

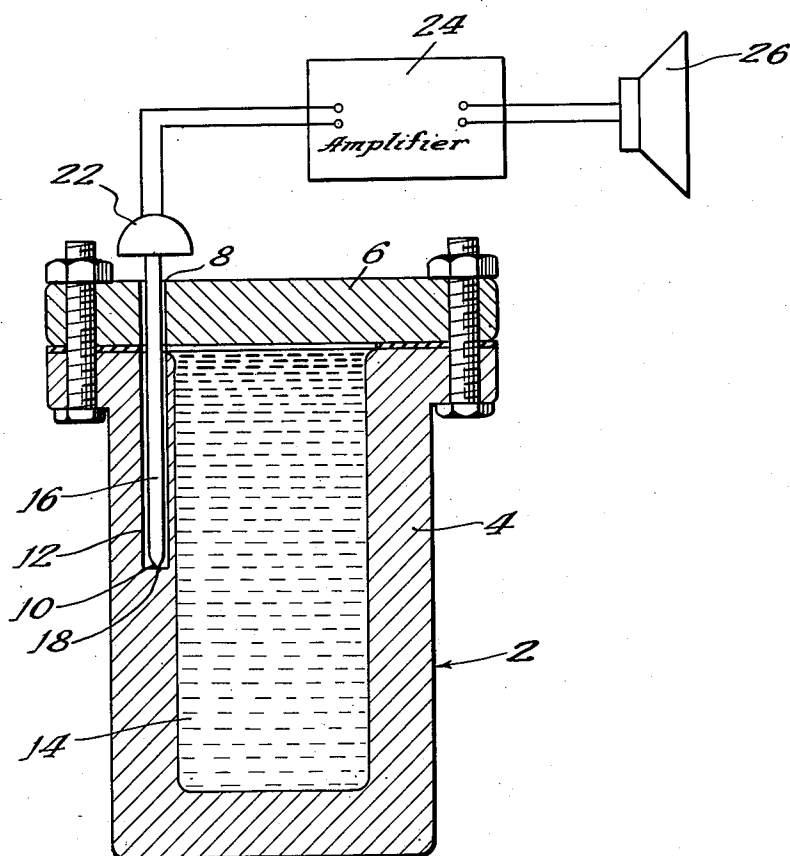
Oct. 21, 1952

H. A. WILHELM

2,614,645

APPARATUS FOR CHEMICAL REACTION DETECTION

Filed Feb. 3, 1947



INVENTOR.

Harley A. Wilhelm

BY

Robert A. Samuels
Attorney.

UNITED STATES PATENT OFFICE

2,614,645

APPARATUS FOR CHEMICAL REACTION
DETECTION

Harley A. Wilhelm, Ames, Iowa, assignor to the
United States of America as represented by the
United States Atomic Energy Commission

Application February 3, 1947, Serial No. 726,185

3 Claims. (Cl. 181-0.5)

1 This invention relates to means for following
the progress of a chemical reaction. The teach-
ings of the invention are particularly adapted to
the detection of chemical reactions occurring in
sealed reaction chambers, often called reaction
"bombs."

Reaction bombs are commonly required to
withstand large pressures which may be induced
by the occurrence of the reaction within the
chamber of the bomb. Therefore, they are com-
monly constructed of a metal of high tensile
strength such as iron or steel. The thickness of
the wall of the chamber may be upwards of 2
inches. When a process is being carried out in-
volving the occurrence of a reaction within such
a bomb, there is difficulty in determining when
a reaction has commenced and when it has pro-
ceeded sufficiently so that the bomb may be
opened and the products of the reaction removed
for use.

It is, therefore, the purpose of this invention to
provide means for determining the progress of a
chemical reaction within the chamber of a reac-
tion bomb.

Generally the above object is accomplished by
a novel combination of devices for the detection
of the sonic vibrations set up within the chamber
of the bomb by the occurrence of the reaction.

For a more complete understanding of the in-
vention, reference is made to the single figure of
the drawing in which is depicted a central longi-
tudinal cross-sectional view of a reaction bomb
together with a schematic diagram of an asso-
ciated system for making exteriorly audible vi-
brations occurring within the bomb.

The reaction bomb, generally designated by the
numeral 2, comprises a cup-shaped bottom por-
tion 4 and a cover plate 6 fastened thereto by
conventional means. Such reaction bombs are
well known in the art. The cover plate 6 has
therein a vertical aperture 8 and the upper part
of the bottom portion 4 has therein a vertical
bore 10. With the cover plate 6 in place on the
bottom portion 4, the aperture 8 is coincident
with the bore 10 so that there is a well 12 extend-
ing from the exterior of the bomb 2 down into
the side wall of the bomb 2. The well 12 is pre-
ferably located in close proximity to the sealed
chamber 14 of the bomb. Persons skilled in the
art will readily determine the minimum safe
spacing of the well 12 from the chamber 14 in
view of the pressures to be expected from the
reaction to be carried out within the chamber 14
and the strength of the materials used in con-
structing the bomb 2. The well 12 is of the same
general type as heretofore used for making tem-

perature measurements in the walls of such
bombs.

Resting within the well 12 is a rod 16, for ex-
ample of steel, having at the lower end thereof
a pointed portion 18 resting upon the bottom of
the well 12. The rod 16 is sufficiently smaller in
diameter than the well 12 so that sonic vibrations
travelling longitudinally through the rod 16 are
not appreciably damped by contact with the wall
of the well 12. The upper end of the rod 16 is
fastened, for example by solder, to the diaphragm
of a microphone 22. The microphone 22 is con-
nected to a conventional amplifier 24, the output
of which is connected to a loudspeaker 26. De-
vices including a rod 16 and a microphone 22,
similar to those illustrated in the drawing, are
commonly used in the detection and measure-
ment of vibrations and are available commer-
cially, being commonly called "vibration pick-
ups."

With the apparatus illustrated in the drawing
and described above, the progress of many chem-
ical reactions within the chamber 14 may readily
be followed by listening to the loudspeaker 26.
Obviously the type of sounds to be expected at
the various stages of the progress of the reaction
must be determined by experimentation with the
particular reaction being carried on. In such
reactions, as for example, in exothermic reduc-
tion reactions where vibration and boiling occur
in the course of the reaction, the following of the
progress is relatively simple because of the ex-
treme turbulence which occurs while the reaction
is in progress. The turbulence, as may readily be
seen, induces sonic vibrations in the wall of the
bomb 2, which vibrations may be heard in the
loudspeaker 26. The stage to which the reaction
has progressed can be readily determined from
the amplitude of the sounds heard.

In the illustration of the drawing, the loud-
speaker 26 serves as a crude measuring device for
both amplitude and frequency characteristics of
the vibrations induced by the reaction, since
the signal is rendered audible. Obviously more
refined instruments for measurement of the
characteristics of the vibrations may be desirable
in particular applications.

The teachings of this invention are not limited
to the specific embodiment illustrated in the
drawing and described above. Persons skilled
in the art will readily devise equivalent methods
and apparatus.

What is claimed is:

1. Apparatus of the class described comprising,
in combination, a sealed reaction bomb having
a chamber and a closure plate, a well extending

through said closure plate and adjacent said chamber, a rod of a material adapted to transmit sonic vibrations, said rod having a portion within said well in contact only with the bottom of the well and a portion exterior to said well, a microphone operatively connected to said rod, an amplifier coupled to said microphone, and a loudspeaker coupled to said amplifier.

2. Apparatus of the class described comprising, in combination, a reaction bomb having walls defining a reaction chamber, a well extending from the exterior of said bomb to a point adjacent said chamber, and a sonic vibration detector having at least a portion thereof within said well adapted to transmit to the exterior of said bomb sonic vibrations occurring within said chamber.

3. Apparatus of the class described comprising, in combination, a reaction bomb having walls defining a chamber, and a sonic vibration de-

tor within at least one of said walls adjacent said chamber.

HARLEY A. WILHELM.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,423,038	Sims	July 18, 1922
1,686,138	Marvel	Oct. 2, 1928

FOREIGN PATENTS

Number	Country	Date
475,421	Great Britain	Nov. 18, 1937
645,132	Germany	June 27, 1936

OTHER REFERENCES

Publication by Scott, "Instruments," September 1937, pp. 231-236.