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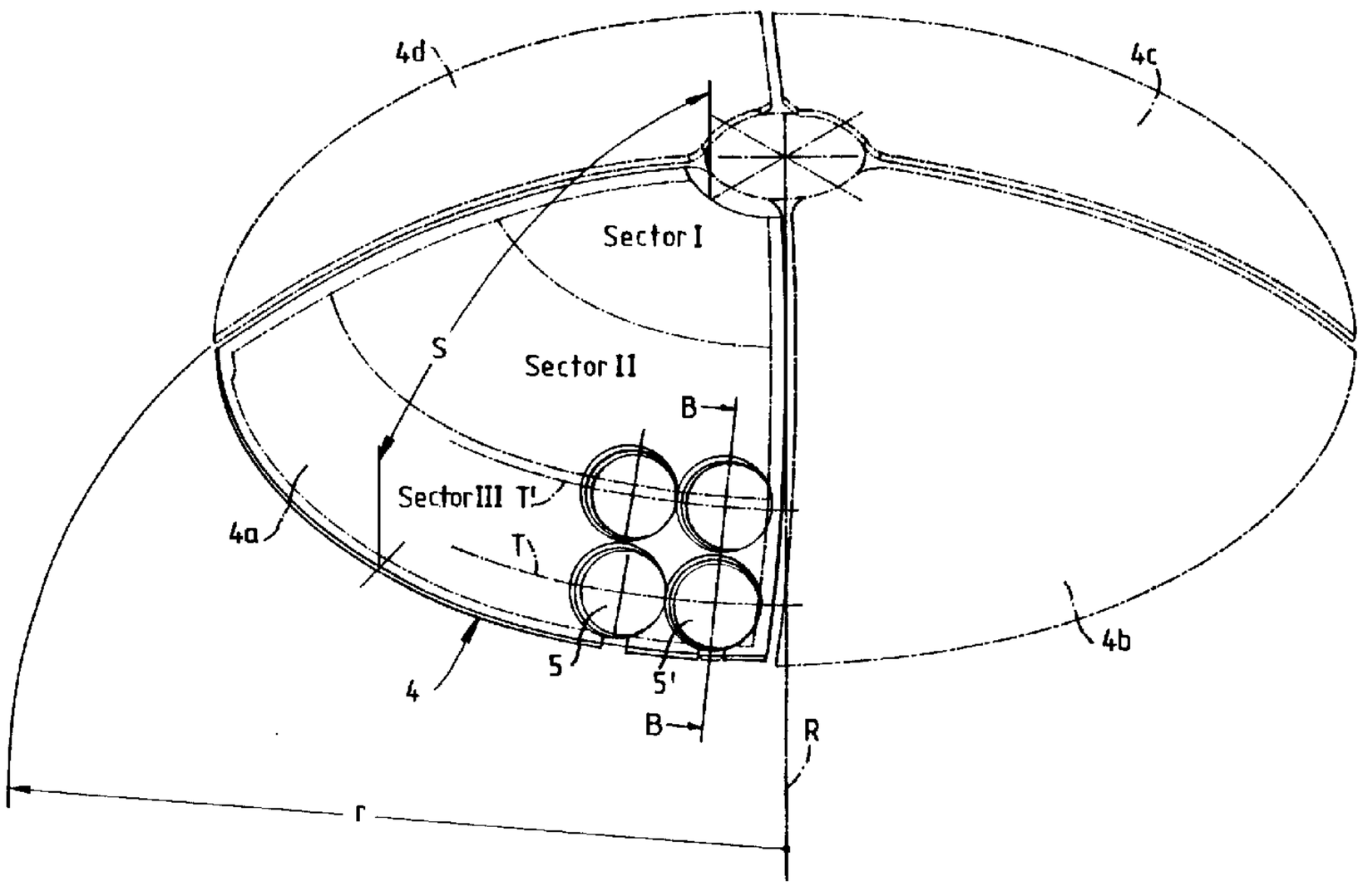
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(54) **DISPOSITIF POUR TENIR LES LENTILLES, NOTAMMENT POUR LE REVETEMENT SOUS VIDE DES LUNETTES PAR PULVERISATEUR**

(54) **DEVICE FOR HOLDING LENSES, ESPECIALLY FOR EYE GLASSES TO BE COATED IN A VACUUM COATING OF SPUTTERING MACHINE**



(57) In a device for holding lenses for eye glasses to be coated (3,3',...) with a substrate holder (4) consisting of cap-like sheet-metal blanks (4a,b,c,d) forming a dish in the form of a spherical segment and having several drill-holes (5,5',...), rotating on a vertical axis (R) in the vacuum chamber (2) above a coating source (Q), the coating source (Q) being mounted to the side of the axis of rotation (R) and the lenses (3,3',...) being placed and held in the drill-holes (5,5',...), the mean perpendicular (M) of the respective drill-hole longitudinal axis (A) intersects the axis of rotation (R) of the substrate holder (4) at a point (O) roughly halfway between the two locations which are the points of intersection (C, F) of the mean perpendiculars (M',M ") of two notional drill-holes of the same drill-hole pitch circle (T) with the axis of rotation (R), whose drill-hole longitudinal axes (A',A ") intersect the coating source (Q), the one notional drill-hole however having the largest and the other notional drill-hole having the shortest distance from the coating source (Q).

Summary

In a device for holding lenses for eye glasses to be coated (3,3',...) with a substrate holder (4) consisting of cap-like sheet-metal blanks (4a,b,c,d) forming a dish in the form of a spherical segment and having several drill-holes (5,5',...), rotating on a vertical axis (R) in the vacuum chamber (2) above a coating source (Q), the coating source (Q) being mounted to the side of the axis of rotation (R) and the lenses (3,3',...) being placed and held in the drill-holes (5,5',...), the mean perpendicular (M) of the respective drill-hole longitudinal axis (A) intersects the axis of rotation (R) of the substrate holder (4) at a point (O) roughly halfway between the two locations which are the points of intersection (C,F) of the mean perpendiculars (M',M'') of two notional drill-holes of the same drill-hole pitch circle (T) with the axis of rotation (R), whose drill-hole longitudinal axes (A',A'') intersect the coating source (Q), the one notional drill-hole however having the largest and the other notional drill-hole having the shortest distance from the coating source (Q).

Fig. 2

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Device for holding lenses, especially for eye glasses to be coated in a vacuum coating or sputtering machine

The invention relates to a device for holding lenses, especially eye glasses to be coated in a vacuum coating or sputtering machine, with a substrate holder consisting of cap-like sheet-metal blanks forming a dish in the form of a spherical segment, and with numerous drill-holes, that is mounted in the vacuum chamber above a coating source, revolving on a vertical axis, with the coating source mounted to the side of the axis of rotation, the lenses being placed in the drill holes and held and centered in the drill holes.

A device of the type in question is disclosed (US 3,859,956) in which the lenses to be coated are inserted in rings which are in turn held by a frame located at a distance above the coating source, and the rings can be tilted relative to the frame, in such a way that the lenses can be aligned with their curved surfaces towards the source. In this device the axis of rotation of the frame runs plumb through the source.

Another device is disclosed (DE-OS 39 21 672) for holding and turning lenses, specially for eye glasses to be coated in a high-vacuum coating machine or sputtering machine, with a pair of rings supporting the lens to be held, that in turn can be connected to a substrate holder that is held in the process chamber of the high-vacuum machine, with the cap-like or half-dish-shaped metal sheet forming the substrate holder at least partly overlapped by a sickle-shaped sheet-metal blank or sectional element forming a slide or rake, the edge of the rake facing towards the substrate holder being held a small distance away from the outer surface of the substrate holder by a slider or articulated arm, the rake being movable in this position relative to the top side of the substrate holder around the axis of rotation of the substrate holder.

A vacuum coating machine has also been proposed for depositing blooming coats on optical substrates (DE-OS 37 15 831) such as

plastic eye lenses, that can be clamped on carriers rotating in an evacuatable container above evaporating sources whereby the carriers include a majority of flat carrier plates that are at least approximately in the shape of a segment of a circle, which are supported in a dome shape relative to each other and can each turn through 180° at a common supporting axis of rotation, each carrier plate having a majority of substrate mountings with at least one holding spring in the opening areas, of which at least one can tilt freely to both sides from the carrier plate plane up to a predetermined angle.

Finally a device has been disclosed (US 4,449,478) for coating lens-shaped substrates including a cap-like substrate holder with several drill-holes arranged on two pitch circles to hold the lenses, the drill-holes being all aligned to the source located below the substrate holder, in such a way that the longitudinal axes of the drill-holes all intersect at the vertical axis of rotation of the substrate holder at one point. The coating source is located comparatively close to the point of intersection of the longitudinal axis.

The function of the present invention is to create a device of the type in question that enables largely even coating, even with machines in which the coating source is located not centrally beneath the substrate holder, but off center, near the axis of rotation of the cap-like substrate body. The device is also

intended to be adjustable to the peculiarities of a coating source, for example the form of the "evaporator beam".

This function is carried out in the device disclosed by having the drill-holes enclosing and centering the rotating cylindrical rims of the lenses roughly aligned towards
the coating source, with the mean perpendicular of the drill-hole longitudinal axis concerned intersecting the axis of rotation of the substrate holder at a point located roughly centrally between two points that are the points of intersection of the mean perpendiculars of two notional drill-holes of the same drill-hole pitch circle with the axis of rotation whose drill-hole longitudinal axes intersect the coating source, but with a notional drill-hole having the largest distance from the coating source and the other notional drill-hole having the shortest distance from the coating source

The oblique coatings that normally occur when coating spherical surfaces of lenses, the so-called half-moon effects, are to a large extent reduced by tilting the lenses in respect of the surface of the substrate holder through a certain angle.

Further details and features are described and characterized in greater detail in the patent claims.

The invention admits of the most diverse range of configurations,

one of which is shown schematically in the appended drawing, showing the following:

Fig. 1 The spatial formation underlying the device

Fig. 2 The perspective view of a substrate holder in the form of 4 half-shell-shaped sheet-metal parts with several drill-holes.

Fig. 3 A partial section according to the lines B-B as per Fig. 2, and

Fig. 4 A section S through the 3 sectors of a sheet-metal part as per Fig. 2.

The substrate holder 4 consists principally of 4 equal sheet-metal blanks 4a, b, c, d, that together form a shell in the shape of a spherical segment that revolves on the vertical axis R in the vacuum chamber 2. As shown in Fig. 1, the crown of the shell-shaped substrate holder 4 or its radius of curvature K is somewhat smaller than the diameter D of the substrate holder 4, all drill-holes 5,5', ... of a pitch circle T, T', ... being aligned roughly to the coating source Q, whereby the mean perpendicular M of the respective drill-hole longitudinal axis A or the straight line perpendicular to the optical axis between the two curved surfaces of the lens intersects the axis or rotation R of the substrate

holder 4 at a point O located roughly half-way between two locations that are the points of intersection C, F of the mean perpendicular M',M'' of two notional drill-holes of the same drill-hole pitch circle T with the axis of rotation R, whose drill-hole longitudinal axes A',A'' intersect the coating source, the one notional drill-hole however having the largest distance from the coating source Q and the other notional drill-hole having the shortest distance from the coating source Q.

As shown in Fig. 2, the substrate holder 4 comprises 4 equal sheet-metal blanks 4a,b,c,d, each of these four sheet-metal blanks being divided into three zones I to III, the respective (approximate) correction angles α being listed in a table for each sector. These correction angles α are derived for the various pitch circles T,T',... or sectors, two of which are indicated in Fig. 2. Depending on the lens diameter specified, more or fewer pitch circles T,T',... can be provided, the corrective value of the sector I to III in which the pitch circle falls being provided for each of the drill-holes 5,5',.... (The four drill-holes 5,5',... indicated in Fig. 2 are accordingly all allocated to sector III.)

The following tables list examples of the main dimensions of coating machines, the second table giving the correction angle α for a machine with a substrate holder 4 with a radius of curvature K of 750 mm in length and for lenses with a diameter d = 65 mm, the angles α,... being corrected in each case by a small amount that is

derived from the form and size of the plasma cloud (vapor beam) of a particular evaporator source, and is determined in series of practical trials.

ϕD	H	K
550	580	400
725	710	500
950	1110	750
1110	1110	750
1500	1500	1000

Sector	I	II	III
α [°]	1.5	4.0	5.5
t [mm]	0.9-0.2	2.3-0.2	3.2-0.2

Patent Claims

1. Device for holding lenses, especially for eye glasses (3,3'...) to be coated in a vacuum coating machine or sputtering machine, with a substrate holder (4) consisting of cap-like sheet-steel blanks (4a,b,c,d) forming a dish in the form of a spherical segment, having several drill-holes (5,5',...), rotating around a vertical axis (R), in the vacuum chamber (2) above a coating source (Q), the coating source (Q) being mounted to the side of the axis of rotation (R) and the lenses (3,3',...) being placed in the drill-holes (5,5',...) and held and centered in the drill-holes (5,5',...), **whereby** the drill-holes (5,5',...) enclosing and centering the rotating cylindrical rims (6,6',...) of the lenses (3,3',...) are each roughly oriented towards the coating source (Q), the mean perpendicular (M) of the respective drill-hole longitudinal axis (A) intersecting the axis of rotation (R) of the substrate holder (4) at a point (O) that lies roughly halfway between two points that are the points of intersection (C,F) of the mean perpendiculars (M',M'') of two notional drill-holes of the same drill-hole pitch circle (T) with the axis of rotation (R), whose drill-hole longitudinal axes (A',A'') intersect the coating source

(Q), one notional drill-hole however having the largest and the other notional drill-hole the shortest distance from the coating source (Q).

2. Device as per Claim 1 **whereby** the drill-holes (5,5',...) are in the form of concentric two-stage drill-holes, the first drill-hole stage turned away from the coating source (Q) being slightly larger, corresponding to the external diameter of the lenses.

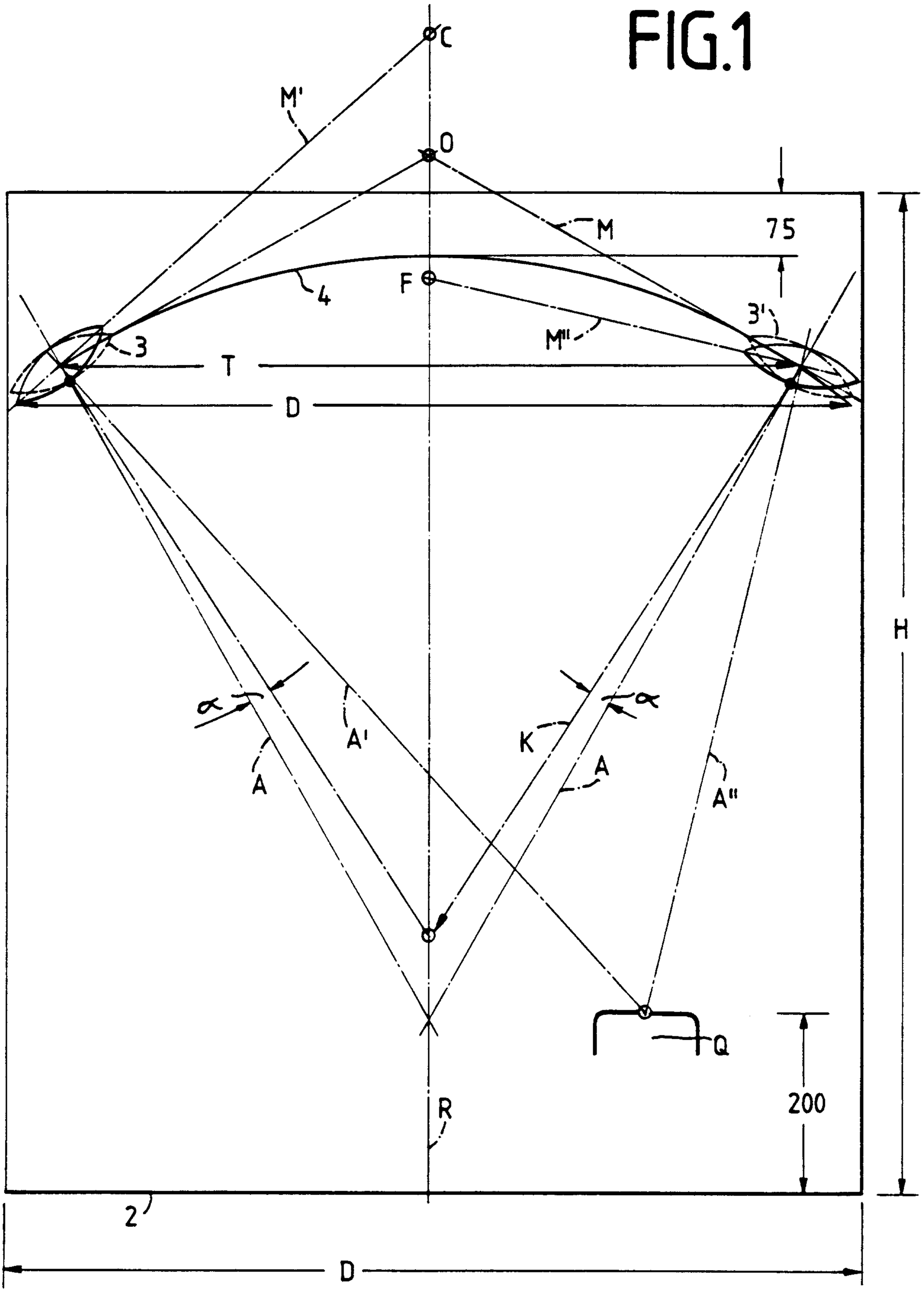
3. Device as per Claims 1 and 2 **whereby** all drill-holes located on a pitch circle (T,T',...) include the same angle (α) with the axis of rotation (R).

4. Device as per the preceding Claims **whereby** all drill-holes (5,5',...) oriented towards the coating source are changed by an additional correction angle to the mounting of the lenses (3,3',...) in their angular position (α) relative to the axis of rotation (R), as a function of the output of the coating source (Q), especially the form and size of the plasma cloud it emits, this correction angle reducing as the plasma cloud increases in size, and vice versa.

Reference List of Symbols

2.	Vacuum chamber
3,3'...	Eye glass, lens
4	Substrate holder
5,5',...	Drill-hole
6,6',...	Lens rim
A,A',...	Drill-hole longitudinal axis
C	Point of intersection
D	Diameter
F	Point of intersection
K	Radius of curvature
M,M',...	Mean perpendicular
O	Point of intersection
Q	Coating source
R	Axis of rotation
T	Drill-hole pitch circle

FIG.1



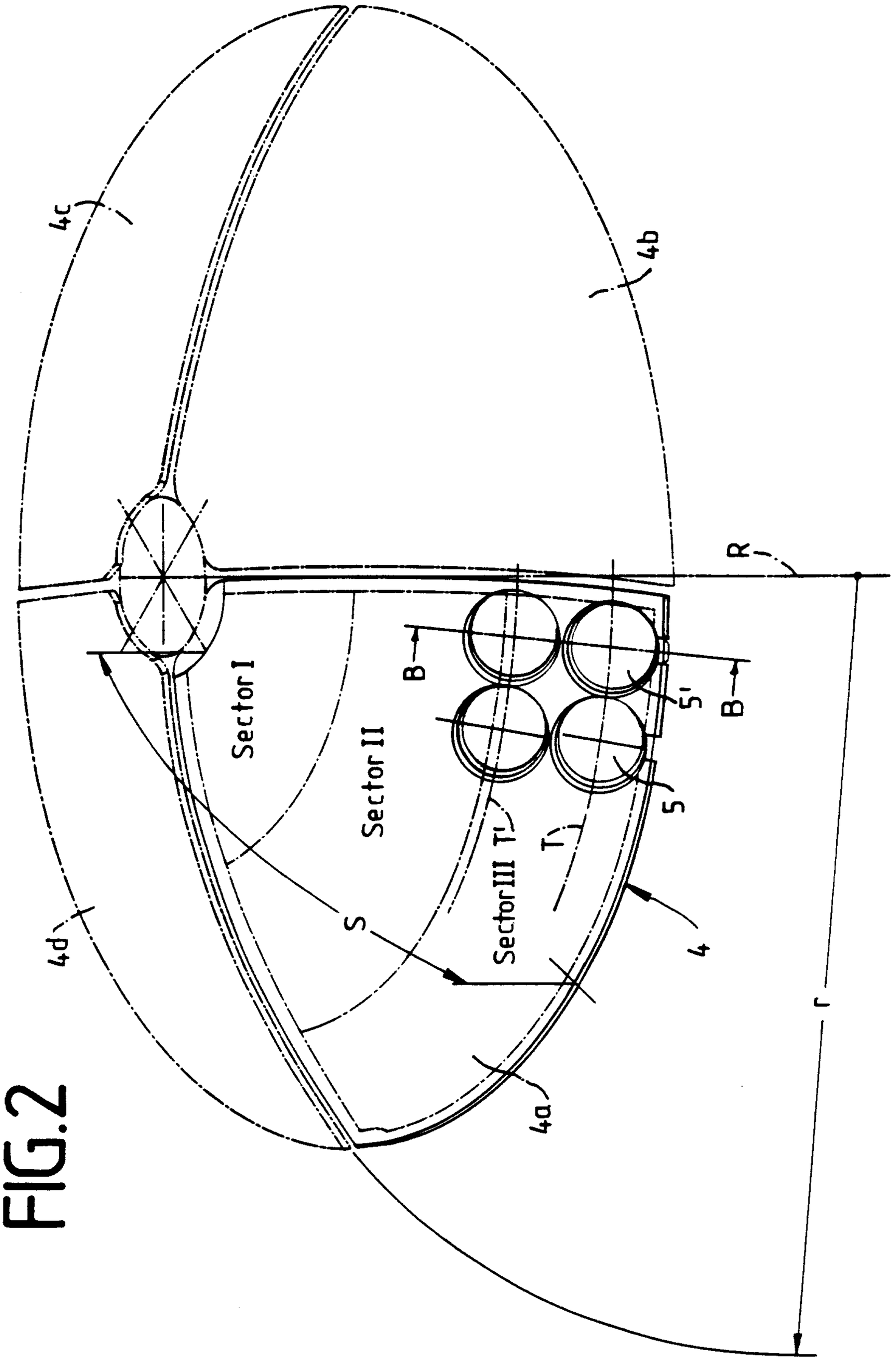


FIG.2

FIG.3

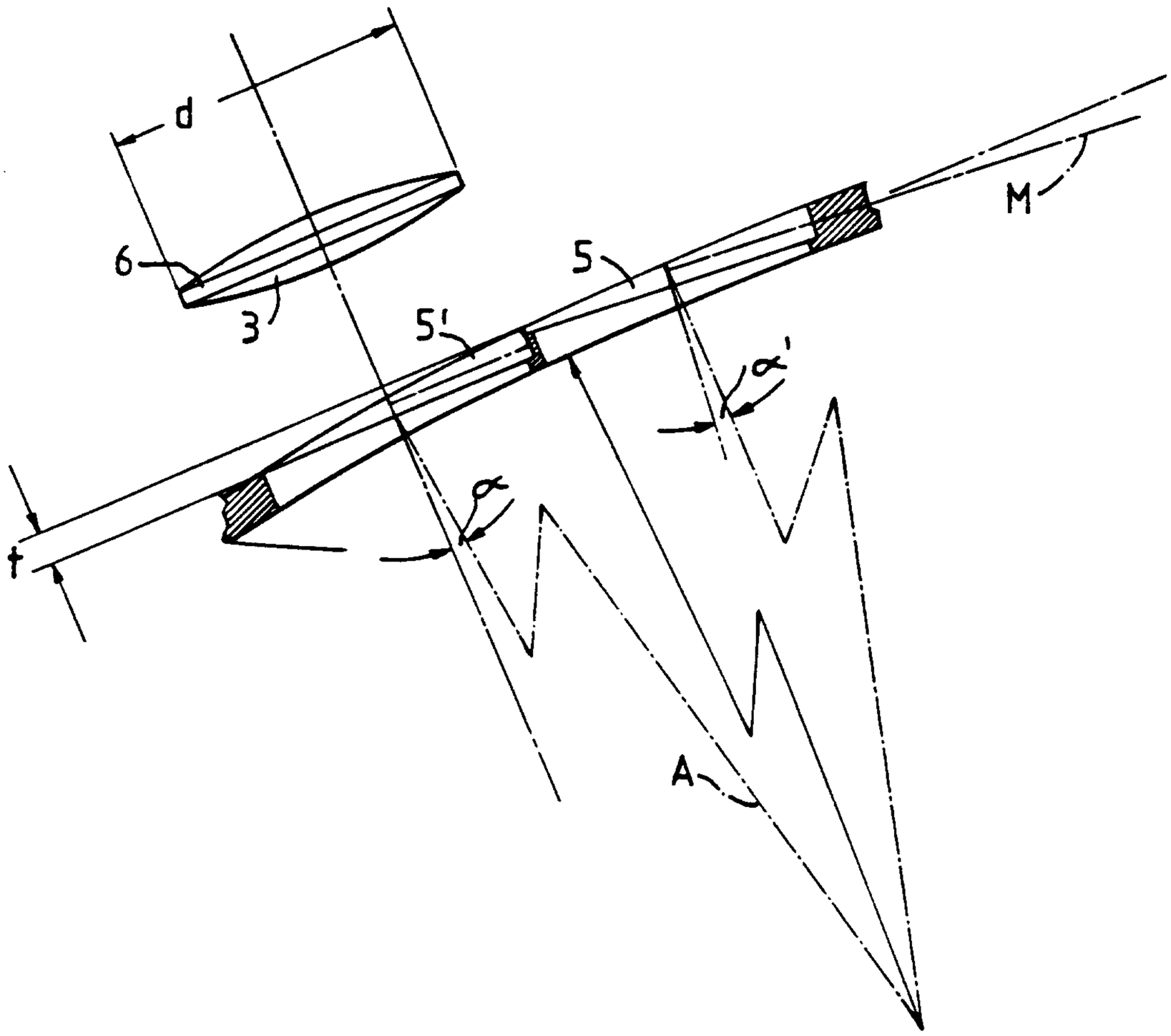


FIG.4

