the LB analyzer

LISTON-BECKER PLANT — BECKMAN DIVISION

BECKMAN INSTRUMENTS, INC. — SPRINGDALE, CONN.

FOREMOST MANUFACTURER OF INFRARED GAS ANALYZERS

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Motor Vehicle Exhaust Gases and Smog

An infrared gas analyzer has been developed which will continuously and accurately check motor vehicle exhaust gases for CO, CO_2, and mixed hydrocarbons.

MANY OF OUR MAJOR cities are frequently plagued with smog—a dense mixture of smoke and fog that cuts visibility and irritates the eyes and nasal passages. Many studies are planned or are in process to determine the causes of smog, and to learn how it can be eliminated or minimized. Los Angeles is especially active in this field, because its smog problems are perhaps more severe than those of other areas.

One factor which has been suspected of contributing to smog is the exhaust gas of automobiles. To study this matter, a Coodinating Research Council (CRC) has been set up, composed of members of the American Petroleum Institute and the Automotive Manufacturers Association. This Council has embarked on an extensive field survey to study and analyze the exhaust gases from a large number of cars and trucks under widely varying operating conditions. By this means, the Council will obtain definite information which will be of help in evaluating the overall effects of exhaust gases on atmospheric conditions.

Gases of interest in this study are CO_2, CO, and mixed unburned hydrocarbons. As a first step in the investigation, the Council set up a Field Survey Panel to explore the various available techniques of analyzing for these gases, including the mass spectrometer, laboratory infrared spectrometer, wet chemical methods, and the like. Such techniques had a number of disadvantages, the major one being the necessity of obtaining large numbers of individual samples under widely varying conditions. Contributing factors were the cost and complexity of the equipment involved.

The one technique which showed greatest promise was that of continuous measurement by means of a nondispersion infrared gas analyzer. Such a technique would overcome the many disadvantages of previously available analysis methods.

Working with engineers from the *Liston-Becker Plant,* the Field Survey Panel set up requirements which should be met by a suitable exhaust gas analyzer. Basically, these requirements were as follows: 1. The instrumentation must be capable of analyzing the exhaust gas for CO_2, CO, and unburned hydrocarbons continuously, rapidly and accurately. 2. The instrument must be compact, mobile, easily mountable and removable from an automobile, and

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Fig. 1. Observer in rear seat of car can easily read meters of analyzers which are supported on the back of the front seat. Recorders may be installed in any convenient location.

MOTOR VEHICLE EXHAUST

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must contain its own power supply, sample pump, sample filter, etc.

On the basis of these studies and recommendations, *Liston-Becker* engineers developed the Three-Channel Exhaust Gas Analyzer shown in Figs. 1 and 2. This analyzer meets the requirements outlined above, and has proved itself in numerous field tests.

Basically the instrument is made up of three separate analyzers, one each for CO_2, CO, and unburned hydrocarbons, with the sample cells all connected in series. The three analyzers can be rack-mounted for strapping to the rear of the driver's seat, thus making them readily visible to an observer sitting in the rear seat. An installation of this type is shown in Figs. 1 and 2.

Each analyzer has a meter for continuous indication of concentration. Terminals for the addition of a recorder are provided, if a continuous record of concentration is desired. Output consists of one milliampere into 1000 ohms, capable of driving either a standard potentiometer type or a string galvanometer type of recorder.

Ranges provided on the instrument are 0-20% for CO and CO_2, and 0-1.5% for mixed hydrocarbons, but these ranges may be altered easily if desired. In co-operation with the CRC

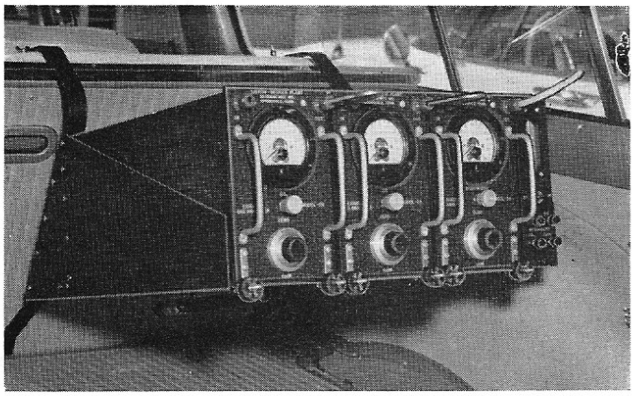

Fig. 2. This view shows the three analyzers mounted on the rear of the front seat. A sample of the exhaust gas passes through the three analyzers in series and then is expelled through car window at the upper right.

group, a new method of charging the mixed hyrdocarbon detector was developed. Specifications called for a detector which would respond to some 30 different hydrocarbons in a weighted manner, depending on their organic carbon content. This was accomplished by charging the detector with a carefully-controlled mixture of several gases. It is interesting to note that this type of sensitizing can be accomplished only in the positive-type of infrared analyzer. Response time of all ranges is one second to 90% of full scale.

The battery pack assembly, shown in Figs. 3 and 4, consists of batteries, converter, meter for checking batteries, a sample filter with a glass fiber element, and a sample pump with a capacity of 10-12 cubic feet per hour. This assembly will fit easily into the trunk of most cars. It includes two storage batteries, which permit operation of the analyzer independently of the car battery. A flow meter is incorporated to indicate the rate of flow of the exhaust gas through the analyzer.

In operation, the battery pack is normally mounted in the trunk of the car under test, and the analyzers strapped to the back of the front seat. One end of a small tube is inserted in the exhaust pipe to sample the exhaust gases, and the other end connected to the sample pump and flow meter. A similar tube carries the gases up to the analyzers. After passing through the three analyzer cells, the gases are expelled through the car window. When the sample pump and flow meter are adjusted for the proper flow rate, the instrument is ready to indicate exhaust gas composition under any and all driving conditions.

This instrument is now in production. Get in touch with one of our sales engineers for more information.

Fig. 3. Over-all view of the power pack as it is mounted in the trunk of the car. Carrying handles are provided for convenience. Cable at left feeds power to the analyzers.

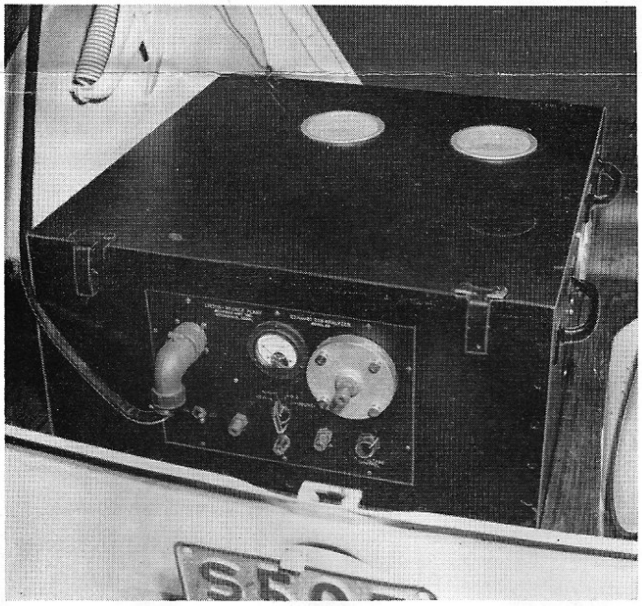

Fig. 4. Interior view of power pack with the cover removed. Two storage batteries are employed. Sample pump and filter can be seen in the lower part of the picture.