

April 25, 1933.

P. MILLET
MACHINE FOR DETERMINING THE RESISTING QUALITIES
IN WEAR OF LEATHER FOR SOLES

1,906,175

Filed April 2, 1927

4 Sheets-Sheet 1

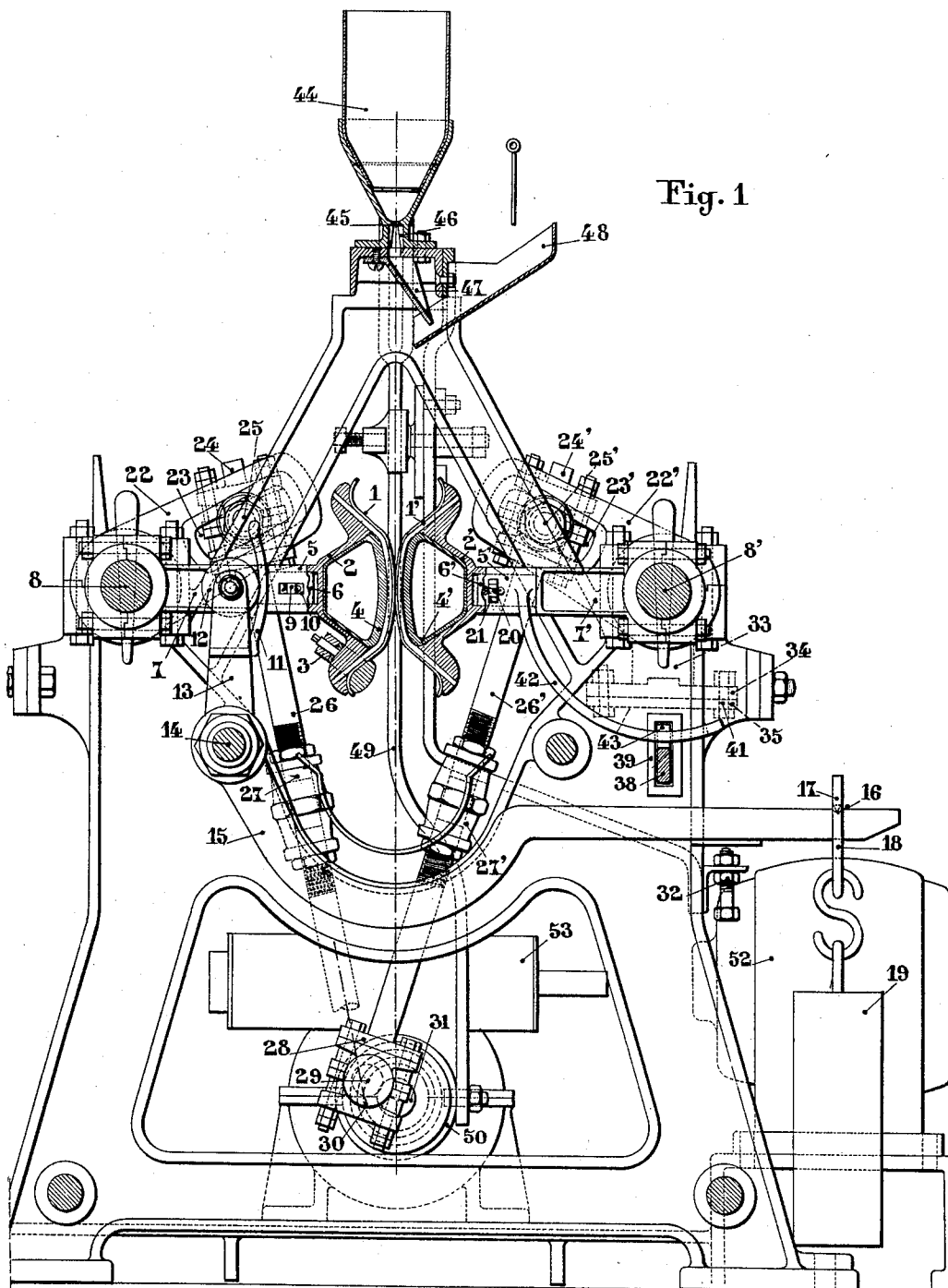


Fig. 1

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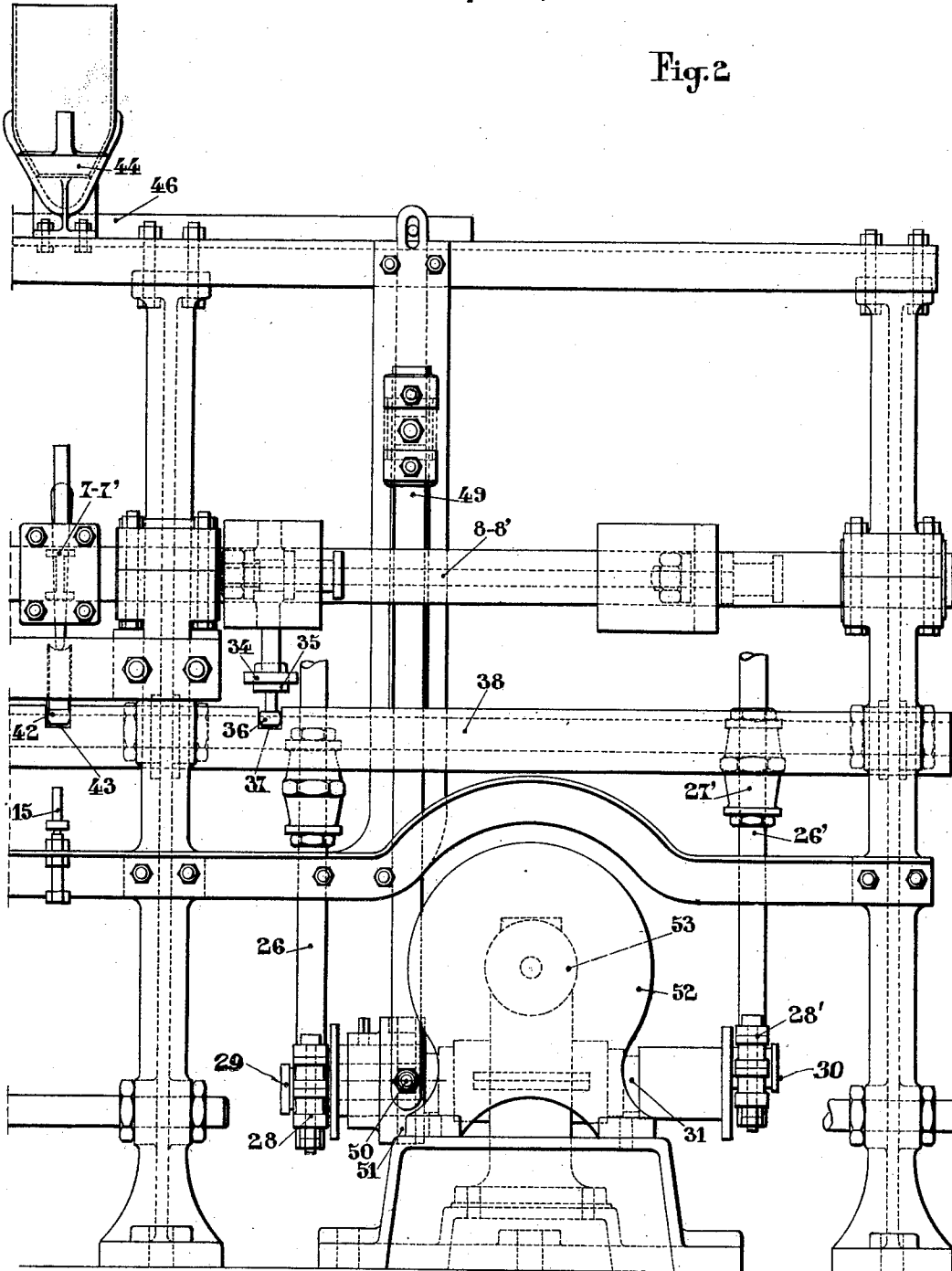
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Fig. 2



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Fig. 3

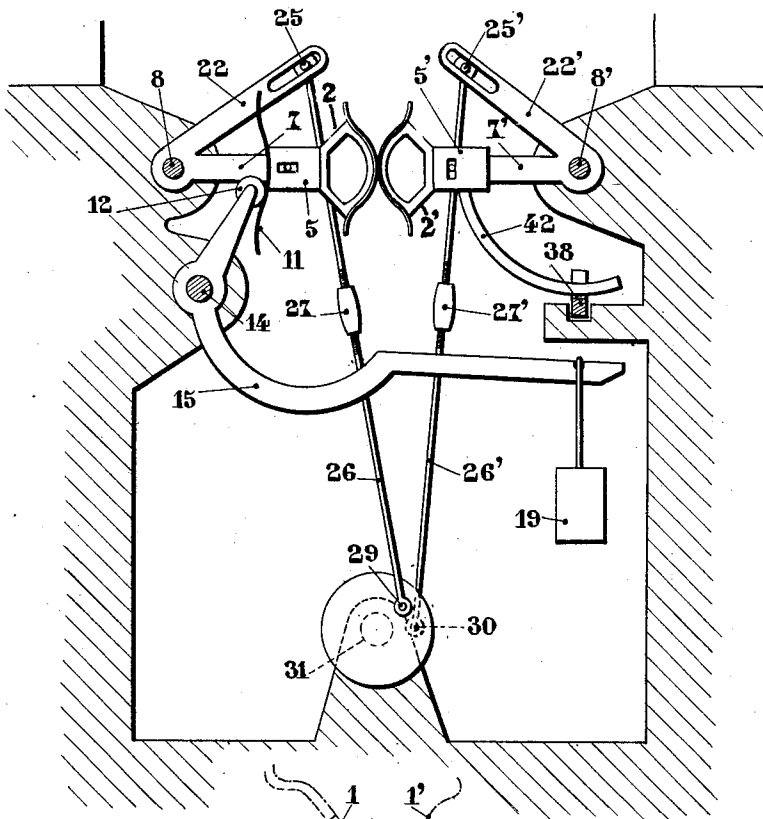
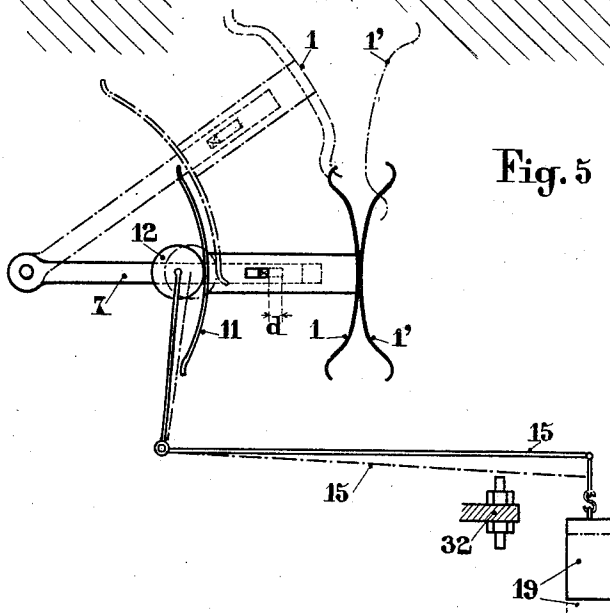


Fig. 5



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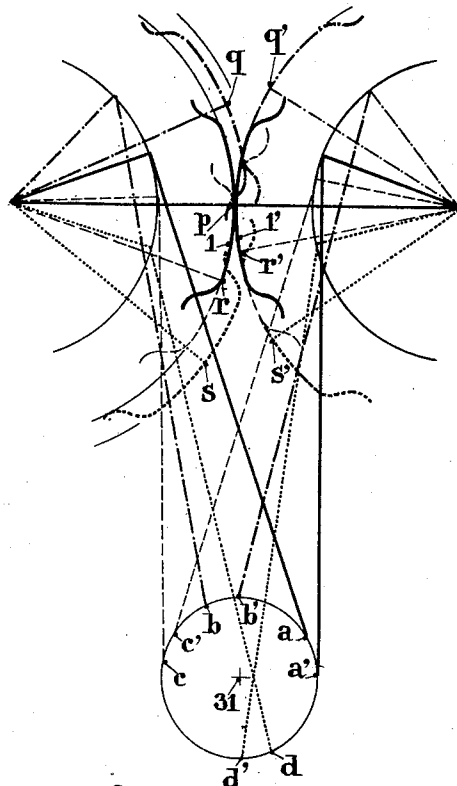


Fig. 4

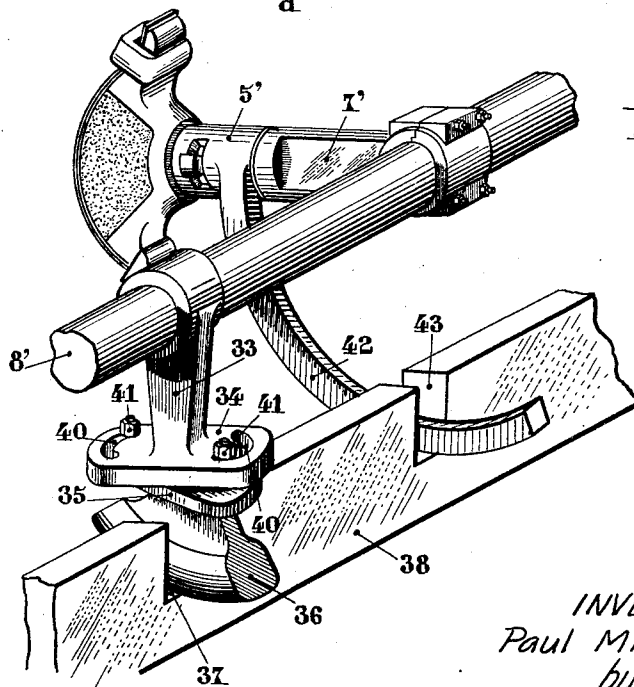


Fig. 6

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UNITED STATES PATENT OFFICE

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MACHINE FOR DETERMINING THE RESISTING QUALITIES IN WEAR OF LEATHER FOR SOLES

Application filed April 2, 1927, Serial No. 180,566, and in France January 28, 1927.

The present invention relates to a machine for determining the resisting qualities in wear of leather for soles.

ous members and their work in carrying out the various movements.

Fig. 4 shows diagrammatically the carrying out of the rubbing motions, sliding and shock.

Fig. 5 is a diagram of the device for carrying out the shock and flexion proportionately at a variable weight.

Lastly, Fig. 6 is a perspective view from the rear of the left side of Figure 2 and illustrates the manner in which the sole to be tested is rotated.

As will be seen from Fig. 1, the soles 1, 1' are fixed on the supports 2, 2' by means of rapid attaching devices such as the strap bolt 3. Strap bolt 3 (see Fig. 6) is made in the form of a loop embracing one end of supports 2, 2' and may be taken up so as to rigidly hold a sole in place, as will be obvious to those skilled in the art. The supports 2, 2' press against each other at their faces, which hold the soles for testing. These faces have a certain flexibility due to the provision on the supports of elastic elements such as, for example, the rubber cushions 4, 4', and the conformation of the contacting faces is such that the pressure of the soles against each other is not uniform, but passes through two maxima at the extremities of the surfaces under test, as occurs during the course of walking; the contacting surfaces presenting greater elasticity in the centre of the sole than towards the extremities thereof.

The rear parts of the supports 2, 2' are integral with couplings 5, 5' of which coupling 5 may be slidably mounted on the extension 6. The extensions 6, 6' of the cranks 7, 7' are keyed respectively on the shafts 8, 8'.

The coupling 5 is rotatably integral with the crank 7, but can be movable longitudinally on the extension 6 which carries a cotter pin 9 movable in a port 10 arranged in the coupling 5.

The said coupling carries on its rear portion a rail 11 against which presses a roller 12 journaled on the arm 13 of a lever pivoted at 14 on the frame of the machine; the other arm 15 of this lever, of suitable length, has at the end farthest from the joint, a notch

The known machines hitherto used for this purpose ascertain the wear of the soles by rubbing the leather against rotary abrasive members such as grindstones or metallic discs sprinkled with abrasive materials. The wear of the sole depends, however, in these machines, solely on these members, the abrasive capacity of which is extremely variable; furthermore, this wear of an inert object by a rotatory member in no way corresponds to the normal wearing conditions of a boot sole.

Portions of sole leather to be tested, whatever may be their shape, are hereinafter referred to as soles.

The machine in accordance with this invention tests the soles under the same conditions in which they would be called upon to work during walking; thus it provides the shock corresponding to the contact with the ground, the pressure corresponding to the weight of the body, and the bending, slipping, rubbing, and rotations to which the sole will be subjected during walking, at the same time as the influence of moisture and of an abrasive material.

The machine according to the invention permits comparison of the resistance to wear of two categories of sole leather, the different phenomena to which these leathers are subject during walking being realized leather against leather with the interposition of abrasive materials, either dry or in the presence of water. The abrasive material used will generally be sifted Fontainebleau sand, but emery, crushed flint and like materials can also be employed.

The machine according to the invention is arranged in such a way that the fixing of the test pieces and the regulation of the pressure are possible during working: It is provided with measuring apparatus.

In the attached drawings:

Fig. 1 is a front elevation of a machine constructed according to the invention.

Fig. 2 is a partial elevation of the side of the same machine.

Fig. 3 shows diagrammatically the vari-

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16 in which lies the knife edge 17 of a ring 18 on which a suitable weight 19 can be hung.

The coupling 5' is fixed longitudinally with the crank 7' but is capable of moving angularly on an extension 6' which carries a cotter pin 20 movable in a port 21 pierced in the coupling 5'.

The shafts 8, 8' receive the angular movements transmitted by the crank arms 22 and 22'; each of these arms has a slot 23, 23'; in these slots the ends 24, 24' of connecting rods 26, 26' can be fixed in any desired position.

The connecting rod ends 24, 24' can oscillate round the axes 25 and 25'; they are integral with the body of the connecting rods 26 and 26' the length of which can be adjusted by means of an adjustable coupling 27, 27' with differential threads for the two parts of the body of the connecting rod. The heads 28, 28' of these connecting rods are articulated on the shaft crank pins 29 and 30 eccentric to the shaft 31 of the motor which drives the movements of the machine, and are made to rotate with the latter; the crank pins 29 and 30 are at an equal distance from the shaft 31 and their angular distance may be comparatively slight.

Fig. 3 is a diagrammatic representation generally of the drive of the various movements of the machine. The pressure of the soles against each other is produced in the following manner. As indicated previously the support 2' can only move with respect to the shaft 8'; it is therefore fixed with respect to the median plane of the machine; as regards the support 2, this can, within certain limits move with respect to the shaft 8, owing to the presence of the cotter pin 9 and the slot 10 previously referred to.

The extent of these movements depends, on the one hand, on the flexibility of the elastic surface 4; it also depends on the other hand, on the weight 19 chosen and which, by means of the lever jointed at 14, pushes the roller 12 against the rail 11. It will be seen that the pressure exercised between the two soles in contact will depend upon the choice of the weight 19.

The friction of the soles against each other is produced by means of the connecting rods 26, 26' acting on the crank arms 22, 22' which rotate the shafts 8 and 8'. If each of these connecting rods is considered individually it will be seen that they determine an angular movement of the sole supports, an angular movement the extent of which and the position in space can be regulated by fixing the extremities of the connecting rods in desired positions in the slots 23 or 23'; but if one considers the movements of the sole supports in conjunction it will be seen that the angular movements are not symmetrical. In fact, on referring to the diagram of Fig. 4 on which have been shown the successive positions of the two connecting rods for each rotation

through 90° of the shaft of the motor 31, it will be seen that, as a result of the eccentricity of the axes of the connecting rod heads 28, 28' with respect to the motor shaft 31 on the one hand, and in consequence of the dissymmetry which results from the method of driving these connecting rods on the other hand, the angular movements of the soles in contact are different each instant; thus, in the example shown by Fig. 4 the soles 1 and 1' were in contact for the positions *a* and *a'* of the connecting rod heads, along a line shown in vertical projection by the point *p*. When the motor shaft has effected a quarter rotation the axes of the connecting rod heads have taken up the positions *b* and *b'*; on examining the diagram it will be seen that the point *p* at the end of this movement occupies on the sole 1 the position *q* and on the sole 1' the position *q'*.

It is simple to follow that the angular movement from the point *p'* to the point *q'* on the sole 1' has been greater than the angular movement from the point *p* to the point *q* on the sole 1.

On continuing the examination of this diagram it will be seen that for the positions *c* and *c'* and for the positions *d* and *d'* of the axes of the connecting rod heads, the point *p* has come to occupy the positions *r* and *r'* respectively then *s* and *s'* on the soles 1 and 1'; the diagram demonstrates the dissymmetry of the angular movements of the sole supports, this dissymmetry results in a friction of the soles against each other, the rapidity of this friction depending upon the speed of the motor, the adjustment of the length of the connecting rods, as also the adjustment of the position of the ends of the connecting rods in the slots of the arms 22 and 22'.

The same diagram of Fig. 4 also demonstrates that, according to the adjustment of the connecting rods, for the extreme positions of the angular movements, the soles may lose touch with each other; this contact, however is prolonged owing to the action of the weight 19 which constantly tends to apply sole 1 against the sole 1' by moving the coupling 5 on the extension 6 of the crank arm 7; the result of this movement is that the sole 1 tends to follow the sole 1' when the straight section of the latter, owing to its oscillation, leaves the median plane of the machine; meanwhile the longitudinal movement of the sole 1 being limited, there comes a moment when the two faces are no longer in contact, this having been preceded by a period of more or less long duration in which the friction has been considerably less energetic and which ended by the soles slipping past each other. When, at the end of the angular movement the two soles have parted, the support 2 is at the bottom of the stroke with respect to the crank 7 and it tends to retain this position under the action of the roller 12 pushed

forward by the weight 19; on the return, the resumption of contact between the two soles will therefore be necessarily accompanied by a shock the force of which will depend solely on the size of the weight 19.

This realization of the shock phenomenon is shown diagrammatically in Fig. 5 which shows two positions of the crank 7; the one (in full lines) for which the axis of this crank is horizontal; the other (in dotted lines) which correspond to the end of the upper stroke or the end of the angular movement of the said crank; for the first position the soles 1 and 1' are in contact; for the second position the contact between the two soles has been broken; the roller 12 pressing on the rail 11 comes into the position shown in dotted lines, and the weight 19 suspended from the arm of the lever 15 also comes into the position shown in dotted lines, the arm 15 resting on a stop 32 the position of which is adjustable with relation to the frame of the machine; this diagram shows that the device being in the position shown in dotted lines, the resumption of contact between the soles 1 and 1' cannot take place unless accompanied by a shock the extent of which must be such that it permits the repulsion of the roller 12 to its initial position re-raising the weight 19.

The various actions (pressure, friction, sliding and shock), the carrying out of which in the machine has been described above, are accompanied, owing to the relative elasticity of the sole supports, by flexion of the leather; in fact, in the resumption of contact of the soles against each other as much as the resumption of contact of the soles, as when friction occurs between these soles, the leather is subjected to deformations the extent of which depends upon the flexibility of the system, and which realize the same phenomenon as those produced during walking.

During walking, however, the actions to which the soles of shoes are subjected are not only those which result from the pressure due to the weight of the body or which result from friction, shocks or deformations of the shoe against the ground; the soles are also subjected to rotations (twists) which occur particularly at the moment when the foot is lifted from the ground. This action of rotation under pressure is realized in the machine in the following manner; as will be seen from the perspective view shown in Fig. 6, a crank 33 is keyed on the shaft 8', the crank arm of which shaft is terminated by a plate 34 against which presses the counter-plate 35 suitably faced, integral with a guide member 36 in the form of a sector, which can move in the groove 37 of a longitudinal bar 38 which can slide in a collar 39 (Fig. 1) integral with the frame of the machine. The plate 34 is pierced with arc-shaped slots 40 in which move bolts 41 integral with the

counter-plate 35; in accordance with the position in which these bolts are fixed in the slots 40, it will be seen that the guide member 36 will have greater or lesser inclination in respect to the bar 38.

The crank 33 being integral with the shaft 8' the oscillations of the latter will cause, according to the position of the guide member 36, greater or lesser movements of the bar 38.

The coupling 5' which, as previously stated, can receive small angular movements with respect to the crank 7' bears an extension 42 of arc-shape which engages in a slot 43 in the bar 38; it may be seen that during the oscillations of the system, these oscillations will be accompanied by angular movements of the coupling 5' on the crank 7' and the extent of these movements will depend on the extent of the alternating movement of the bar 38; it will also be seen that these same angular movements of the coupling 5', occurring at the same time as the actions referred to above (pressure, friction, shock), will realize the phenomenon of rotation under pressure of the soles against each other.

It will thus be possible to regulate the extent of the rotation by adjustment of the bolts 41 in the grooves 40 of the crank 33.

The abrasive material used is placed in a feed cup 44 fixed on the frame at the upper part of the machine; it can be mixed with water or not. The feed cup 44 is provided at its base with a hole 45 beneath which is a perforated member 46, the apertures of which permit or prevent the passage of the abrasive into the spouts 47 and 48, the mouth of the latter being placed in such a way that it distributes the material between the two soles under test.

The movement of the perforated member 46 is controlled by a rod such as 49 the oscillations of which are determined by a cam member 50 guided by a cam 51 fixed on the motor shaft.

The various movements of the machine are controlled in the manner described, by the shaft 31 which can be actuated, either by a neighbouring transmission or by an electric motor 52 driving the transverse shaft through a speed reducer 53.

The description given applies to the whole of the mechanism which determines the various relative movements of the two soles under test, but it will be quite understood that if the shafts 8 and 8' are suitably prolonged, it will be possible to control the oscillations of as many sole supports as may be desired.

It will thus be possible with one machine to proceed with tests of a different nature as regards the conditions to which the tested leathers will be subjected, these differences in working conditions being obtained by the various regulators referred to in the course of the description, i. e. length of the con-

necting rods, position of the extremities of same, size of the weight and the extent of the rotation; it will be the same as regards the abrasive material used, the nature of which
5 and the amount of moisture being capable of variation for each pair of soles worked.

It will also be understood that the machine now described will be capable both in the form and the constitution of its members, of
10 modifications in detail, without going beyond the characteristics of the invention.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:
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1. In a machine for testing the wearing quality of flexible materials, a pair of oscillatably mounted supports having opposed peripheral curved surfaces, means for mounting
20 flexible material to be tested on said surfaces, means operative to force said supports towards and into contact with one another, and means for simultaneously angularly displacing each of said supports so that a pair of
25 points on the peripheral surfaces thereof move at different linear velocities relatively to one another.

2. A structure as defined in claim 1 in combination with means for varying the relative velocities of said supports.
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3. In a machine for testing the wearing quality of flexible materials, a pair of supports oscillatably mounted and having peripheral curved surfaces facing one another, one of the said supports being mounted so as to be capable of rotation, means for fastening
35 materials to be tested to the peripheral surfaces of said supports, means operative to move said supports towards and into contact with one another, means for displacing the peripheral surfaces of said supports relatively to one another, and means for rotating
40 one of said supports in planes forming angles with the peripheral surface of the other of said supports.

4. In a machine for testing the wearing quality of a material intended to be subjected to friction, a pair of oscillatable shafts, a pair of supports, means connecting said
50 supports to said oscillatable shafts and said supports having curved peripheral surfaces facing one another, means for fastening material to be tested to the peripheral surfaces of said supports, a rotatable shaft, means for
55 rotating said shaft, crank-arms rigidly connected to said oscillatable shafts, connecting rods extending from said crank-arms to independent points eccentric to the axis of said rotatable shaft, and means maintaining one
60 end of each of said connecting rods at a fixed distance from the axis of rotation of said rotatable shaft, and means for yieldably forcing said supports towards and into contact with one another.

5. In a machine for testing the wearing

quality of flexible materials, a support oscillatably mounted and having a curved peripheral surface, said support being also mounted for rotation about an axis positioned radially with relation to its axis of oscillation, means for fastening the flexible material to be tested in contact with the peripheral surface of said support, frictional surface means for exerting pressure having a force component in a direction normal to and against the peripheral surface of said support, means for oscillating
70 said support and means for rotating said support in a series of planes forming intersections with said frictional surface.
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6. In a machine for testing the wearing quality of flexible materials, a support having a flexible curved peripheral surface, said support being mounted so as to be capable of oscillation and being also rotatable about an axis positioned radially with respect to its axis of oscillation, means for fastening the flexible material to be tested in contact with the peripheral surface of said support, frictional surface means for exerting pressure having a force component normal to and against the peripheral surface of said support, means for oscillating said support and means for rotating said support in a series of planes intersecting said frictional surface.
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7. In a machine for testing the wearing quality of a flexible material intended to be subjected to friction, an oscillatable shaft, an arm carried by said shaft, a support oscillatably mounted on said arm and having a curved peripheral portion, means for fastening material to be tested on the peripheral portion of said support, frictional means contacting with said support and operative to exert pressure having a force component normal to the peripheral portion of said support, means for oscillating said shaft and means for oscillating said support.
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In testimony whereof I have signed my name to this specification.
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PAUL MILLET.

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