We, LES PRODUITS ASSOCIES LPA-BROXO S.A., of 39, rue Peillonnex, 1225, Chene-Bourg, Switzerland, hereby applies for the grant of a standard patent for an invention entitled:

"DENTAL FLOSS HOLDER"

which is described in the accompanying complete specification.

Our address for service is:-

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DATED this ELEVENTH day of FEBRUARY 1987

LES PRODUITS ASSOCIES LPA-BROXO S.A.

By: [Signature]

Registered Patent Attorney

TO: THE COMMISSIONER OF PATENTS
AUSTRALIA

SBR: JMA:112W
COMMONWEALTH OF AUSTRALIA

THE PATENTS ACT 1952

DECLARATION IN SUPPORT OF AN
APPLICATION FOR PATENT

In support of the Application made

by LES PRODUITS ASSOCIES LPA-BROXO S.A.

for a patent for an invention entitled:
"DENTAL FLOSS HOLDER"

We, Michel Moret

care of LES PRODUITS ASSOCIES LPA-BROXO S.A.
39, rue Peillonnex 1225, Chene-Dourg, Switzerland

do solemnly and sincerely declare as follows:

1. I, Michel Moret, am the applicant(s) for the patent.

(Or, in the case of an application by a body corporate)

2. Michel-Antoine MORET and Pierre-Jean JOUSSON

are the actual inventor(s) of the invention.

(Or, where a person other than the inventor is the applicant)

The said applicant is the assignee of Michel-Antoine MORET
and Pierre-Jean JOUSSON.

Declared at Chene-Bourg this Twenty-Fourth day of March 1987

Les Produits ASSOCIES

LPA-BROXO S.A.

39, rue Peillonnex
1225 CHENE-BOURG / Switzerland

Michel Moret

Signature of Declarant(s)

To: The Commissioner of Patents
DENTAL FLOSS HOLDER

1. Dental floss holder with two arms which are arranged in a fork shape and between which the dental floss can be stretched along an intercept, wherein the position of the taut floss is defined by fixing points provided on the arms, characterised in that the holder is designed as a detachable instrument for a hand-held appliance for dental care, which comprises a rotatably mounted shaft for the instrument and a motor which oscillates this shaft about its own axis, that the straight line passing through the intercept and the axis of rotation of the holder are skew lines, said straight line passing through the intercept being inclined at an angle \( \alpha \) to a plane oriented perpendicularly to said axis of rotation, that the distance between the fixing point on one arm and the axis of rotation is smaller than the distance between the fixing point on the other arm and the axis of rotation, and that the perpendicular drawn from the first-mentioned fixing point to the axis of rotation forms, with the vertical projection of the intercept to the plane passing through the perpendicular and perpendicular to the axis of rotation, an angle \( \beta \) which is at least 90°.
FORM 10

COMMONWEALTH OF AUSTRALIA

PATENTS ACT 1952

COMPLETE SPECIFICATION

(ORIGINAL)

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Complete Specification Lodged:

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Related Art:

Name of Applicant: LES PRODUITS ASSOCIES LPA-BROXO S.A.

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Complete Specification for the invention entitled:

"DENTAL FLOSS HOLDER"

The following statement is a full description of this invention, including the best method of performing it known to us

SBK:JMA:112W
ABSTRACT

The dental floss holder (10) is designed as an interchangeable instrument for a hand-held appliance (1) which has a motor and a shaft (7) which can be oscillated thereby about its own axis. The dental floss holder (10) has curved arms (13, 14) arranged in a fork shape, with fixing points provided thereon, between which is stretched the dental floss (11) serving to clean the gaps between teeth. The taut floss (11) lies obliquely to the axis of rotation (D) of the holder (10) and is at an angle to a plane oriented perpendicularly to the axis of rotation (D).

The fixing point on one arm (13) is a smaller distance away from the axis of rotation (D) than the fixing point on the other arm (14). Furthermore, the perpendicular drawn from the first fixing point to the axis of rotation (D) forms an angle of at least 90° with the vertical projection of the line connecting the two fixing points, to the plane which is perpendicular to the axis of rotation and passes through this perpendicular.

(Figure 1)
Dental floss holder

Specification

The invention relates to a dental floss holder, with two arms which are arranged in a fork shape and between whose ends the dental floss can be stretched.

Dental floss holders of this kind to be used by hand, for cleaning the gaps between teeth, have been known for a long time, but due to the intricate manipulations to be performed are not yet used as frequently as would be desirable with regard to proper dental hygiene.

Furthermore, hand-held appliances for dental and oral hygiene, with interchangeably attachable toothbrushes and, if required, attachable nozzles for fluid treatment, are known in various embodiments. For example, in US patent 2,917,758 and in Swiss patent 646,554, corresponding to West German Offenlegungsschrift 3,025,675, are described hand-held appliances with an electric oscillating-armature motor which can be connected to an a.c. voltage network and drives the attached instrument at the frequency of this supply network, the amplitude of oscillations decreasing as the motor load increases. Hand-held appliances with an oscillating-armature motor of this kind are also already known, in which the amplitude of oscillations can be varied by altering the motor supply voltage by means of an adjusting knob, by switching on and off or varying resistances in the motor circuit.

Another known hand-held appliance operates with a rotating motor which drives the instrument in oscillating fashion by means of a movement transducer, wherein the amplitude of oscillations can be varied mechanically by means of an adjustable cam mechanism, as described for example in Swiss patent 636,509, corresponding to West German Offenlegungsschrift 2,944,391.

Furthermore, hydraulically driven hand-held appliances of this kind are known, as described for example in West German patent 1,802,838 or in Swiss patent 601,664, corresponding to West German Offenlegungsschrift 2,634,315. Here, in the housing of the hand-held appliance is provided a hydraulic piston motor which is supplied by an external fluid pump; optionally, on these hand-held appliances can be mounted spray nozzles which
can be connected to the fluid pump instead of the hydraulic motor and discharge a pulsating fluid jet for fluid treatment. An adjusting knob for varying the fluid pressure allows adjustment of the amplitude of oscillation during operation of the hydraulic motor.

It is the object of the invention to design a dental floss holder in such a way that it can be operated effectively as a mechanically driven instrument with a hand-held appliance of the kind described hereinbefore, and at the same time excessive strain or even damage to the tooth enamel or gums by friction of the rapidly vibrating dental floss is avoided.

According to the invention, this object is achieved by the characteristics specified in patent claim 1.

By using a dental floss holder designed as a detachable instrument of this kind, with a hand-held appliance of the kind described hereinbefore which drives this holder in oscillating fashion about its axis of rotation, an instrument which is easy to operate and works effectively for cleaning the gaps between teeth is made available to the user. The taut dental floss is oscillated in a gap between teeth at the frequency of the driving motor, i.e. 50 Hz in the case of an electric motor, or a frequency of 40-60 Hz in the case of a hydraulic motor, covering an area which is a hyperboloid of revolution on account of the special geometry of the holder. This prevents the area covered by the dental floss during a period of oscillation from being X-shaped or V-shaped, that is to say, the straight lines defined by the instantaneous positions of the periodically moving dental floss do not intersect with each other and therefore do not form a common point of intersection at which localised frictional action would be particularly vigorous and therefore dangerous. Likewise, a sawing effect is avoided, as oscillation of the dental floss takes place at an angle to the longitudinal direction of the taut dental floss.

It is moreover particularly advantageous if the amplitude of oscillation at which the hand-held appliance operates, is variable or decreases as the motor load increases. Where the amplitude of oscillation is variable, the operation can thus be performed when using a dental floss holder with a lower amplitude of oscillation, for example from 10 to 40°, than when using a tooth-
brush, so that the risk of possible irritation or injury of the gums is reduced still further. On the other hand, an amplitude of oscillation of the toothbrush between $40^\circ$ and $70^\circ$ is advantageous for massage of healthy gums. Since furthermore the amplitude of oscillation decreases as the motor load increases in the hand-held appliances of the kind described hereinbefore, the amplitude of oscillation is automatically reduced when the dental floss is pressed harder against the teeth.

In one advantageous development, the angle of inclination $\alpha$ mentioned above is between $10^\circ$ and $40^\circ$, preferably about $20^\circ$, the distance $R_1$ is between 8 and 20 mm, preferably about 12 mm, the distance $R_2$ is between 15 and 45 mm, preferably about 25 mm, and the angle $\beta$ is between $95^\circ$ and $150^\circ$, preferably about $110^\circ$.

Further advantageous developments of the invention are apparent from the dependent claims.

The invention is illustrated by several practical examples with reference to the drawings.

Figure 1 shows a hand-held appliance with a dental floss holder mounted on the appliance housing, this hand-held appliance being fitted with a hydraulic motor and therefore connected to a fluid pump in the example concerned.

Figure 2 shows a plan view of the dental floss holder, with the curved double arrow showing the direction of oscillation.

Figure 3 shows a side view of the dental floss holder of Fig. 1, slightly enlarged from the view of Figure 1.

Figure 4 shows the same dental floss holder in a position rotated through $90^\circ$ about its own axis.

Figure 5 shows a schematic view to illustrate the geometry of the dental floss holder and its oscillation, in plan view.

Figure 6 shows a side view in the direction of arrows VI in Figure 5, on a smaller scale than the view of Figure 5.

Figure 7 shows a variant of the dental floss holder.

Figure 8 shows a section along line VIII of Figure 7 through the floss tensioning and mounting device.

Figure 9 shows another variant of the dental floss holder.

According to Figure 1, the housing of a hand-held appliance 1 for dental care, which is equipped with a hydraulic piston motor, is connected by a double hose 2 with forward and return pipes for the fluid to a fluid pump 3 on which is mounted a re-
movable fluid reservoir 4. On the fluid pump 3 are mounted
an on/off switch 5 for the electric motor driving the pump,
and a rotary knob 6 for adjusting the fluid pressure.

In the housing of the hand-held appliance 1 is rotatably
mounted a shaft 7 extending along the axis thereof, which shaft
protrudes at the top end of the housing and can have instruments
fitted onto it interchangeably. Figure 1 shows, as a detachable
instrument, a mounted dental floss holder 10 with a socket
device 12a forming an integral part of its shank 12, and with
curved arms 13 and 14 which are arranged in a fork shape and
between whose ends is stretched the dental floss 11 serving to
clean the gaps between teeth.

The shaft 7 and hence the dental floss holder 10 are oscill-
ated by the hydraulic motor and caused to vibrate about the axis
of the shaft 7, as shown by the curved double arrow in Figure 2.
If the hydraulic motor comprises a linearly reciprocating piston,
this oscillating motion of the shaft 7 is produced by means of
a suitable movement transducer, as described for example in West
German patent 1,802,838. However, the hand-held appliance 1
may also be equipped with a hydraulic piston motor whose piston
is curved arcuately in the direction of the stroke; this piston
is mounted directly on the shaft 7 by means of a radial exten-
sion, and reciprocated along an arc concentric to the shaft 7.
A hand-held appliance with a hydraulic drive of this kind is
described in Swiss patent 601,664, corresponding to West German
Offenlegungsschrift 2,634,315, and does not require a movement
transducer between hydraulic motor and driven shaft, as the
hydraulic piston directly causes the shaft to oscillate about
its own axis.

The hand-held appliance with hydraulic drive shown in
Figure 1 can also, like the known hand-held appliances mentioned
in the introduction, be operated with an attached toothbrush or
a spray nozzle which when fitted is connected to a pipe extend-
ing adjacent to the hydraulic motor. An adjusting knob 8
mounted on the housing of the hand-held appliance 1 allows ad-
justment of a three-way valve by means of which the fluid pipe coming
from the fluid pump 3 is either connected to the cylinder of the
hydraulic motor for the purpose of driving a dental floss holder
10 or a toothbrush, or connected to the pipe leading to a spray
nozzle for the purpose of supplying this spray nozzle, so that the spray nozzle discharges a pulsating fluid jet for cleaning the teeth and massaging the gums. Another adjusting knob 9 on the hand-held appliance 1 operates a valve by which the fluid return pipe leading back to the fluid pump 3 is either blocked or connected to the fluid supply pipe. In the former case the appliance 1 is switched on, and therefore either the hydraulic motor is driven or the spray nozzle is supplied, and in the latter case the appliance is switched off, as the fluid pump is short-circuited via the fluid supply pipe, the above-mentioned valve and the fluid return pipe.

Figures 3 and 4 show the dental floss holder 10 of Figure 1 on an enlarged scale. This fork-like holder 10 has a shank 12 whose lower end is provided with the socket device 12a for fitting onto the shaft 7 of the appliance 1, while on the upper portion are integrally formed asymmetrically designed arms 13 and 14 which curve away from the longitudinal axis of the shank 12 in the same direction, and diverge in a V-shape. The two arms 13 and 14 curve in different planes with different curvatures. In the example under consideration, the curved arm 13 lies in a plane more or less parallel to and offset from the axis of rotation D, as shown by Figure 2, while the curved arm 14 lies in a plane at an angle to the axis of rotation D. Arm 13 may also lie in a plane passing through the axis of rotation. The two arms may also be bent with different angles.

Between the rounded ends 13', 14' of the two arms 13 and 14 is stretched the dental floss 11 shown in dashed lines. The arms 13 and 14 comprise longitudinal grooves 13b and 14b in which the dental floss is guided towards the ends of the arms and which open out into notches. These notches form the fixing points 13a, 14a for the dental floss 11 which can thus be tensioned in a definite manner along the intercept A (Figure 6). The free ends 11a of the floss are wound around a knob 15 provided on the shank 12, to fix them.

The geometry of the dental floss holder 10, shown particularly in Figures 5 and 6, is selected as follows: the straight line extending through the taut floss 11 and the straight line passing through the axis of rotation D of the holder 10 are skew lines, that means these two lines do not intersect and are not parallel. Moreover the line extending through the taut floss 11 is inclined at an angle $\alpha$ to a plane $E$ oriented
perpendicularly to this axis of rotation, as shown by the view in Figure 6; in Fig. 6 the two fixing points 13a and 14a lie in a plane oriented parallel to the plane of the drawing.

According to Figure 5, which shows a schematic plan view of the assembly, that is, in the direction of the axis of rotation D of the holder 10, the distance R1 between the fixing point 13a and the axis of rotation D is smaller than the distance R2 between the fixing point 14a and the axis of rotation D. In order to prevent the instantaneous positions of the taut floss 11 from intersecting with each other during oscillation, and thus prevent points subject to particularly high friction from arising during treatment, the following condition must be fulfilled, as can easily be seen with reference to Figure 5: the perpendicular L of length R1 drawn from the fixing point 13a on the arm 13 to the axis of rotation D must form with line C an angle \( \beta \) which is at least 90°; line C is the projection \( A \cos \alpha \) of the intercept A, that is, the taut floss 11, to the plane which is perpendicular to the axis of rotation and which passes through the perpendicular L.

Advantageously angle \( \alpha \) is selected between 10° and 40°, angle \( \beta \) between 95° and 150°, distance R1 between 8 and 20 mm, and distance R2 between 15 and 45 mm. A preferred embodiment has approximately the following values: \( \alpha = 20°, \beta = 110°, \) R1 = 12 mm and R2 = 25 mm. The above radii and angles are appropriately selected so that the intercept A, that is, the length of the taut floss, is approximately 15 to 40 mm, preferably about 25 mm.

During an oscillation, each point of the taut floss 11, as shown by a double arrow in Figure 5, describes an arc concentric to the axis of rotation D, and the area covered by the taut floss 11, in the plan view of Figure 5, with an angle of oscillation \( \gamma \), is defined by the two arcs B1 and B2 of radius R1 and R2 respectively, which are concentric to the axis of rotation D, and the extreme positions of the floss, marked 11 and 11'. This area covered by the floss 11 constitutes a surface portion of a hyperboloid of revolution. Thus the section of the vibrating floss 11 located in the gap between teeth at any given time, with the position of the holder 10 unchanged, is also reciprocated in
oscillating fashion in the direction of the axis of rotation D, that is, perpendicularly to the actual oscillating motion, which is particularly advantageous to the cleaning action and avoids a sawing effect.

If the angle $\beta$ were exactly 90°, then the above-mentioned projection $C=\text{A} \cos \alpha$ would form precisely the tangent $T$ to the circle drawn with radius $R_1$ about the axis of rotation $D$, at fixing point 13a. As the relationship $R_2^2=R_1^2+T^2$ holds good, as can readily be seen from Figure 5, the condition $\beta \approx 90^\circ$ is equivalent to the condition that $C \leq \sqrt{R_2^2-R_1^2}$. If this condition is not fulfilled, and therefore $\beta < 90^\circ$, the projection $C=\text{A} \cos \alpha$ intersects with the smaller circle of radius $R_1$, and adjacent instantaneous positions of the vibrating floss 11 intersect with each other, which is to be avoided, as stated before.

In the case of a hydraulically driven hand-held appliance 1, according to Figure 1 the user can adjust the fluid pressure with the knob 6 and hence adjust the energy of the hydraulic motor, so that in this way the amplitude of oscillation of the driven instrument can be varied. Also, at reduced fluid pressure, the amplitude of oscillation decreases relatively rapidly as the load on the instrument increases. Therefore a toothbrush for example can be operated with maximum fluid pressure, while a dental floss holder 10 is operated with correspondingly reduced fluid pressure and reduced amplitude of oscillation, to avoid injuries. Moreover, the greater the load applied to the dental floss when cleaning the gaps between teeth by pressing it against the teeth, the greater the decrease in amplitude of oscillation, which is likewise a desirable effect in this application, in order to keep irritation of the gums as low as possible on contact therewith.

In the example according to Figures 7 and 8, the dental floss holder 10, whose arms 13 and 14 again comprise grooves and notches for guiding the floss 11, is provided with a tensioning and mounting device for the floss 11, and a pin 18 which re-routes the floss from the arm 14 in the direction of the shank 12. This device consists of a pot-shaped body 17 attached to or formed integrally with the shank 12, and a clamping button 16 which is reciprocable in the body 17 in the axial direction thereof and which passes through an opening in the bottom of the body 17 or in the shank 12. After the ends 11a of the floss 11 have been passed through under the head of the clamping button 16, this
clamping button 16 is pressed into the body 17, whereby the dental floss 11 is tensioned and at the same time its ends 11a are held tight. To release the floss, the clamping button 16 is pressed out of the body 17 by pressing on the plate 16a which is formed integrally on its other side, as shown in Figure 8.

In the example according to Figure 9, the holder 10 according to Figure 7 is moreover provided with a supply reel 19 for the floss 11, so that the length of used floss can easily be replaced by a new length from the supply reel 19 and can be tensioned and fixed by means of the device 16, 17.

Instead of a tensioning and mounting device operating with a push button, there may be provided a screw which tensions and fixes the ends of the floss by screwing into a threaded opening provided in the shank of the holder.

The devices described above can of course also be provided instead of the knob 15 in the practical example described with reference to Figures 1 to 6, in which case a special pin for deflecting the floss is omitted, as the guide grooves 13b, 14b in the arms both extend in the direction of this device.

Instead of a hydraulically driven hand-held appliance, of course, an electrically driven appliance with an electric motor can be used, as described for example in US patent 2,917,758 or in Swiss patent 646,554, corresponding to West German Offenlegungsschrift 3,025,675. These electric motors installed in the housing of the appliance are oscillating-armature motors, in which the armature oscillates at the frequency of the a.c. network to which the motor is connected. The shaft driving the instrument is mounted directly on the motor armature. In these cases of motors, the amplitude of oscillation of the armature decreases with increasing load, which is an advantage when using a dental floss holder, as mentioned above. Furthermore, there is known the technique of fitting electrically operated appliances of this kind with variable resistors or other components which alter the voltage, for the purpose of varying the supply voltage of the motor and hence the amplitude of oscillation, so that the user can reduce the amplitude of oscillation as required when he uses the dental floss holder.

Finally, a known hand-held appliance which comprises a shaft
oscillated by a small rotating motor via a movement transducer and a mechanical device for adjusting the amplitude of oscillation, is also suitable for operation with an attached dental floss holder according to the invention. A hand-held appliance of this kind with mechanically adjustable amplitude of oscillation of the driven instrument is described in Swiss patent 636,509, corresponding to West German Offenlegungsschrift 2,944,391.
CLAIMS
THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. Dental floss holder with two arms which are arranged in a fork shape and between which the dental floss can be stretched along an intercept, wherein the position of the taut floss is defined by fixing points provided on the arms, characterised in that the holder is designed as a detachable instrument for a hand-held appliance for dental care, which comprises a rotatably mounted shaft for the instrument and a motor which oscillates this shaft about its own axis, that the straight line passing through the intercept and the axis of rotation of the holder are skew lines, said straight line passing through the intercept being inclined at an angle \( \alpha \) to a plane oriented perpendicularly to said axis of rotation, that the distance between the fixing point on one arm and the axis of rotation is smaller than the distance between the fixing point on the other arm and the axis of rotation, and that the perpendicular drawn from the first-mentioned fixing point to the axis of rotation forms, with the vertical projection of the intercept to the plane passing through the perpendicular and perpendicular to the axis of rotation, an angle \( \beta \) which is at least 90°.

2. Dental floss holder according to claim 1, characterised in that the angle of inclination \( \alpha \) is between 10° and 40°, preferably about 20°.

3. Dental floss holder according to claim 1 or 2, characterised in that the distance between the fixing point on one arm and the axis of rotation is between 8 and 20mm, preferably about 12mm, and the distance between the fixing point on the other arm and the axis of rotation is between 15 and 45mm, preferably about 25mm, and that the angle \( \gamma \) is between 95° and 150°, preferably about 110°.

4. Dental floss holder according to any of claims 1 to 3, characterised in that the two arms curve in different planes with different curvatures or are bent with different angles.
5. Dental floss holder according to claim 4, characterised in that one curved arm lies in a plane which is oriented parallel to the axis of rotation of the holder or in which this axis of rotation extends, and the other curved arm lies in a plane at an angle to this axis of rotation.

6. Dental floss holder according to any of claims 1 to 5, characterised in that the arms have rounded ends.

7. Dental floss holder according to any of claims 1 to 6, characterised in that the dental floss is guided along the arms in grooves which open out into notches which form fixing points.

8. Dental floss holder according to any of claims 1 to 7, characterised in that it is provided with a tensioning and mounting device for the floss, consisting of a pot-shaped body and, coaxial therewith, a button which is movable in the axial direction and which in its clamping position is pressed into the interior of the pot-shaped body.

9. Dental floss holder according to any of claims 1 to 8, characterised in that it comprises a tensioning and mounting device consisting of a screw which can be screwed into a threaded opening in its shank.

10. Dental floss holder according to any of claims 1 to 9, characterised in that it is fitted with a supply reel for the dental floss.

DATED this ELEVENTH day of FEBRUARY 1987

LES PRODUITS ASSOCIES LPA-BROXO S.A.

Patent Attorneys for the Applicant
SPRUSON & FERGUSON
including the best method of performing it known to us.