We, ALLIED CORPORATION, a Corporation organized and existing under the laws of the State of New York, United States of America, of Columbia Road and Park Avenue, Morris Township, Morris County, New Jersey, United States of America, hereby apply for the grant of a Standard Patent for an invention entitled:

"PLASTIC MASTER CYLINDER"

which is described in the accompanying Complete Specification.

Details of basic application:

- Number: 676,978
- Country: U.S.A.
- Date: 30th November, 1984

Our address for service is:

SHELSTON WATERS
55 Clarence Street
SYDNEY, N.S.W. 2000.

DATED this 7th day of November, 1985

ALLIED CORPORATION

by Robert J. Shelton

Fellow Institute of Patent Attorneys of Australia
of SHELSTON WATERS

To: The Commissioner of Patents

WODEN A.C.T. 2606

File: D.B. 34G

Fee: $120.00

MM
COMMONWEALTH OF AUSTRALIA PATENTS ACT, 1952-1973

DECLARATION IN SUPPORT OF A CONVENTION APPLICATION FOR A PATENT

In support of the Convention Application No. made by ALLIED CORPORATION of Columbia Road and Park Avenue, Morris Township, Morris County, New Jersey, United States of America (hereafter referred to as "Applicant") for a patent for an invention entitled: America PLASTIC MASTER CYLINDER,

I, Roy A. Massengill, Assistant Secretary of ALLIED CORPORATION, do solemnly and sincerely declare as follows:

1. I am authorised by Applicant to make this declaration on its behalf.

2. The basic Application(s) as defined by section 141 of the Act was/were made in the United States on the 30th day of November, 1984.

3. Lawrence Robert Myers, of 2144 L. Roosevelt Road, South Bend, Indiana 46614, of the United States of America, is/are the actual Inventor(s) of the invention and the facts upon which Applicant is entitled to make the Application are as follows:

   Applicant is the Assignee of the said Inventor(s).

4. The basic Application(s) referred to in paragraph 2 of this Declaration was/were the first Application(s) made in a Convention country in respect of the invention, the subject of the Application.

   DECLARED at Morris Township, New Jersey this 30th day of September, 1985.

(Signature of Declaring Official)

To THE COMMISSIONER OF PATENTS.

SHELSTON WATERS
PATENT ATTORNEYS
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The metal liner tube is in the form of a cylinder closed at one end, the other end being open and for receiving...
1. A master cylinder assembly comprising a housing defining a bore movably receiving therein a pair of pistons, sealing means for cooperating with the pair of pistons and surface of the bore to substantially define a pair of pressure chambers, a reservoir, opening means for communication with said pressure chambers to permit fluid within the reservoir to communicate with said bore, outlet means for communicating fluid pressure from the respective chambers to respective brake line connections, the pair of pistons being movable during braking to generate fluid pressure within the pair of pressure chambers and the fluid pressure communicated to the brake line connections, and a liner engaging said housing, characterized in that the housing comprises a plastic housing encasing said liner, the liner providing structural integrity for said plastic housing and being completely enclosed, interiorly and exteriorly, by plastic where said housing and liner define the perimeters of said high pressure chambers.
The following statement is a full description of this invention, including the best method of performing it known to me/us:

"PLASTIC MASTER CYLINDER"
PLASTIC MASTER CYLINDER

This invention relates to a plastic master cylinder and method for manufacturing same.

In recent years, there has been a great emphasis on reducing the overall weight of automotive vehicles in order to increase the mileage capability of such vehicles. This has resulted in not only an emphasis on providing more simplified structures, but in eliminating heavy materials utilized in the manufacture of many components. The use of plastics has increased dramatically, to the extent that many of the interior and exterior components of an automobile are plastic. The brake master cylinder of an automobile has been manufactured traditionally by a casting utilizing either sand or metal cores. Cast metal master cylinders have been utilized for many years to provide a small but heavy component for the vehicle. In order to provide a light weight brake master cylinder, alternatives such as magnesium die casting have been attempted. Fields U. S. Patent 4,122,596 issued October 31, 1978 illustrates a brake master cylinder having a magnesium body die cast about a metal tube liner. However, at high pressures the materials separate and allow leakage because of the different expansion rates of the materials involved. It is desirable to provide a simple, inexpensive, yet reliable brake master cylinder which is able to withstand the pressures effected during application of the vehicle brakes. Plastic master cylinders have been produced for low pressure applications such as motorcycles and clutch master cylinders wherein the plastic material, by itself, has sufficient strength to withstand the low pressures effected during braking application. However, it is desirable to produce a plastic brake master cylinder able to withstand the high braking pressures effected during the braking of much larger automotive vehicles, as opposed to the above-described low pressure applications.

The present invention comprises a plastic master cylinder which is insert molded about a metal liner tube.
The metal liner tube is in the form of a cylinder closed at one end, the other end being open and for receiving a pair of pistons therein. The metal liner tube is disposed within an insert molding cavity, and an appropriately shaped mandrel placed within the tube. Plastic material is insert molded within the cavity to form a plastic master cylinder enveloping substantially the metal liner tube, and also providing an integral reservoir. The plastic master cylinder is removed from the cavity, and subsequent manufacturing operations accomplished in order to provide a finished product. The plastic master cylinder of the present invention provides a low cost, light weight, and simply manufactured brake master cylinder which is able to withstand the high pressures effected in the pressure chambers during brake application. Specifically, the metal tube liner provides sufficient strength to withstand the hoop stresses effected during braking. The master cylinder provides an integral plastic housing and reservoir comprising an inexpensive, integral brake master cylinder unit.

The invention will now be described with reference to the accompanying drawing wherein:

Figure 1 is a cross section of the plastic master cylinder assembly constructed in accordance with the present invention.

The master cylinder of the present invention is designated generally by reference numeral 10. A metal liner or tube 12 is substantially cylindrical in shape with closed end 14 and open end 16. End 16 includes a radially outwardly extending flange 18, and liner 12 includes reservoir openings 20 and 22 disposed on one side of the liner and brake line connection openings 24 and 26 disposed on the other side. Plastic master cylinder housing 30 comprises plastic material insert molded about liner 12 to substantially encase or encompass the liner. Plastic housing 30 includes brake outlet openings 34 and 36 for communication between the master cylinder bore 28 and brake line connections. Reservoir openings
38 and 40 provide for communication between the reservoir 50 the bore 28. Reservoir 50 comprises plastic material formed simultaneously with the forming of master cylinder housing 30 to provide an integral plastic master cylinder housing and reservoir. A pair of pistons 60 and 70 are disposed within bore 28, with primary piston 70 biasing a spring 72 against the secondary piston 60 and a spring 64 being disposed between piston 60 and end wall 31 of bore 28. A slide rod 73 is received by extension piece 62 engaging secondary piston 60. The pistons 60 and 70 have seals 80 disposed thereabout that provide sealing engagement with the circumposing bore 28, and seal 82 is disposed between a housing shoulder 84 and ring 88. It should be clearly understood that the particular type and shape of pistons, springs, and seals are entirely discretionary according to the designs characteristics desired. The plastic brake master cylinder housing and reservoir integral therewith may include many different modifications and changes, in order to accommodate a wide variety of master cylinder designs.

The fluid inserts 85 are located at brake outlet openings 34 and 36. The inclusion of inserts 85 is optional according to the type of master cylinder design being provided. In other words, the housing 30 may be formed with integral threadings for receiving brake line connections, or if different or stronger connections are needed, metal inserts 85 may be included in the insert molding process in order to provide a metal-to-metal connection with brake line couplings. Pistons 60 and 70 combine with bore 28 and end wall 31 to define high pressure chambers 90 and 91. The respective high pressure areas of chambers 90 and 91 are indicated by the distances X illustrated Figure 1, and the low pressure areas indicated by the distances Y. When the brake pedal (not shown) is depressed so that a push rod 100 displaces piston 70 to the left and results in the creation of high pressure in chamber 90, the high pressure is communicated through outlet opening 36 to the associated brake line,
and spring 72 correspondingly biases piston 60 to the left to pressurize brake fluid within chamber 91 for communication through line 34 to the associated brake line. It should be noted that in the high pressure areas indicated by the distances *X*, metal liner tube 12 is completely encased by plastic material. This precludes any possibility of separation of the two materials (plastic and metal) because of the high pressure exerted thereon. By eliminating any exposed surfaces where two different materials are mated, there is no possibility for pressurized fluid to enter between the materials and cause separation thereof. The high pressure areas begin just past the compensation ports or reservoir openings 38 and 40, and for high pressure chamber 90 the area extends almost to pressure opening 41.

The plastic master cylinder 10 of the present invention is manufactured by forming the metal liner tube 16 so that the end 14 is substantially closed and the other open end has an outwardly extending flange 16. Alternatively, end 14 of tube 16 may include a small opening for receiving a positioning pin of the mandrel positioned within the tube during the insert molding process. The small opening would be sealed by a plug which would preclude the escape of any fluid from high pressure chamber 91. The metal tube 12 and an appropriately shaped mandrel (not shown) are positioned within the die of an insert molding apparatus. Plastic material, for example fibre glass reinforced nylon such as Zytel®, is insert molded within the die to form plastic master cylinder body 30 and integral reservoir 50. Liner 12 may be made of steel, aluminum, magnesium, and any other metal suitable for use in the present invention. Aluminum is the preferred material for liner 12 because aluminum and nylon have approximately equal coefficients of thermal expansion so that they do not separate from one another during temperature changes. It should be clearly understood that the formation of reservoir 50 as an integral component of plastic master
cylinder housing 30 is optional; the reservoir 50 may be a separate plastic or metal unit which is subsequently attached or secured to the master cylinder body 30. After the insert molding operation, the plastic master cylinder is removed from the die, and then further de-flashing operations and preparation enables the subsequent insertion of springs 64, 72 and piston 60, 70. Of course, the metal inserts 85 may be included within the insert molding process in order to provide threaded metal couplings for receiving the metal threads of brake connection lines, or the openings 34 and 36 may have plastic threads for receiving complementary-shaped plastic threads of a brake lining connection.

The plastic master cylinder and reservoir provides a low cost, light weight assembly having substantial advantages over prior art master cylinder constructions. The plastic housing provides for a plastic-to-plastic interface with plastic pistons, so that expensive machining operations for the metal pistons and bore are eliminated. The metal liner provides sufficient strength to withstand the hoop stresses effected during braking application, and additionally the reservoir unit may be integrally molded with master cylinder housing 30. Because housing 30 completely encompasses the metal liner in the areas where high pressures are effected during braking application, there is no possibility of separation between the metal material and the molded plastic material. This accomplishes a high structural integrity for plastic master cylinder housing 30. Additionally, the plastic master cylinder eliminates many machining operations that are required in the manufacture of a typical, cast metal master cylinder body. Thus, there is a substantial savings in weight accompanied by a reduction in manufacturing costs and price.

Although this invention has been described in connection with the illustrated embodiment, it will be obvious to those skilled in the art that various changes may be made in the form, structure, and arrangement of parts without departing from the invention.
CLAIMS

1. A metal Piston
2. The Piston
3. Piston
4. Piston
5. Piston
6. Piston
7. Piston
8. Piston
9. Piston
10. Piston

The above claims are hereby set forth in further detail.
THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A master cylinder assembly comprising a housing defining a bore movably receiving therein a pair of pistons, sealing means for cooperating with the pair of pistons and surface of the bore to substantially define a pair of pressure chambers, a reservoir, opening means for communication with said pressure chambers to permit fluid within the reservoir to communicate with said bore, outlet means for communicating fluid pressure from the respective chambers to respective brake line connections, the pair of pistons being movable during braking to generate fluid pressure within the pair of pressure chambers and the fluid pressure communicated to the brake line connections, and a liner engaging said housing, characterized in that the housing comprises a plastic housing encasing said liner, the liner providing structural integrity for said plastic housing and being completely enclosed, interiorly and exteriorly, by plastic where said housing and liner define the perimeters of said high pressure chambers.

2. The master cylinder in accordance with claim 1, wherein said reservoir is integral with said plastic housing.

3. The master cylinder in accordance with claim 1, wherein said liner comprises a metallic lining in the shape of a tube and insert molded within said plastic housing.

4. The master cylinder in accordance with claim 1, further comprising outlet inserts secured within the
plastic housing at the outlet means and for fixedly receiving the brake line connections.

5. The master cylinder in accordance with claim 1, wherein said liner has at an open end a flange extending radially outwardly.

6. The master cylinder in accordance with claim 1, wherein the reservoir is integral with the plastic housing and the opening means includes compensation passages between said reservoir and bore.

7. The master cylinder in accordance with claim 1, wherein said pistons are biased by resilient means toward an open end of said master cylinder.

8. The master cylinder in accordance with claim 1, wherein the perimeters include openings in the liner, the openings defining areas of the plastic housing with said outlet means therein and the openings completely enclosed by plastic.

DATED this 7th day of November, 1985

ALLIED CORPORATION

Attorney: ROBERT G. SHELSTON

Fellow Institute of Patent Attorneys of Australia of SHELSTON WATERS