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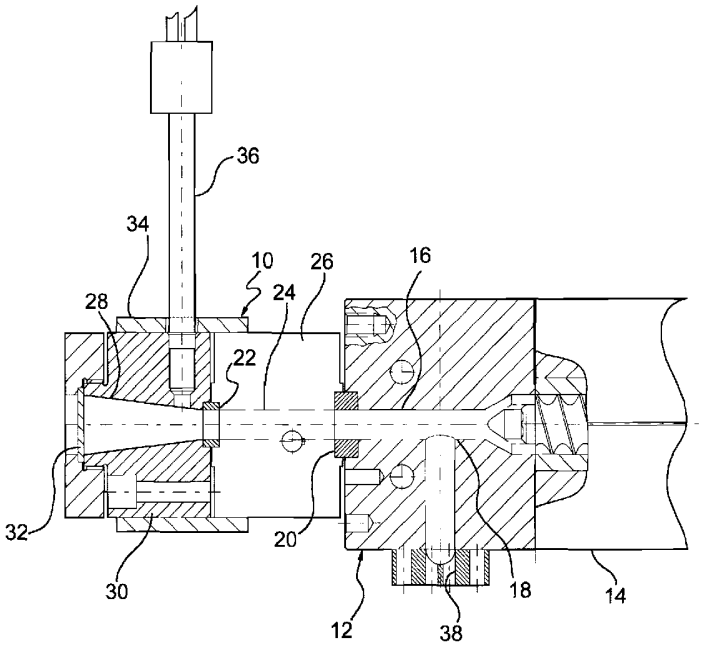
For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) **Title:** APPARATUS AND METHOD FOR CARRYING OUT THE PRESSURE FILTER TEST



(57) **Abstract:** The apparatus (10) is used for performing the pressure filter test on a material formed by mixing a filler and/or a pigment with a polymer matrix, on-line while mixing is carried out in an extruder (14). The apparatus comprises: means of directing, into a measuring pipe (22), just a fraction of the stream of material that has been extruded or is undergoing mixing in extruder (14); a pump (26) capable of guaranteeing a constant delivery, and located on the measuring pipe (22); a filter (32) positioned across the measuring pipe (22) downstream of the pump (26); and means of measuring the pressure drop through the filter (32).

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APPARATUS AND METHOD FOR CARRYING OUT THE PRESSURE FILTER TEST

The present invention relates to an apparatus for carrying out the pressure filter test on a material formed by mixing a filler and/or a pigment with a polymer matrix, and to the associated test procedure.

The pressure filter test has been used commonly and widely for many years in the plastics industry for assessing how well fillers and/or pigments are dispersed in a polymer matrix.

According to a known test method, a small amount of material already mixed in a process extruder is diluted with virgin polymer, extruded in another suitable extruder and then passed through a filter by the action of a gear pump mounted downstream of the extruder head. Here, a sensor records the pressure increase caused by the progressive deposition, on the surface of the filter, of particles of filler and/or pigment that have not mixed perfectly in the polymer matrix. The value of the parameter measured at the end of the test is thus determined by the time taken to reach a given pressure increase or by the pressure increase recorded on extruding a predetermined amount of pigment or filler.

The known method described above has the drawbacks that it requires a suitable extruder, dilution with virgin polymer is necessary, and execution of the test takes quite an appreciable time, which can be estimated as at least half an hour, plus the time required for cleaning the extruder.

To avoid the aforementioned drawbacks, the subject-matter of

the present invention is an apparatus for carrying out the pressure filter test and the associated test procedure, having the characteristics referred to specifically in the Claims given later.

The apparatus of the invention offers the advantage of being able to work directly on the extruded material or during mixing by a process extruder without the need to carry out any dilution with virgin polymeric material, or of using an additional dedicated extruder. It is moreover compatible with essentially any type of extruder used conventionally for mixing a polymer matrix with a filler or pigment. Furthermore, both the material that passed through the test filter and the material used for "washing" the apparatus between successive measurements can be returned to the production cycle, with an obvious economic benefit.

The apparatus of the invention offers the further advantage of carrying out a single measurement in a very short time - of the order of 15 minutes - so that said measurement can be repeated often and it permits systematic quality control according to automated procedures.

It should further be pointed out that as the apparatus of the invention is also able to conduct the test on material while it is being mixed in the extruder, it means that process control can be performed substantially in real time. Consequently, any defects can be corrected as soon as they occur, avoiding the production of batches of material which must then be scrapped after testing for verification of quality.

Further advantages and characteristics of the present

invention will become clear from the detailed description given hereunder, which refers to the appended drawings, supplied as a non-limiting example, in which:

Fig. 1 is a front view of apparatus of the invention, mounted on an extruder,

Fig. 2 is a sectional view along line II-II in Fig. 1, and

Fig. 3 is a schematic representation of various possible sites for installation of the apparatus of the invention on an extruder.

An apparatus 10 for carrying out the pressure filter test is mounted (Figs. 1 and 2) downstream of the head 12 of an extruder 14 intended for producing a material formed by mixing a filler and/or a pigment with a polymer matrix.

Inside the head 12 of the extruder 14, there is a branch pipe 16 which starts from an outlet pipe 18 for the extruded material and ends at the mouth 20 of a measuring pipe 22 of apparatus 10.

The measuring pipe 22 comprises a first section 24 provided inside the body of a pump 26 and a second section 28 provided inside a coupling 30 that supports a filter 32 placed across the pipe 22. Pump 26 is of a type that can guarantee a constant delivery, for example a gear pump.

Heat generating means - for example of the type with an electric resistor 34 - are provided round part of the body of the pump 26 and the coupling 30 that supports the filter 32.

A manometer 36 is mounted within coupling 30 to permit detection of the pressure drop through the filter 32.

The pressure filter test is carried out on line during normal operation of extruder 14, which continues to deliver mixed material through the head 38 of outlet pipe 18. By operation of the pump 26, a fraction of the extruded material is directed into the branch pipe 16 of head 12 and flows from there into the measuring pipe 22, from where it passes through the filter 32. The heat generated by electric resistor 34 maintains the extruded material in the fluid state, and therefore it can flow freely.

As flow proceeds, particles of filler and/or pigment that are not mixed perfectly in the polymer matrix are deposited progressively on the surface of filter 32, giving rise to a gradually increasing pressure drop, the values of which are measured by the manometer 36. The value of the parameter detected at the end of the test is thus determined by the time taken to cause a given pressure drop or by the magnitude of the latter after filtration of a predetermined amount of material.

It follows from the above description that - as already mentioned - execution of the test does not require interruption of normal operation of extruder 14, from which only a small fraction of the extruded material is taken. The latter can moreover be measured as it is, without the need to dilute it with virgin polymer and, at the end of the test, can be returned to the extruder 14 without any waste.

Execution of the test takes about 15 minutes, and as it is of such short duration it can be repeated whenever necessary.

Fig. 3 shows various possible sites for installation of the apparatus of the invention on the extruder 14. The

installation site of the apparatus indicate d by reference number 10a corresponds to the site at the head 12 of extruder 14, already described in detail with reference to Figs. 1 and 2. The sites of installation of the apparatuses indicated by reference numbers 10b, 10c, 10d and 10e are respective portions of the side wall of extruder 14. It should be pointed out that although the simultaneous installation of several apparatuses 10a-10e on the same extruder is not excluded, the various installation sites shown in Fig. 3 are typically alternative, and can possibly be used at different times.

For each apparatus 10b-10e, the means for directing a fraction of material into the measuring pipe 22 comprise the mouth 20 of the latter, arranged as an extension of a respective opening 40 in the side wall of the extruder 14.

The remaining components of the apparatuses 10b-10e, and the respective operating modes, correspond to those of apparatus 10a. It is only necessary to point out that the apparatuses 10b-10e do not carry out measurement on the final extruded material, but on the material at different respective stages of mixing inside the extruder 14, thus permitting process control to be performed substantially in real time. Accordingly, it is possible to correct any defects as soon as they appear, avoiding, or at least greatly reducing, the production of reject batches of material.

Naturally, without prejudice to the principle of the invention, the details of application and embodiment can be varied widely relative to what has been described purely by way of illustration, without departing from the claimed scope of the invention.

CLAIMS

1. Apparatus (10) for performing the pressure filter test on a material formed by mixing a filler and/or a pigment with a polymer matrix, on-line while said mixing is being carried out in an extruder (14), said apparatus comprising:

- means of directing, into a measuring pipe (22), just a fraction of the stream of material that has been extruded or is undergoing mixing in extruder (14),

- a pump (26) that is capable of guaranteeing a constant delivery, and is located on said measuring pipe (22),

- a filter (32) positioned across said measuring pipe (22) downstream of said pump (26), and

- means of measuring the pressure drop through the filter (32).

2. Apparatus (10) according to Claim 1, characterized in that said directing means comprise a head (12) of extruder (14), wherein a branch pipe (16) is provided, which starts from an outlet pipe (18) for the extruded material and ends in said measuring pipe (22).

3. Apparatus (10) according to Claim 1, wherein said directing means comprise a mouth (20) of the measuring pipe (22) arranged as an extension of an opening (40) made in the side wall of extruder (14).

4. Apparatus (10) according to any one of the preceding Claims, wherein said measuring pipe (22) comprises a first section (24) provided in the body of said pump (26) and a second section (28) provided in a coupling (30) that supports the filter (32).

5. Apparatus (10) according to any one of the preceding Claims, further comprising heat generating means surrounding at least part of the body of said pump (26) and/or of said coupling (30) that supports the filter (32).

6. Apparatus (10) according to Claim 5, wherein said heat generating means are constituted by an electric resistor (34).

7. Apparatus (10) according to any one of the preceding Claims, wherein said pump (26) is a gear pump.

8. Apparatus (10) according to any one of the preceding Claims, wherein said means of measuring the pressure drop through the filter (32) are constituted by a manometer (36).

9. Method of performing the pressure filter test on a material formed by mixing a filler and/or a pigment with a polymer matrix, said method envisaging the use of an apparatus according to any one of the preceding Claims on-line on an extruder wherein said mixing is in progress.

Fig.2

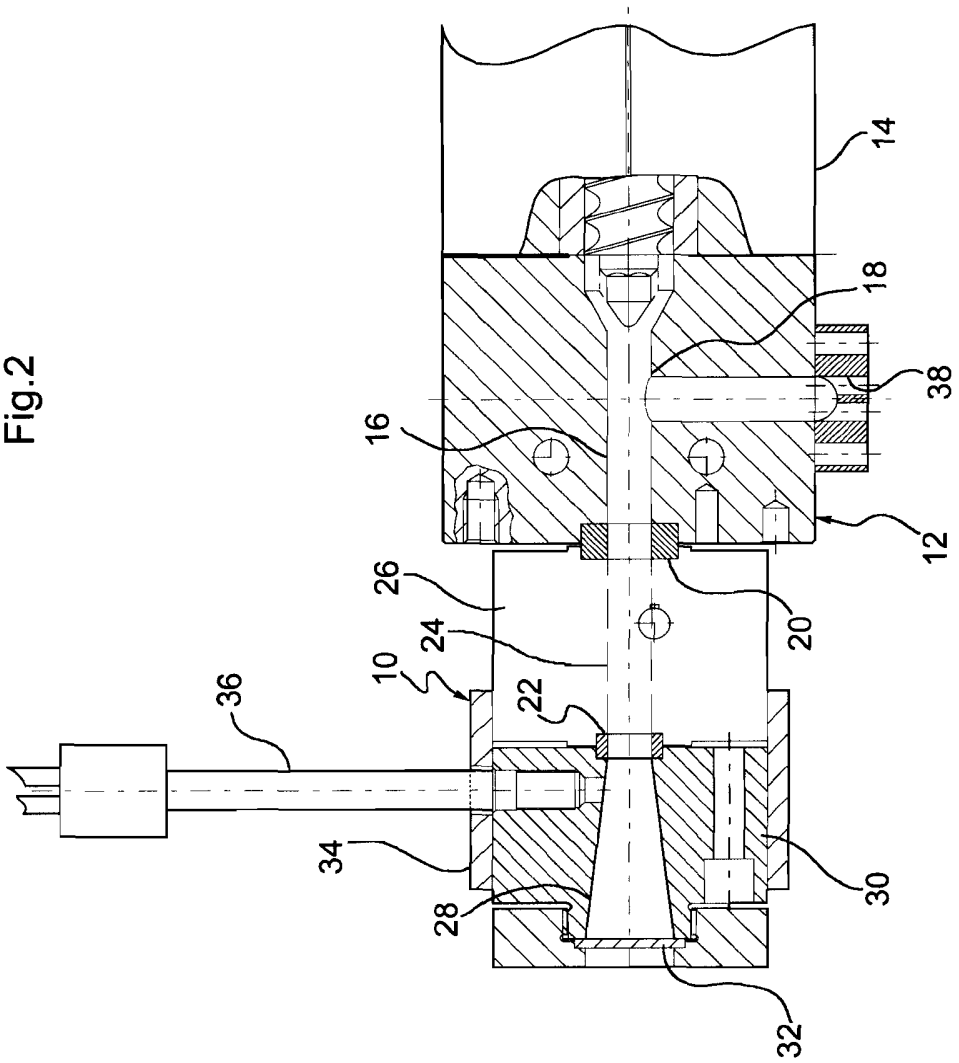
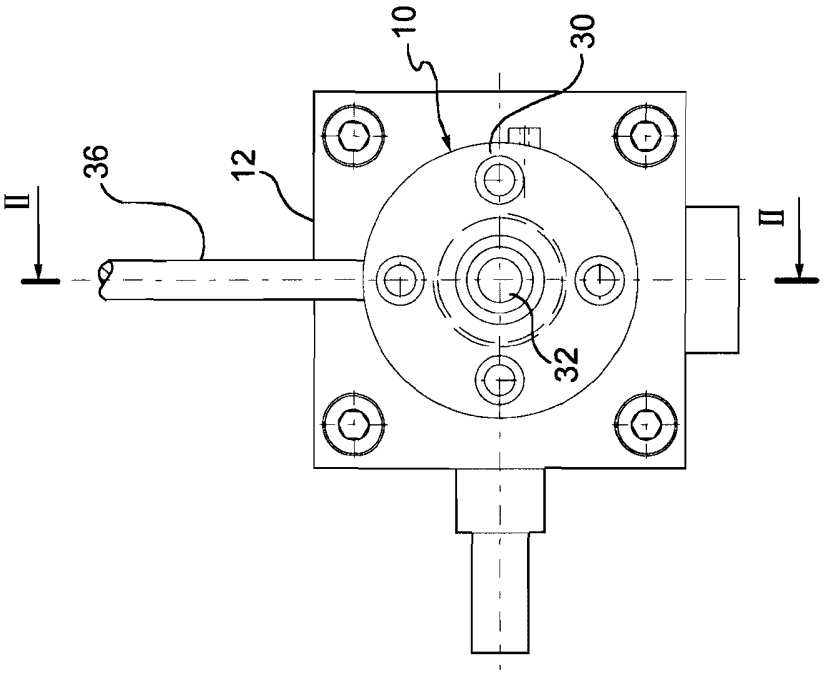


Fig.1



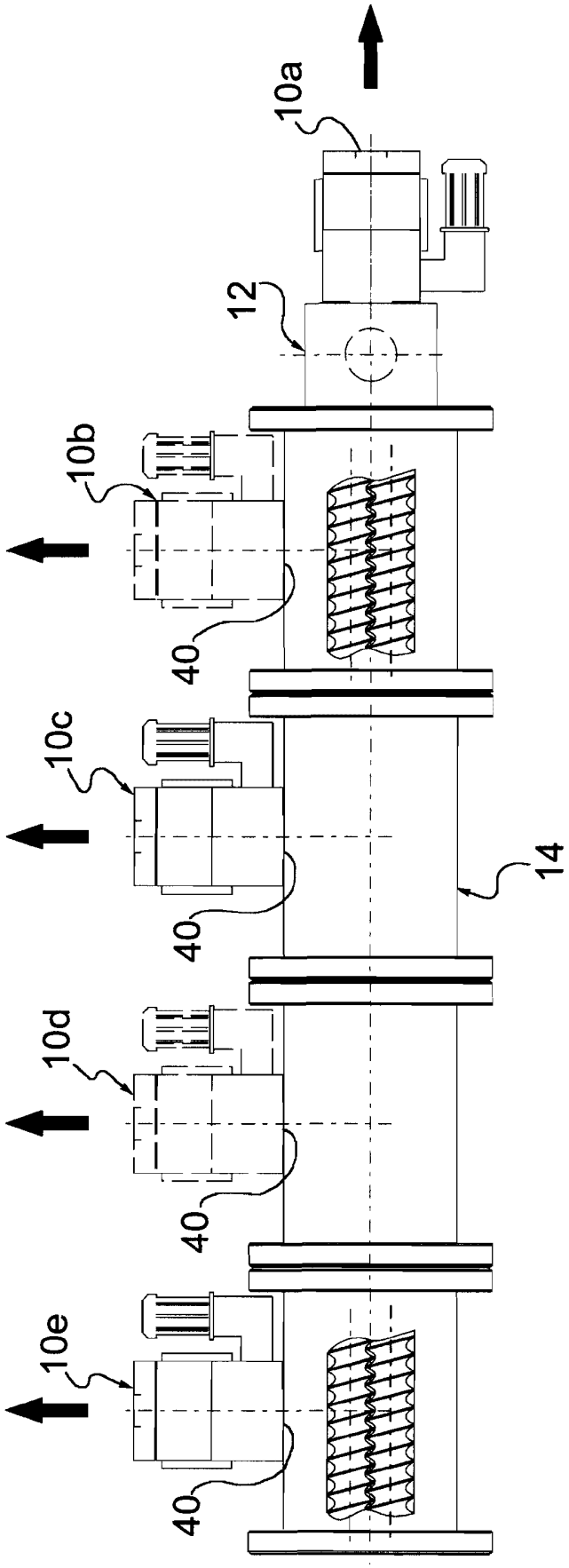


Fig.3

INTERNATIONAL SEARCH REPORT

International application No
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A. CLASSIFICATION OF SUBJECT MATTER
INV. B29C47/92 B29C47/68
ADD. G01N11/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B29C G01N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2004/191123 A1 (COLLIN HEINRICH) 30 September 2004 (2004-09-30) paragraphs [0003], [0004], [0058] - [0062]; figures	1-9
X	DE 33 06 476 A1 (SIEMENS AG) 23 August 1984 (1984-08-23) page 5, line 1 - line 29; figures	1,9
A	DE 198 48 076 A1 (RUBICON GUMMITECHNIK UND BERATUNG GMBH) 27 April 2000 (2000-04-27) column 3, line 41 - column 4, line 19; figures	1,9
A	EP 0 266 753 A (IPT INST PRUEFTECH GERAETEBAU; IPT INSTITUT FUER PRUEFTECHNIK GERAETEB) 11 May 1988 (1988-05-11) column 3, line 26 - column 5, line 24; figures	1-9

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

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Date of the actual completion of the international search	Date of mailing of the international search report
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INTERNATIONAL SEARCH REPORT

Information on patent family members

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