web as to units of length and to control said indicator selectively as to units of width, and I am enabled to perform this operation most simply and effectively by the interposition of suitable electrical devices acted on by the web and controlling said indicator.

Referring to the drawings, 1 is the frame of the machine, and 2 is a web-propelling measuring-roll journaled in said frame and made of an insulating substance, said roll having a series of annular grooves 3 3, located at unit intervals along its length. The roll 2 is rotated in a suitable manner, as by means of an electric motor 4, connected by gears 5, 6, 7, 8, and 9 with the axle of said roll.

10 is an opposed pressure-roll mounted in yielding bearings above the propelling-roll 2 and preferably geared to rotate at the same peripheral speed as said roll. The surface of the roll 10 throughout its length is made of a conductive material, such as brass, and is suitably insulated from its shaft or axle, as represented in Fig. 4.

11 11 are a series of spring contacts or brushes mounted in the grooves 3 3 of the roll 2 and attached to an insulating base or beam 12. The ends of these brushes are normally in contact with the upper roll 10, and to maintain them in a fixed lateral relation with respect to said roll the periphery of the roll may be provided with annular grooves 13 13. Wires 14 14 are led from the several brushes 11 to the several segments 15 15 of a fixed commutator 16, said commutator having a brush 17, carried upon an arm 18 and adapted to revolve in contact with the segments 15. The current is carried from the brush 17 to a fixed conductive ring 19. The arm 18 is mounted upon the stud of the gear 7 and is hence rotated in a predetermined relation to the roll 2. This relation may be assumed to be six revolutions of the arm to one of the roll.

20 is a vertical shaft connected by miter-gears 21 21 with the shaft of the roll 2, and hence rotating in a predetermined relation with said shaft, which relation may be assumed to be one rotation of the shaft 20 to one of the roll 2.

22 is an area-indicator mounted upon the machine-frame above the upper end of the shaft 20 and having a dial 23, graduated in suitable units of area, such as square feet, and a rotary pointer 24, adapted to indicate upon said dial.

25 is an electromagnetic clutch adapted to connect or disconnect the shaft 20 with the shaft 26, upon which the pointer 24 is mount-

ed. Secured to the rear end of the pointer-shaft 26 is a gear 27, meshing with a pinion 28. Said pinion 28 is secured to a shaft 29, at the lower end of which is a soft-iron disk 30. Mounted above said disk 30 is a second disk 31, secured by pins 32 to a cup-shaped yoke or head 33, attached to the upper end of the shaft 20. The yoke 32 and disk 31 are therefore continuously rotated. The shaft 29 passes centrally through the core 34 of a double magnet, whose upper winding or helix is represented at 35 and the lower winding at 36. One of the poles of the upper magnet is at 37 on the end of the soft-iron core 34 and the other pole is on the end of a soft-iron annulus 38, surrounding the winding 35. The poles of the lower magnet are at corresponding points at 39 40 on the lower ends of said core and annulus. The iron disk 30 constitutes the armature of the lower magnet, and a second iron disk 41, secured to the shaft 29, constitutes the armature of the upper magnet. The shaft 29 has a limited vertical movement in its socket or bearing and is adapted to rotate therein. The disk 31 is made up of a soft-iron center 42, opposite the magnet-pole 39, and a soft-iron ring or annulus 43, opposite the other pole 40, an annulus or ring 44 of a non-magnetic material, such as brass, being interposed between the two. The effect of this arrangement is to direct the magnetic lines of force which tend to pass from one to the other of the poles 39 40 across through the iron parts of the disk 31 into the armature-disk 30. The upper magnet is wound so as to be of greater strength than the lower one, so that if an electric current is divided between the magnets, part going through one magnet and part through another, with a common return, the influence of the upper magnet will be the stronger and its armature 41 will be held down against the poles. This prevents the shaft 29 from rotating and leaves the disk 31 free from disk 30. If, however, that portion of the current which flows through the upper magnet-winding be shut off, the armature 30 will be lifted by magnetic attraction and held against the disk 31. The shaft 29 will therefore be locked frictionally with the shaft 20 and will rotate therewith as though the two were rigid. As soon as the current is reëstablished through the upper magnet the shaft 29 will again be freed and magnetically locked. By providing a double magnet, as above described, and passing the current continuously through one end of it the iron in the magnet is kept in a state of magnetic saturation, and when the relation of the currents is changed there is a practically instantaneous magnetic effect due to the absence of what is known as "magnetic retardation." I do not herein specifically claim the construction of the magnetic clutch 25, as this is made the subject of another application, Serial No. 32,325, filed by me October 8, 1900.

45 represents a suitable source of electric energy, such as a battery, from one pole of which, as the positive pole, a wire 46 is led to a brush 47, which maintains continuous contact with the metallic surface of the presser-roll 10, and another wire 48 is led to one terminal of the lower magnet-winding or helix 36. The other terminal of said winding connects with a wire 49, leading to the negative pole of the battery. One terminal of the upper magnet-winding or helix 35 is also connected with the wire 49, and the other terminal of said winding is connected with a wire 50, leading from the stationary conductive-ring 19 of the commutator. The current from the battery therefore passes through the wire 46, brush 47, roll 10, one of the brushes 11, the corresponding wire 14, and the corresponding commutator-segment 15 through the brush 17, conductive-ring 19, wire 50, helix 35, and wire 49 back to the battery. Another portion of the current passes from the battery through the wire 48, helix 36, and wire 49 back to the battery, this latter circuit being maintained closed at all times.

The operation is as follows: It may be assumed that the roll 2 has a circumference of one foot, or twelve inches, and that the brushes 11 are placed at a distance of one inch apart. The web in being passed between the rolls 2 10 will be propelled by frictional contact a distance of one foot in one revolution of the roll 2. The roll 2 may therefore be said to measure the dimension of length in the web, since any definite portion of a revolution or number of revolutions is equivalent to a known distance. The pointer 24 when positively geared with the roll 2 by the operation of the clutch will have a movement proportional to the movement of the roll. The index is therefore operated positively or independently of the web as to the dimension of length. The electrical connections from the battery through the roll 10, the brushes 11, commutator-segments 15, and magnet-winding 35 constitute a series of electric circuits whose terminals are adapted to be separated by the passage of the web between the rolls 2 10. These circuits are rendered temporarily operative in succession by the rotation of the brush 17, which establishes the circuit successively through the several commutator-segments corresponding to the several brushes 11. It has been stated that the brush 17 rotates six times to one rotation of the roll 2, or, in other words, the brush 17 rotates once while two lineal inches of the web are passing between the rolls. So long as the current passes through any one of the brushes 11 or commutator-segments 15, the upper helix 35 will be energized and the pointer 24 will remain stationary. As soon, however, as the circuit through the helix 35 is entirely broken the pointer will be allowed to rotate proportionally with the rotation of the roll 2. We may imagine that the web which is being introduced between the rolls to be measured is divided into zones of two inches in length par-

allel to the rolls and that these zones are divided off into a series of small rectangles, each two inches long and one inch wide, each rectangle therefore having an area of two square inches. In each revolution of the commutator-brush 17 the machine tests or "feels" every one of the inch-wide rectangles in a zone two inches long and as wide as the length of the rolls 2 10, each one of the brushes 11 corresponding to one of these rectangles. For every brush that is in contact with the roll 10 the circuit will remain complete and there will be no effect on the indicator. For every brush that is held away from the roll 10 by the presence of the web there will be a movement of the pointer 24, indicating two square inches on the dial. For each rotation of the brush 17 the machine therefore sums up the number of square inches of surface present on a zone of the web two inches in length. This summation proceeds as long as the web passes through the rolls, and at the end of its passage there is a direct reading of the area of the web upon the indicator.

It is evident that the machine will measure the thinnest kind of a web which will separate the brushes 11 from the roll 10, and its results are of great accuracy, since the record does not depend upon the frictional propelling power which the surface of the web exerts upon any mechanism, but only upon the frictional draft of the propelling-rolls upon the web, which in practice can be made practically perfect or without any slippage.

The pointer 24 is loosely mounted upon its shaft 26 and is held with a friction device 51 upon said shaft, so as to normally rotate with the shaft, but be capable of being turned back without rotating the shaft. The pointer is independently rotatable by means of a knob or hub 52 attached to it. In operating the machine the pointer 24 is started at zero for each web and is turned back after the reading indicating the area of a web has been observed.

The term "commutator" used herein obviously does not mean a device to change the direction of currents as used in dynamos and motors, but is employed in its secondary sense, meaning a table of insulated contacts, which are usually arranged in a form similar to the ordinary motor or dynamo commutator.

I claim—

1. In a machine for measuring the area of a web, an area-indicator, web-propelling means operated synchronously with said indicator by positive connecting mechanism, and means controlled by the units of breadth in the web and controlling the operation of said indicator.

2. In a machine for measuring the area of a web, web-propelling means, an area-indicator, provisions for operating said indicator synchronously with the propelling means, and a series of electric circuits controlled by the web and controlling said provisions.

3. In a machine for measuring the area of a web, a web-propelling measuring-roll, a member operated synchronously with said roll, an area-indicator, and a clutch adapted to connect said member with the indicator and controlled selectively by the units of breadth in the web.

4. In a machine for measuring the area of a web, web-propelling means, a member operated synchronously therewith, an area-indicator, an electromagnetic clutch adapted to connect said member with the indicator, and a series of electric circuits controlled by the web and controlling said clutch.

5. In a machine for measuring the area of a web, web-propelling means, a series of electric circuits corresponding to units of breadth and controlled by the web, an area-indicator controlled by said circuits and having a scale of numerical symbols representing areas, and an indicating member to successively register with said symbols, and means to render said circuits temporarily operative in succession through periods synchronous with those of the web-propelling means.

6. In a machine for measuring the area of a web, a web-propelling measuring-roll, a series of electric circuits corresponding to units of breadth and controlled by the web, an area-indicator controlled by said circuits, and a commutator controlling the circuits and having a brush rotated in synchronism with said roll.

7. In a machine for measuring the area of a web, web-propelling means, a member operated synchronously therewith, an area-indicator, an electromagnetic clutch adapted to connect said member with the indicator, a series of electric circuits corresponding to units of breadth, said circuits being controlled by the web and controlling the clutch, and means to render said circuits temporarily operative through periods bearing a predetermined relation to the travel produced in the web.

8. In a machine for measuring the area of a web, a web-propelling measuring-roll, a member operated synchronously therewith, an area-indicator, an electromagnetic clutch adapted to connect said member with the indicator, a series of electric circuits corresponding to units of breadth, said circuits being controlled by the web and controlling the clutch, and a commutator controlling the circuits and having a brush rotated in synchronism with said roll.

9. In a machine for measuring the area of a web, an area-indicator, web-propelling means operated synchronously with said indicator by positive connecting mechanism, and a series of electric circuits controlling the operation of said indicator, said circuits having terminals arranged according to units of breadth and adapted to be separated by the moving web.

10. In a machine for measuring the area of a web, web-propelling means, a member operated synchronously therewith, an area-in-

dicator, a series of electric circuits having terminals arranged according to units of breadth and adapted to be separated by the moving web, an electromagnetic clutch device controlled by the circuits and adapted to connect said member with the indicator only when a current passes through some one of the circuits, and means to render said circuits temporarily operative in succession through periods synchronous with those of the propelling means.

11. In a machine for measuring the area of a web, a web-propelling, measuring-roll, a series of electric circuits having terminals arranged in a series at unit intervals lengthwise of said roll, and an area-indicator controlled by said circuits and having a scale of numerical symbols representing areas, and an indicating member to successively register with said symbols.

12. In a machine for measuring the area of a web, a web-propelling, grooved, non-conductive, measuring-roll, a series of electric circuits having terminals or brushes arranged at unit intervals in the grooves of said roll, an opposed conductive presser-roll forming a common circuit-terminal with the brushes, and an area-indicator controlled by said circuits.

In testimony whereof I have affixed my signature in presence of two witnesses.

ERL V. BEALS.

Witnesses:
R. M. PIERSON,
P. W. PEZZETTI.