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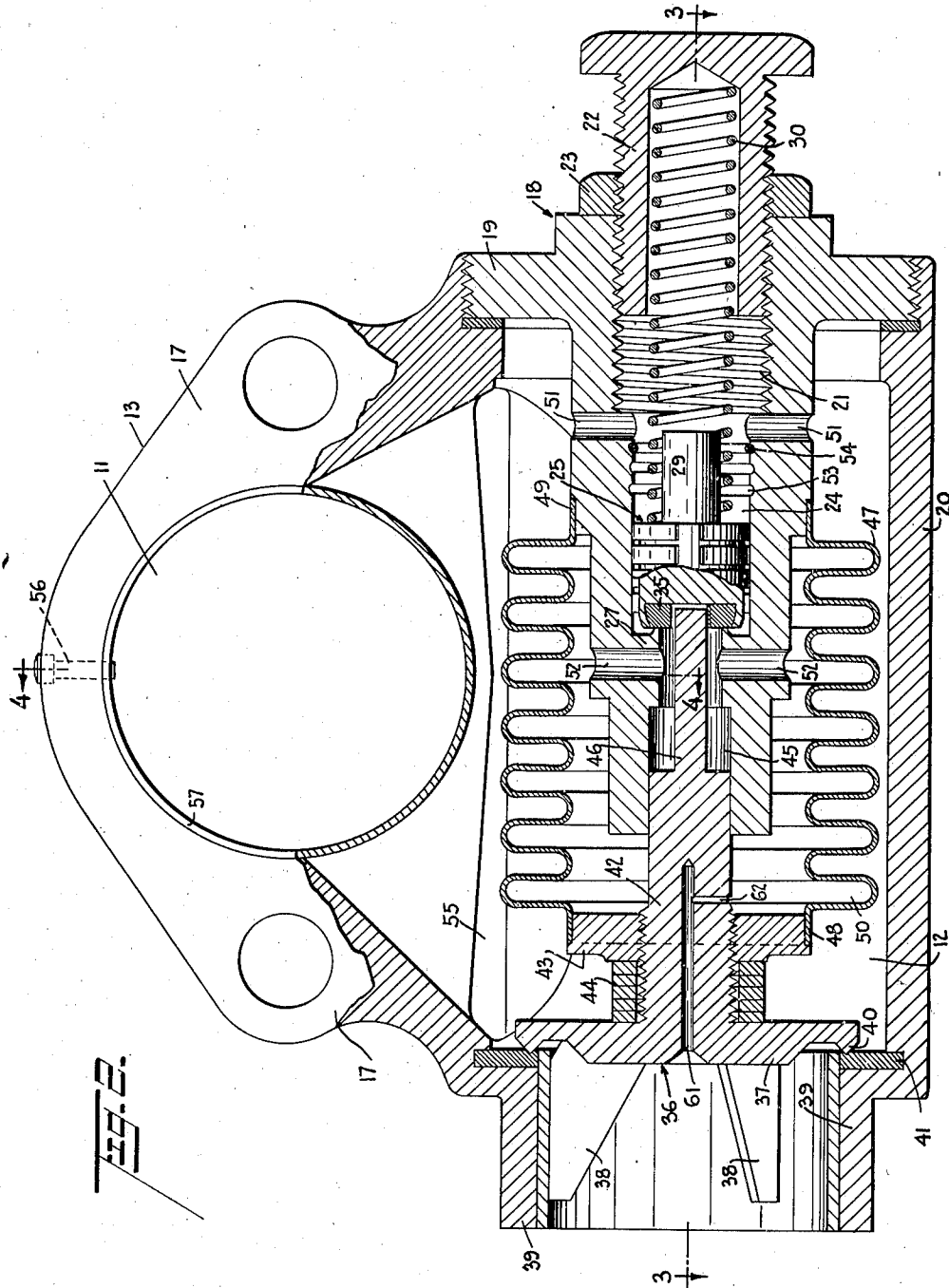
S. JACOVELLI

2,191,076

FUME ELIMINATING VALVE FOR INTERNAL COMBUSTION ENGINES

Filed April 17, 1939

3 Sheets-Sheet 2



BY

INVENTOR.
SAMUEL JACOVELLI.

ATTORNEY.

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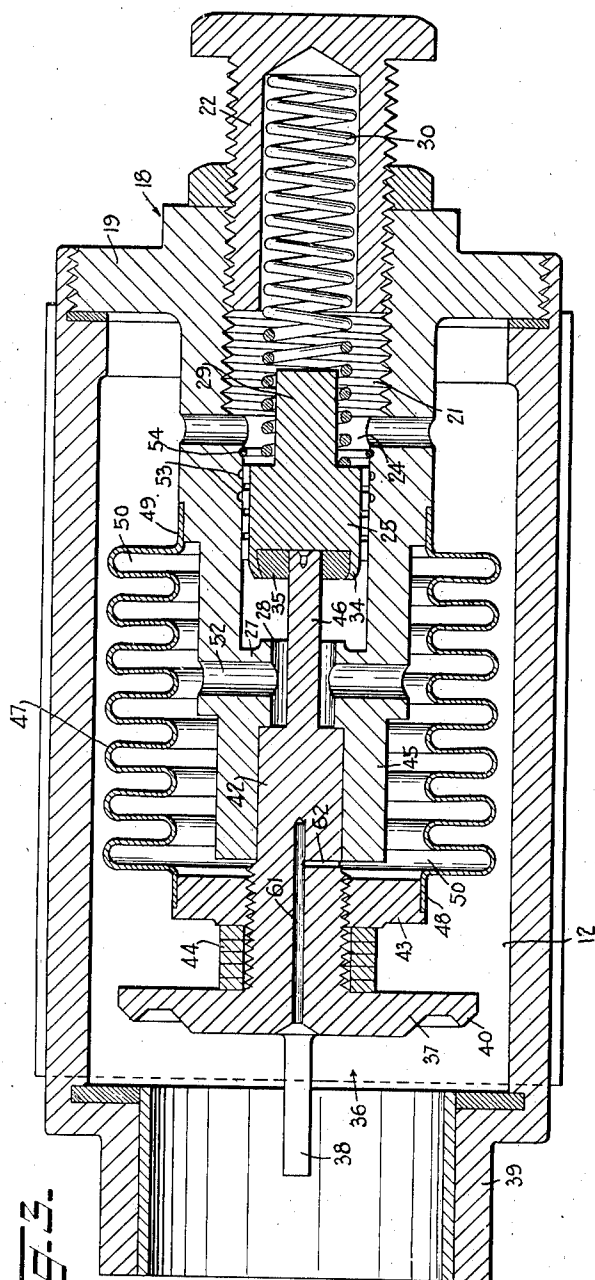
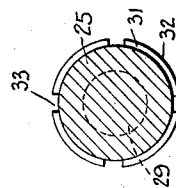
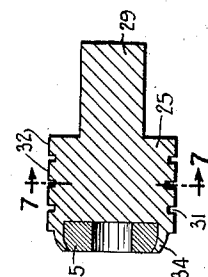
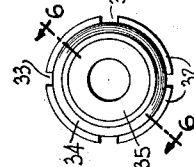
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INVENTOR.
SAMUEL JACOVELLI:

J. Ledermann
ATTORNEY.

UNITED STATES PATENT OFFICE

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FUME ELIMINATING VALVE FOR INTERNAL COMBUSTION ENGINES

Samuel Jacovelli, Brooklyn, N. Y.

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7 Claims. (Cl. 137—153)

This invention relates generally to internal combustion engines, and more particularly to devices, adapted to be mounted in the intake line between the carburetor and the engine, for providing an instantly available auxiliary air supply to the cylinders upon deceleration of the engine so that the gas fuel therein may be more thoroughly burned.

The fuel condition within the cylinders of an automobile engine resulting from deceleration of the motor, is responsible for the exhaust odors. When the motor is idling, and because the throttle is closed, a partial vacuum is created in the intake manifold. During deceleration, the motor is running at a higher speed than when idling because it is being rotated by the momentum of the vehicle, yet the throttle is also closed during deceleration, thereby causing a much greater degree of vacuum to be created in the cylinders. Thus, excess quantities of gas fuel are sucked from the idling jets by this increased vacuum. Some of the oil film on the cylinder walls is also drawn into the combustion chamber. These two facts, together with the fact that little or no air is being delivered into the combustion chamber owing to the throttle being open at only the idling position, create a condition in which the fuel is unable to burn or explode efficiently, and this poor combustion causes unburned and incompletely burned fuel to be passed through the exhaust, so that the exhaust is malodorous and often even visible. These conditions also cause, as a consequence of the incomplete combustion in cylinders, the deposit of large quantities of carbon in the cylinders, besides the waste of gasoline and oil at a time when the motor requires no fuel to keep it running.

It is the object of the present invention to eliminate the above undesirable conditions entirely by breaking up the vacuum in the intake manifold and feeding a full volume of pure air to the combustion chamber during deceleration.

This and other correlated objects will become apparent in the description below, reference being had to the accompanying drawings, in which reference numerals refer to like-numbered parts in the drawings.

Referring briefly to the drawings, Figure 1 is a fragmentary side elevational view showing the device mounted in the intake manifold between the carburetor and the manifold.

Figure 2 is partly a plan view of the device and partly a cross-sectional view taken on the line 2—2 of Figure 1, showing the secondary air valve closed.

Figure 3 is a cross-sectional view taken on the line 3—3 of Figure 2, showing the secondary air valve open.

Figure 4 is in part a cross-sectional view taken on the line 4—4 of Figure 2 and in part a left-hand end elevation of the same figure.

Figure 5 is a front view of the master valve.

Figure 6 is a cross-sectional view taken on the line 6—6 of Figure 5.

Figure 7 is a cross-sectional view taken on the line 7—7 of Figure 6.

Referring in detail to the drawings, the numeral 10 indicates the unitary housing of the device, enclosing two spaced-apart cylindrical compartments 11 and 12, open at both ends, the planes through whose axes intersect at right angles. The compartment 11 is enclosed by the wall 13 of the housing, and this wall has an external contour which is substantially diamond-shaped on one side to accommodate the contour of the standard manifold flange 14 and carburetor flange 15, between which flanges the device is clamped by bolts 16. The top and bottom surfaces 17 of the housing 10 are flat, so that they will fit snugly, with the usual gaskets (not shown) therebetween, against the said flanges. The wall separating the two compartments 11 and 12 is cut away in a manner which will hereinafter be described. The wall 20 surrounding the greater part of the compartment 12, is cylindrical.

An elongated hollow stem 18 is screwed, by means of its flange 19, into the rear of the compartment 12. The rearward portion 21 of the channel through the stem 18 is internally threaded to accommodate a hollow set screw 22 provided with a lock nut 23. Forward of the chamber 21 the continuous channel through the stem 18 is again reduced to provide the chamber 24 wherein the master valve 25 is slidably mounted. At its forward end the chamber 24 is further reduced by a peripheral shoulder 27 on the inner rim of which a rearwardly projecting peripheral lip 28 is formed. The reduced stem 29 of the valve 25 is surrounded by one end of a coiled spring 30 whose other end registers in the hollow of the set screw 22.

In the cylindrical surface of the head of the valve 25 a number of spaced peripheral grooves 31 are formed, dividing the cylindrical surface thereof into a number of spaced peripheral rings 32. In addition, a plurality of spaced radial grooves 33 are formed on the same surface to the same depth, thus cutting through the rings 32. The front end of the valve 25 is cupped out and has its peripheral wall 34 spun over to enclose and

retain an annular seat 35 of relatively soft material, such as leather. When the valve 25 is in its extreme left-hand position (Figure 2), the lip 28 seats against the seat 35 and seals the chamber 24 from the forward portion of the channel through the stem 18.

The secondary valve 36 comprises the head 37 from which three guide fins 38 project forward and slidably engage the inner surface of the reduced air inlet 39 to the compartment 12. The head 37 is provided with a forwardly extending peripheral lip 40 which, when the valve 37 is closed, engages the gasket or seat 41 against the shoulder between the inlet 39 and the compartment 12. A stem 42 extends rearward from the head 37 and has its forward portion threaded to receive a cylindrical nut 43. A plurality of spacer rings 44 are locked between the nut 43 and the head 37. The stem 42 projects slidably into the forward chamber 45 of the channel through the stem 18. A pin 46 projects rearward from the stem 42 and its end is adapted to register in the opening of the annular seat 35 of the valve 25.

A metallic bellows 47, cylindrical in all cross section, has its forward lip 48 secured in airtight fashion around the nut 43, and its rearward lip 49 in similar fashion secured around the stem 18 at a position intermediate the length of the chamber 24. This bellows is of standard construction, and is longitudinally and sensitively resilient, in the fashion of an accordion. The bellows 47 thus encloses a compartment 50 within the compartment 12.

A plurality of spaced radial ports 51 through the rearward portion of the stem 18 provide communication between the compartment 12 and the chamber 24. Similarly, a plurality of spaced radial ports 52 through the forward portion of the stem 18 provide communication between the compartment 12 and the bellows compartment 50.

In the inner wall of the chamber 24, at the rear end thereof, a plurality of spaced peripheral grooves 53 are provided, into any one of which a split lock ring 54 is adapted to be placed, to limit the rearward stroke of the valve 25, as the rearward movement of the valve 25 will stop when its head strikes the ring 54.

The housing wall separating the compartment 12 from the compartment 11 is mostly broken away so that free communication between these compartments would be possible. However, to prevent free communication and to provide a trap for exhaust gases, the following construction is provided. At the top and the bottom of the communicating space between these compartments, the housing is formed to provide oppositely disposed ridges 55 projecting into this space and extending across the width thereof, to reduce the opening between the compartments. A threaded countersunk hole is provided through one side of the wall to receive a screw 56, a tube 57, adapted to fit snugly in the compartment 11, has a threaded hole therethrough positioned on one side of the middle (lengthwise) thereof, adapted to receive the end of the screw 56. In Figure 4, the tube is shown with its lower end flush with the upper surface 17 of the housing and its upper end lying, on one side, close to the ridges 55. Air sucked into the manifold from the compartment 12 has only one path, that is, past the ridges 55, and around the upper end of the tube 57 on upward through the upper end of the compartment 11, in the direction of the arrow 58. However, incompletely evaporated fuel

being drawn into the manifold from the carburetor in an upward direction through the compartment 11, has a clear path out at the top of the compartment, and the upper end of the tube 57 adjacent the ridges 55 acts as a baffle to discourage the said fuel from entering the compartment 12. The reason for providing the threaded tube hole offset from the middle thereof, is that the tube may be removed from its position shown in Figure 4 and then re-inserted after turning it through 180 degrees, in which case its upper end will lie flush with the top housing surface 17 and its lower end will provide a baffle against said fall, as is obvious. This adjustability of the tube 57 is necessary, since some engines have a down draft intake manifold.

The air inlet 39 may be open directly to the air, as shown, or an air screen, not shown, may be mounted on the inlet. The inlet might also be connected with the carburetor inlet 59 of the carburetor 60. A minute auxiliary channel 61-62 extends through the stem 42 between the air inlet and the bellows compartment 50.

The operation of the device is as follows. The secondary valve 37 is normally closed, i. e., seated against the gasket 41, being retained in that position by force of the bellows 47. As soon as the motor decelerates, the added vacuum thus created in the compartment 11 is communicated to the compartment 12 outside the bellows 30. This urges the bellows to expand, but instead of tending to open the valve 37 it actually urges the latter to remain closed, as the other end 49 of the bellows is constrained against movement by virtue of its rigid attachment to the stem 18. The vacuum just mentioned, however, has access to the chamber 24 through the ports 51, and when this vacuum is sufficient, as determined by the tension of the spring 30, the atmospheric pressure within the bellows against the head of valve 25 pushes the latter off its seat. Thus, the passage between chambers 24 and 25 is opened, through the grooves 33 and 31, permitting the vacuum to have access into the chamber 45, and through the ports 52 into the bellows compartment 50. With the vacuum thus communicated to the compartment 50, and with atmospheric pressure applied on the outside of the valve 37, the bellows will contract and open the valve 37. Hence the pin 46, pushes the valve 25 further from its seat 28 and holds it there due to the great excess of surface area of the bellows over the cross-sectional area of the valve 25. The moment the vacuum coming from the motor ceases, the spring 30 and the bellow 47 (by expanding) both combine to seat valves 25 and 37. When the bellows expands as abovementioned, the ports 61-62 permit entry from the outside of air thereto to permit quick seating of the valve 37.

In actual use, however, the vacuum coming from the motor does not cease until deceleration comes to an end, as one cylinder follows the other in continuous succession in supplying the vacuum. Thus, both valves 25 and 37 remain unseated until deceleration ceases, and an instant thereafter with the return of atmospheric pressure to within and without the bellows, the spring 30 and the resiliency of the bellows restore both valves instantly to the closed positions. The wide opening of the valve 37, as shown in Figure 3, permits an immediate and continuous supply of fresh air in large volume into the cylinders during deceleration, thus permitting complete combustion of the consequently greatly reduced

amount of gasoline therein and keeping the cylinder lubricating oil from being sucked into the cylinders. Hence, the objections mentioned above, as to malodorous exhaust etc., are fully overcome.

The ring 54 is placed in any one of the grooves 53 of the chamber 24, depending upon the degree of maximum opening of the valve 25 desired, and the latter depends upon the size and type of engine to which the device is applied. Accurate adjustment of the spring 30 is had by the screw 22, to assure efficient performance of the device.

Obviously, modifications in form and structure may be made without departing from the spirit and scope of the invention.

I claim:

1. A device of the class described comprising a housing having two separated compartments therein communicating with each other, one of said compartments being open at both ends and being connected in the intake manifold of an engine, the other of said compartments having a hollow stem projecting thereinto through one end, said stem being closed on its outer end, an inwardly projecting valve seat provided in said stem intermediate its length, a valve slidably mounted in said stem and adapted to seat against said valve seat, a spring normally urging said valve against said valve seat, said valve having longitudinal surface grooves, a peripheral internal flange surrounding the other end of said second compartment, a second valve slidably mounted in said other end of said second compartment adapted to seat against said flange to open or close said other end, said second valve having a stem projecting through said valve seat to a point adjacent said first valve, a bellows open at both ends, one of said open bellows ends being sealed against said second valve and the other end being sealed around said stem, radial ports through the walls of said stem outside said bellows, and additional radial ports through the walls of said stem inside said bellows.

2. A device of the class described comprising a housing having two separated compartments therein communicating with each other, one of said compartments being open at both ends and being connected in the intake manifold of an engine, the other of said compartments having a hollow stem projecting thereinto through one end, said stem being closed on its outer end, an inwardly projecting valve seat provided in said stem intermediate its length, a valve slidably mounted in said stem and adapted to seat against said valve seat, a spring normally urging said valve against said seat, said valve having longitudinal surface grooves, a peripheral internal flange surrounding the other end of said second compartment, a second valve slidably mounted in said other end of said second compartment adapted to seat against said flange to open or close said other end, said second valve having a stem projecting through said valve seat to a point adjacent said first valve, a bellows open at both ends, one of said open bellows ends being sealed against said second valve and the other end being sealed around said stem, radial ports through the walls of said stem outside said bellows, and additional radial ports through the walls of said stem inside said bellows, and adjustable means for limiting the movement of said first valve from said seat.

3. A device of the class described comprising a housing having two separated compartments therein communicating with each other, one of

said compartments being open at both ends and being connected in the intake manifold of an engine, the other of said compartments having a hollow stem projecting therein through one end, said stem being closed on its outer end, an inwardly projecting valve seat provided in said stem intermediate its length, a valve slidably mounted in said stem and adapted to seat against said valve seat, a spring normally urging said valve against said seat, said valve having longitudinal surface grooves, a peripheral internal flange surrounding the other end of said second compartment, a second valve slidably mounted in said other end of said second compartment adapted to seat against said flange to open or close said other end, said second valve having a stem projecting through said valve seat to a point adjacent said first valve, a bellows open at both ends, one of said open bellows ends being sealed against said second valve and the other end being sealed around said stem, radial ports through the walls of said stem outside said bellows, and additional radial ports through the walls of said stem inside said bellows, and a removable sleeve mounted in said first compartment and partly closing the communication between said compartments.

4. A device of the class described comprising a housing having two separated compartments therein communicating with each other, one of said compartments being open at both ends and being connected in the intake manifold of an engine, the other of said compartments having a hollow stem projecting thereinto through one end, said stem being closed on its outer end, an inwardly projecting valve seat provided in said stem intermediate its length, a valve slidably mounted in said stem and adapted to seat against said valve seat, a spring normally urging said valve against said seat, said valve having longitudinal surface grooves, a peripheral internal flange surrounding the other end of said second compartment, a second valve slidably mounted in said other end of said second compartment adapted to seat against said flange to open or close said other end, said second valve having a stem projecting through said valve seat to a point adjacent said first valve, a bellows open at both ends, one of said open bellows ends being sealed against said second valve and the other end being sealed around said stem, radial ports through the walls of said stem outside said bellows, and additional radial ports through the walls of said stem inside said bellows, and means for adjusting the tension of said resilient means.

5. A device of the class described comprising a housing having two separated compartments therein communicating with each other, one of said compartments being open at both ends and being connected in the intake manifold of an engine, the other of said compartments having a hollow stem projecting thereinto through one end, said stem being closed on its outer end, an inwardly projecting valve seat provided in said stem intermediate its length, a valve slidably mounted in said stem and adapted to seat against said valve seat, a spring normally urging said valve against said seat, said valve having longitudinal surface grooves, a peripheral internal flange surrounding the other end of said second compartment, a second valve slidably mounted in said other end of said second compartment adapted to seat against said flange to open or close said other end, said second valve having a stem projecting through said valve seat to a point

adjacent said first valve, a bellows open at both ends, one of said open bellows ends being sealed against said second valve and the other end being sealed around said stem, radial ports through the walls of said stem outside said bellows, and additional radial ports through the walls of said stem inside said bellows, and adjustable means for limiting the movement of said first valve from said seat, and a removable sleeve mounted in said first compartment and partly closing the communication between said compartments.

6. A device of the class described comprising a housing having two separated compartments therein communicating with each other, one of said compartments being open at both ends and being connected in the intake manifold of an engine, the other of said compartments having a hollow stem projecting thereinto through one end, said stem being closed on its outer end, an inwardly projecting valve seat provided in said stem intermediate its length, a valve slidably mounted in said stem and adapted to seat against said valve seat, a spring normally urging said valve against said seat, said valve having longitudinal surface grooves, a peripheral internal flange surrounding the other end of said second compartment, a second valve slidably mounted in said other end of said second compartment adapted to seat against said flange to open or close said other end, said second valve having a stem projecting through said valve seat to a point adjacent said first valve, a bellows open at both ends, one of said open bellows ends being sealed against said second valve and the other end being sealed around said stem, radial ports through the walls of said stem outside said bellows, and additional radial ports through the walls of said

stem inside said bellows, and adjustable means for limiting the movement of said first valve from said seat, and means for adjusting the tension of said resilient means.

7. A device of the class described comprising a housing having two separated compartments therein communicating with each other, one of said compartments being open at both ends and being connected in the intake manifold of an engine, the other of said compartments having a hollow stem projecting thereinto through one end, said stem being closed on its outer end, an inwardly projecting valve seat provided in said stem intermediate its length, a valve slidably mounted in said stem and adapted to seat against said valve seat, a spring normally urging said valve against said seat, said valve having longitudinal surface grooves, a peripheral flange surrounding the other end of said second compartment, a second valve slidably mounted in said other end of said second compartment adapted to seat against said flange to open or close said other end, said second valve having a stem projecting through said valve seat to a point adjacent said first valve, a bellows open at both ends, one of said open bellows ends being sealed against said second valve and the other end being sealed around said stem, radial ports through the walls of said stem outside said bellows, and additional radial ports through the walls of said stem inside said bellows, and a removable sleeve mounted in said first compartment and partly closing the communication between said compartments, and means for adjusting the tension of said resilient means.

SAMUEL JACOVELLI.