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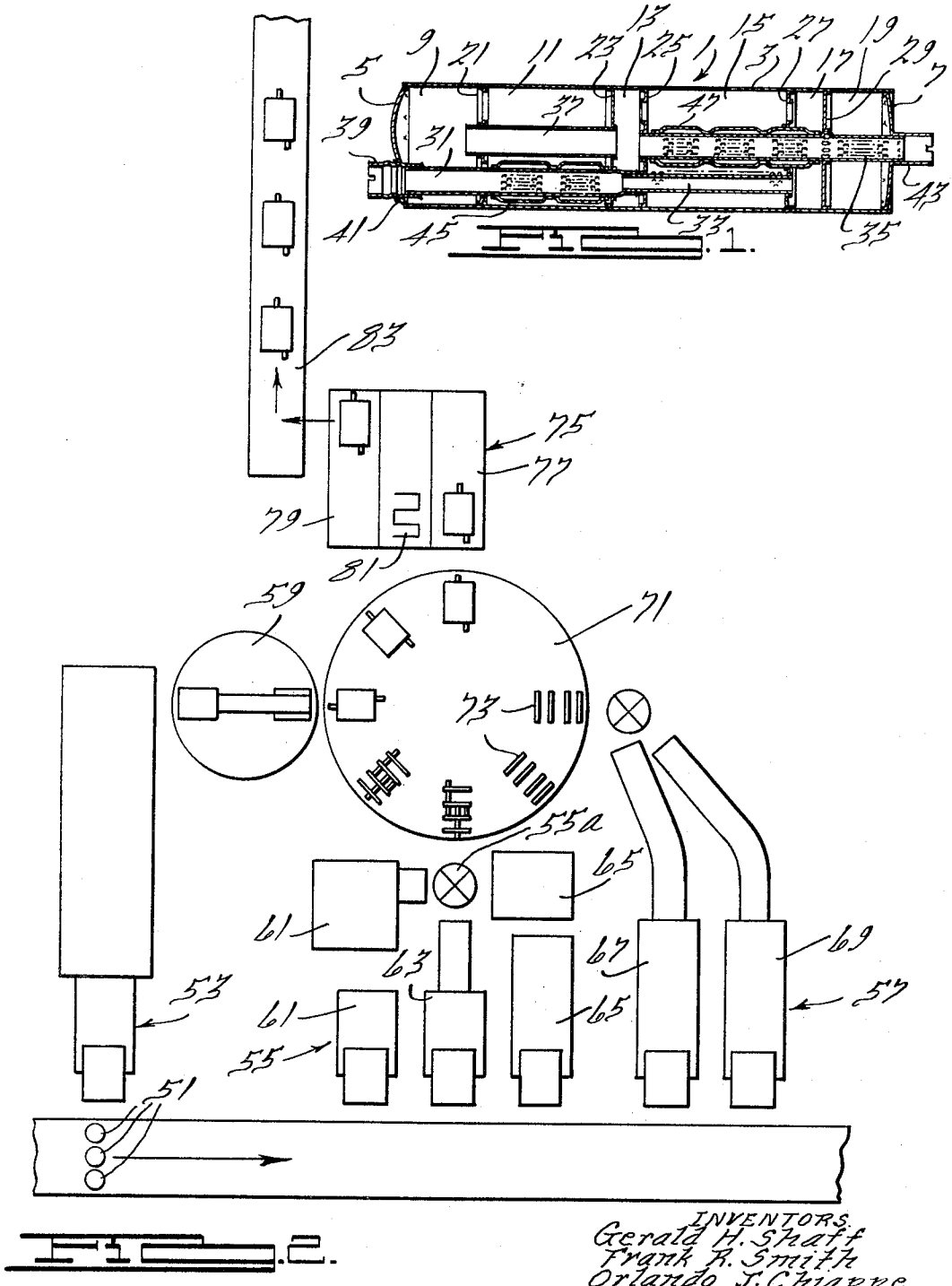


FIG. 2.

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MUFFLER MANUFACTURING SYSTEM

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ABSTRACT OF THE DISCLOSURE

A muffler manufacturing method forms a muffler shell at one station, muffler tubes at another station, and muffler partitions at still another station. The tubes and partitions are then combined into a skeleton and then the skeleton is inserted into the muffler shell and welded in place.

This invention relates to the method of making automotive exhaust mufflers or the like from sheet steel.

It is the purpose of this invention to provide a muffler manufacturing arrangement that is well adapted to mass manufacture by automated equipment and procedures.

The invention accomplishes the foregoing and other objects by dividing the component parts of a muffler into groups of similar parts that may be manufactured on substantially the same equipment. The groups of parts are then fed to an assembly area where they are assembled into a muffler and secured together.

The invention is illustrated in the accompanying drawings in which:

FIGURE 1 is a longitudinal cross section through a typical automotive exhaust muffler that may be manufactured in accordance with the invention; and

FIGURE 2 is a schematic diagram of a muffler manufacturing process embodying the principles of the invention.

The muffler **1** of FIGURE 1 comprises an outer shell **3** which is usually oval in cross section. Opposite ends of the shell **3** are closed by inlet and outlet headers in the form of transverse end walls **5** and **7** respectively which have peripheral flanges that fit inside and are welded to the ends of the shell.

The inside of the shell **3** is divided into a number of separate chambers **9**, **11**, **13**, **15**, **17**, and **19** by means of transverse walls (acting with the end headers) in the form of partitions **21**, **23**, **25**, **27**, and **29** which have peripheral flanges that are welded to the shell **3**. Some of these partitions have holes or necked openings therein to provide communication between adjacent chambers as shown. They also have flanged openings to support the aligned gas inlet tubes **31** and **33**, the gas outlet tube **35**, and the tuning tube **37**. The inlet tube **31** is welded inside and to an inlet bushing **39** that in turn is welded to a flanged neck **41** in the inlet header **5** and the outlet tube is welded inside and to an outlet bushing **43** that is formed in the outlet header **7**.

Sections of the tubes are perforated or louvered as shown to allow communication between the insides of the tubes and the chambers through which they pass. Spit chamber shells **45** and **47** formed from complemental halves welded together along a midplane are positioned around louvered areas of tubes **31** and **35** to form high frequency sound attenuation or spit chambers.

It will be seen that the muffler **1** comprises the following groups of parts: (a) shell **3**, (b) tubes **31**, **33**, **35**, **37** and bushing **39**, (c) spit chamber half shells **45** and **47**, (d) partitions **21**, **23**, **25**, **27**, and **29**, and (e) headers **5** and **7**.

The processing layout of FIGURE 2 includes a line or conveyor for carrying a coil **51** of sheet steel to each of three stations **53**, **55**, and **57**. Station **53** comprises suitable

equipment for cutting, blanking, forming, and connecting sheet steel from a coil **51** into a muffler shell **3** and for moving it on to a shell expanding station **59**.

Station **55** comprises three substations **61**, **63**, and **65**. Substation **61** comprises suitable equipment for cutting, perforating, forming, rolling, and connecting sheet steel from a coil **51** into tubes **31**, **33**, **35**, and **37**. Substation **63** comprises suitable equipment for cutting, perforating, forming, rolling, and connecting sheet steel from a coil **51** into bushings **39**. Substation **65** comprises suitable equipment for cutting, blanking, and forming sheet steel from a coil **51** into the spit chamber shell halves **45** and **47**.

Station **57** comprises two substations **67** and **69**. Substation **67** comprises suitable equipment for cutting, blanking, piercing, drawing, and forming sheet steel from coil **51** into partitions **21**, **23**, **25**, **27**, and **29** while substation **69** is capable of performing similar operations to produce headers **5** and **7**.

Each of the stations and substations includes suitable conveyor or moving means for moving the parts downstream toward and preferably on to the rotary assembly station **71**. Station **55** includes a rotary subassembly station **55***a* to receive the parts for loading on to station **71** and for assembling the spit chamber shell halves **45** and **47** together on the tubes **31** and **35**.

The rotary station **71** includes suitable fixtures **73** to support the various parts while the tubes, partitions, bushing, and headers are subassembled. The parts are welded together into a skeleton structure exclusive of the outer shell **3** as the station **71** rotates toward shell expanding station **59**. At station **59** the shell **3** is loaded onto station **71** and the skeleton of tubes, partitions, spit chamber shells, and end headers positioned inside the shell. The combined shell and internal parts are then transferred to the weld station **75**. Station **75** has a pre-chamber **77** and a post chamber **79** and a suitable welder **81**, such as an electron beam, intermediate these chambers. The headers and partitions are welded to the shell in unit **81** and the completed muffler is then transferred to conveyor **83** for transfer to a desired area.

Modifications may be made in the specific procedures and arrangements of equipment disclosed without departing from the spirit and scope of the invention. It will be recognized that certain parts may be omitted in some muffler structures, such as bushings and spit chamber shells, and that additional parts to those shown may be added.

We claim:

1. The method of making automotive exhaust mufflers or the like which comprises passing sheet metal to a shell forming station and forming a shell at such station, passing sheet metal to a tube forming station and forming gas flow tubes at such station, passing sheet metal to a transverse wall forming station and forming transverse walls at such station, passing the tubes and walls to an assembly station and combining them into a skeleton of parts, passing a shell to such assembly station and inserting said skeleton into the shell, passing the assembled shell and skeleton to a welding station and welding the walls to the shell to form a muffler.

2. A method as set forth in claim **1** including forming headers at said wall forming station, passing the headers to said assembly station and combining them with the tubes into said skeleton, and welding the headers to the shell.

3. A method as set forth in claim **1** including forming said walls at said wall forming stataion in the shape of partitions, passing the partitions to said assembly station and combining them with the tubes into said skeleton, and welding the partitions to the shell.

4. A method as set forth in claim **1** including forming

said walls at said wall forming station in the shape of partitions and headers, passing the partitions to said assembly station and combining them with the tubes into said skeleton, and welding the partitions and headers to the shell to form a substantially finished muffler.

5. The method of making automotive exhaust mufflers or the like which comprises passing sheet metal to a shell forming station and forming a shell at such station, passing sheet metal to a tube forming station and forming gas flow tubes at such station, passing sheet metal to a transverse wall forming station and forming transverse walls at such station, passing the tubes and walls to an assembly station and combining them into a skeleton of parts, inserting said skeleton into the shell, and welding the walls to the shell to form a muffler.

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