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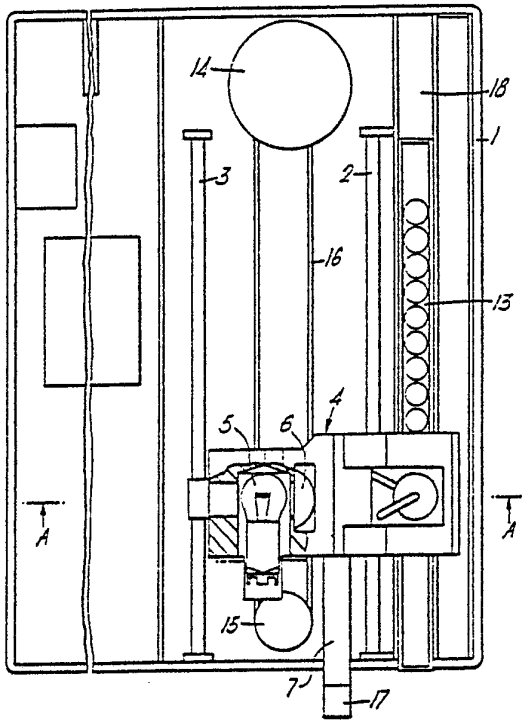
In English translation (filed in Finnish)

(54) Title: PHOTOMETER

(57) Abstract

Photometer which comprises a source of light (5), from which the measurement light is arranged to be passed through a lens (6) and a filter (7) onto a semi-transparent mirror (8) placed on the path of the light preferably at an angle of 45°, the reference beam of light (9) being arranged as passing through the said mirror onto a reference detector (11) and the measurement beam of light (10) reflected from the said mirror being arranged as passing to the measurement detector (12). According to the invention, the said source of light (5), lens (6), filter (7), semi-transparent mirror (8), and the reference detector (11) and the measurement detector (12) are placed in an optics frame (4) of one piece, the said optics frame being movable in relation to the frame and case part (1) of the photometer along one or several guides (2, 3). The track of movement of the optics frame consists of linear movement back and forth, the length of the movement corresponding the length of the in-line cuvette set (13) to be measured by means of the photometer.



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Photometer

The subject of the present invention is a photometer, which comprises a source of light, from which the measurement light is arranged to be passed through a lens and a filter onto a semi-transparent mirror placed on the path of the light preferably at an angle of 45°, the reference beam of light being arranged as passing through the said mirror onto a reference detector and the measurement beam of light reflected from the said mirror being arranged as passing to the measurement detector.

The object of the invention is to provide a photometer that is handy in use, has small external diameters and compact construction. The photometer in accordance with the invention is mainly characterized in that the said source of light, lens, filter, semitransparent mirror, and the reference detector and the measurement detector are placed in an optics frame of one piece, the said optics frame being movable in relation to the frame and case part of the photometer along one or several guides.

The invention comes out more closely from the following description and from the attached drawings, wherein

Figure 1 shows the photometer as a top view with the cover structure of the photometer removed and

Figure 2 shows a section along line A-A in Fig. 1.

As is shown in Figures 1 and 2, horizontal guides 2 and 3 are fitted in the frame and case part 1 of the photometer, the optics frame 4 being arranged as movable along the said guides. The shifting of the optics frame 4 along the guides 2 and 3 can take place, e.g., by means of a cogbelt 16 fitted between an electric motor 14 suitable for the purpose and a pulley 15, the cogbelt 16 being at one point fastened to the optics frame 4. The operation of the electric motor 14 is

controlled by means of some automatic control system suitable for the purpose.

A source of light 5, a lens 6, a filter 7, a semi-transparent mirror 8, a reference detector 11, and a measurement detector 12 are fitted onto the optics frame movable in relation to the frame and case part 1. The beam of light from the source of light 5 through the lens 6, the filter 7 and the semi-transparent mirror 8 is passed horizontally to the reference detector 11. The vertical measurement beam of light 10 reflected from the semi-transparent mirror 8 is, in the example case shown by the figures, passed through the bottom of the cuvette to be measured, out of the cuvette set 13, and through the liquid to be measured in the cuvette to the measurement detector 12. The results from the reference detector 11 and from the measurement detector 12 are produced as an output and processed in a known way. The handle portion 17 of the filter unit 7 projects to the side of the frame and case part 1 to the outside so that the filter can be easily replaced in the optics frame 4 by just pulling the filter 7 out and by pushing another filter into its place. The semi-transparent mirror 8 is placed preferably at an angle of 45° in relation to the horizontal plane and to the beam of light coming from the lamp 5 so that the measurement beam of light 10 is reflected from the mirror 8 straight upwards.

Between the semi-transparent mirror 8 and the measurement detector 12 there is an open space in the optics frame for the in-line cuvette set 13 to be measured, pushed into the sample channel 18 in the frame and case part 1. The cuvette set 13 is pushed from the side of the photometer into the sample channel 18 into a specified position, where the cuvette set 13 remains stationary throughout the entire process of measurement, whereas the optics frame 4 is shifted manually or mechanically in relation to the stationary object of measurement, i.e. alternatingly onto each cuvette to be measured

out of the cuvette set 13.

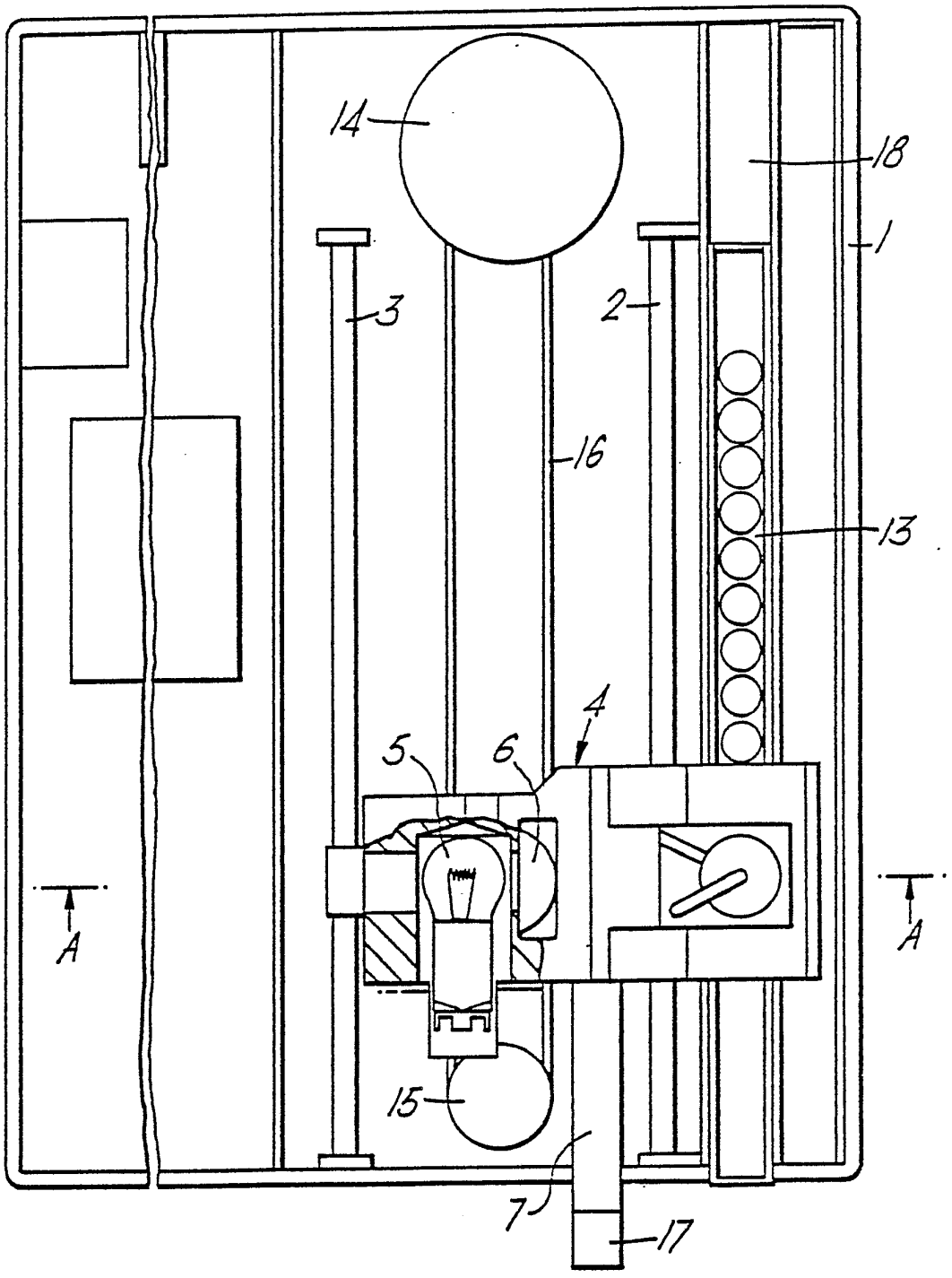
If the cuvette set were shifted in relation to a stationary optics part, which is normally the case, the track along which the cuvette set is shifted must be at least twice as long as the cuvette set. When the cuvette set is stationary and the optics part is shifted in relation to the cuvette set, the required maximum length of movement is equal to the length of the cuvette set. Since the maximum dimension of the photometer is determined in accordance with the length of the cuvette set, the photometer can be made a device of a very small size and highly compact.

WHAT IS CLAIMED IS:

1. A photometer, which comprises a source of light (5), from which the measurement light is arranged to be passed through a lens (6) and a filter (7) onto a semi-transparent mirror (8) placed on the path of the light preferably at an angle of 45°, the reference beam of light (9) being arranged as passing through the said mirror onto a reference detector (11) and the measurement beam of light (10) reflected from the said mirror being arranged as passing to the measurement detector (12), c h a r a c t e r i z e d in that the said source of light (5), lens (6), filter (7), semi-transparent mirror (8), and the reference detector (11) and the measurement detector (12) are placed in an optics frame (4) of one piece, the said optics frame being movable in relation to the frame and case part (1) of the photometer along one or several guides (2, 3).

2. A photometer as claimed in claim 1, c h a r a c t e r i z e d in that the beam of light from the source of light (5) through the lens (6), the filter (7) and the semi-transparent mirror (8) is passed horizontally to the reference detector (11) and that the vertical measurement beam of light (10) reflected from the semi-transparent mirror (8) passes onto the measurement detector (12), which is placed above the semi-transparent mirror (8) located on the path of the light at an angle of 45°.

Fig. 1.



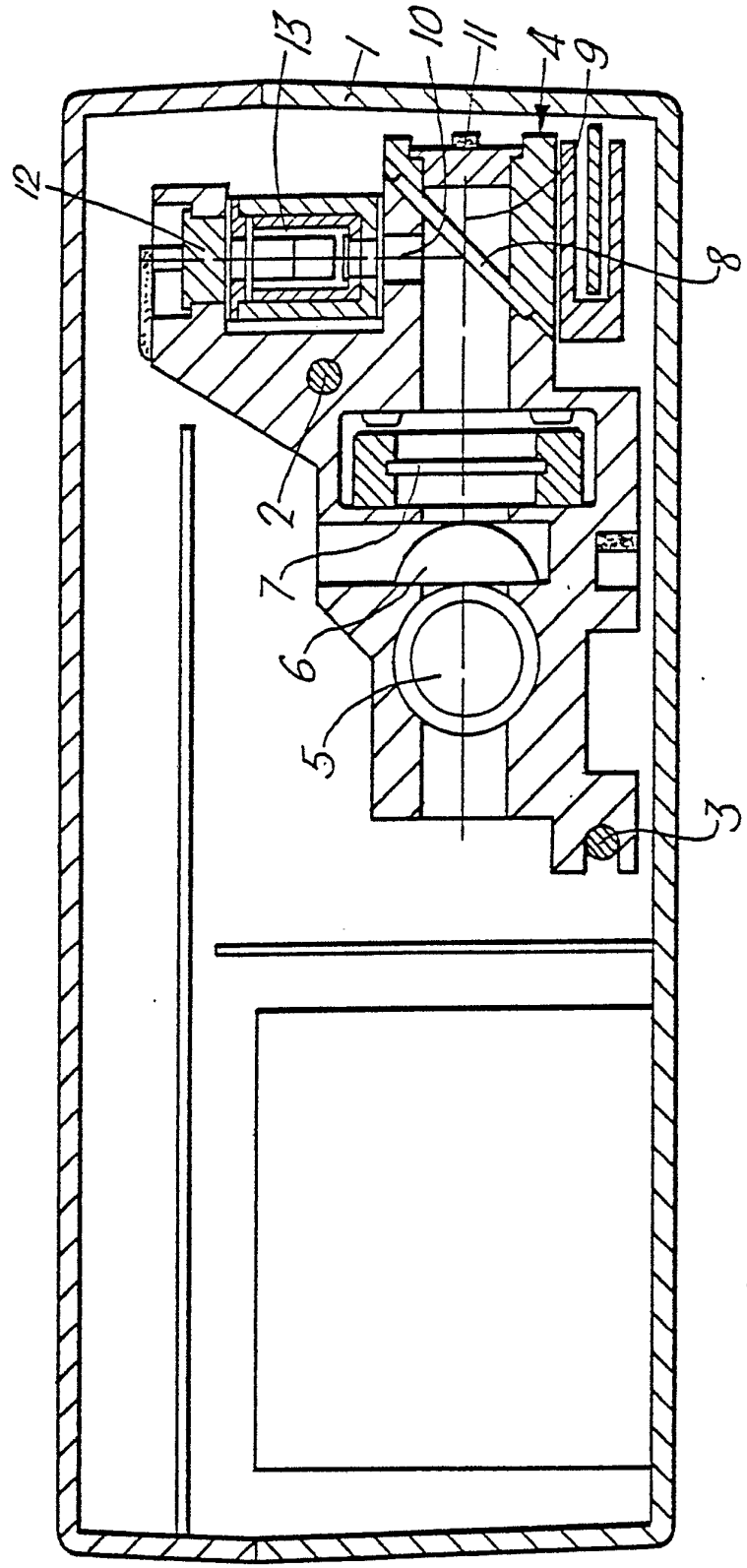


Fig. 2.

INTERNATIONAL SEARCH REPORT

International Application No PCT/FI81/00055

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [3]

According to International Patent Classification (IPC) or to both National Classification and IPC 3

G 01 N 21/27

II. FIELDS SEARCHED

Minimum Documentation Searched [4]

Classification System	Classification Symbols
IPC 3	G 01 N 21/01, 21/03, 21/13, 21/17, 21/25, 21/27, 21/31, 21/84, 21/90, G 01 J 1/10, 1/16, 1/42, 3/50 .../...

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [5]

SE, NO, DK, FI classes as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT [14]

Category *	Citation of Document, [16] with indication, where appropriate, of the relevant passages [17]	Relevant to Claim No. [18]
A	SE, A, 7705864-2 published 1977, November 20, Gesellschaft f. Strahlen- u. Umwelt-forschung mbH	
A	CH, A, 516 156 published 1972, January 14, Measurex Corporation	
A	DE, A1, 2 218 134 published 1972, October 26, Mandrel Industries Inc	
A	DE, A1, 2 618 233 published 1977, November 10, Alkem GmbH	
A	WO 80/00188 published 1980, February 7, Beckman Instruments Inc	
A	SE, B, 367 254 published 1974, May 20, E J Du Pont de Nemours and Co	

* Special categories of cited documents: [15]

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search [1]	Date of Mailing of this International Search Report [2]
1981-09-30	1981 -10- 06
International Searching Authority [1]	**Signature of Authorized Officer [20]**
Swedish Patent Office	Kristina Brandell

International Application No. PCT/FI81/00055

FURTHER INFORMATION CONTINUED FROM THE SECOND SHEET

II	Continuation Fields Searched
IPC [2]	G 01 N 21/22, 21/24, 21/28
US Cl	356:179, 195, 206, 219, 222, 229, 234, 246, 407, 411, 435, 436, 440, 442

V. ☐ OBSERVATIONS WHERE CERTAIN CLAIMS WERE FOUND UNSEARCHABLE [10]

This international search report has not been established in respect of certain claims under Article 17(2) (a) for the following reasons:

1. ☐ Claim numbers . . . . . , because they relate to subject matter [12] not required to be searched by this Authority, namely:

2. ☐ Claim numbers . . . . . , because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out [13], specifically:

VI. ☐ OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING [11]

This International Searching Authority found multiple inventions in this international application as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims of the international application.

2. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims of the international application for which fees were paid, specifically claims:

3. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claim numbers:

4. ☐ As all searchable claims could be searched without effort justifying an additional fee, the International Searching Authority did not invite payment of any additional fee.

Remark on Protest

☐ The additional search fees were accompanied by applicant's protest.

☐ No protest accompanied the payment of additional search fees.