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J. R. GROVES

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2 Sheets-Sheet 1

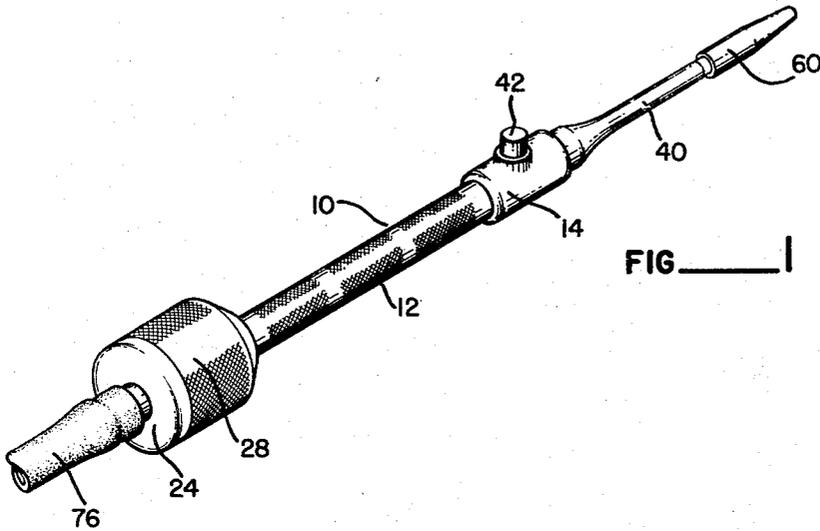


FIG. 1

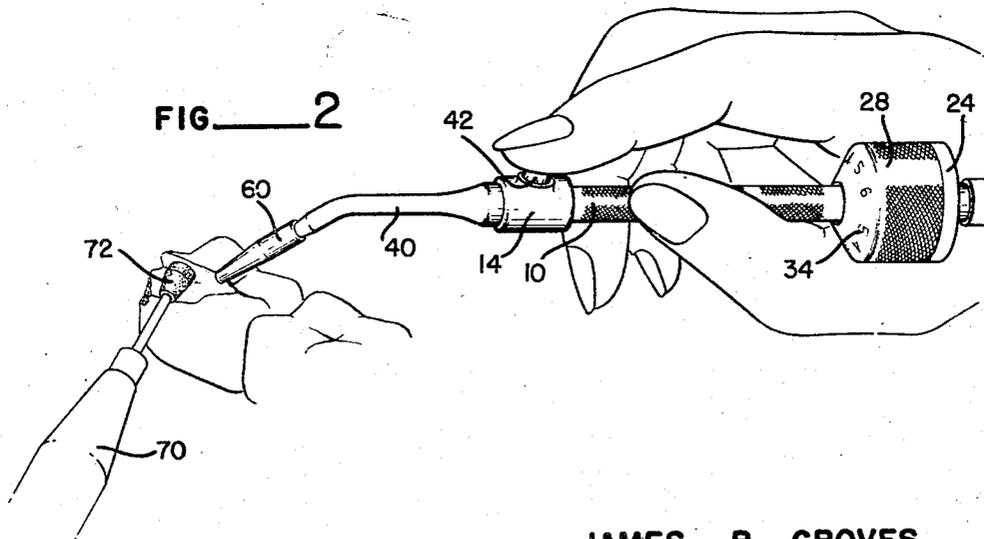


FIG. 2

JAMES R. GROVES  
INVENTOR

BY  
*Smith & Tuck*

June 28, 1955

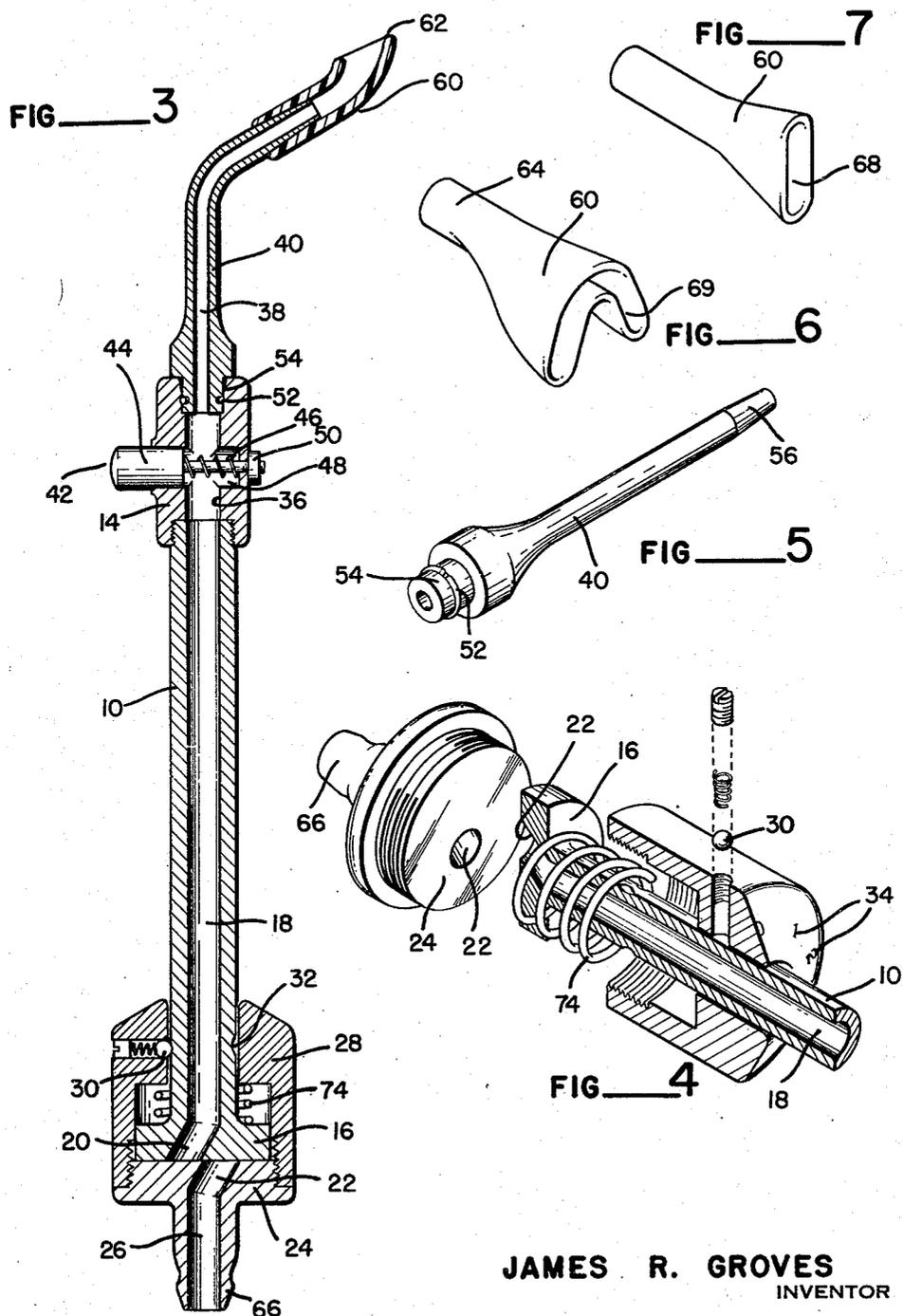
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JAMES R. GROVES  
INVENTOR

BY  
*Smith & Tuck*

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**VACUUM EJECTOR FOR DENTAL DEBRIS**

James R. Groves, Seattle, Wash.

Application February 16, 1953, Serial No. 336,954

6 Claims. (Cl. 32-33)

This present invention relates to the general art of dental ejectors, or siphons, and more particularly to an ejector designed to remove dental debris by suction without the use of water. The device is generally similar in appearance to the ordinary dental hand piece and is to be connected, for use, to a source of negative pressure usually of the type where a small motor drives a vacuum pump which in turn is directly connected to the hand piece by suction tubing. A characteristic of the equipment is that the outline of the nozzle, which can be varied for different teeth, should be small enough to lie normally within the margins of the tooth being worked upon and the terminal portion of the hand piece should be so constructed that when the nozzle itself is in the optimum position it can be easily held by a nurse or assistant in such a manner as not to hinder the operation of the dentist nor in any way obscure his vision.

In the past a number of attempts have been made to solve the problem of removing dry grindings or other dental debris from the teeth in order to avoid the use of water and the flushing of the often sharp materials through the mouth. A common means employed is to use an air blast. This is objectionable in that the sharp dust is driven into the eyes, nose and skin of both the dentist and the patient. Further if the tooth pulp is exposed the sharp particles may cause considerable pain to the patient. In this present instance I have avoided the use of any bulky or otherwise undesirable equipment and have provided that only a small diameter tube should actually be inserted within the oral cavity. To the end of the suction tube is connected a yieldable tip, made of rubber, or some of the yieldable plastic materials. The tips themselves must be of relatively small size so they will not obscure the vision of the dentist. This present equipment in no way hampers the operation of the dental hand piece as can so easily occur when the evacuation equipment is operably secured to the hand piece. It is therefore believed that this present equipment provides a most satisfactory solution of this perplexing problem and will thus be found to be a real contribution in the advancement of the field.

The principal object of this present invention is to provide an ejector for dry dental debris which equipment is so proportioned as to remove the debris directly from the tooth as it is produced by the dental burr or other equipment used by the dentist.

A further object of this invention is to provide an ejector for dental debris which is in no way secured to the dentist's hand piece and which will not hinder his free use of the same.

A further object of this invention is to provide yieldable tips adapted to engage the surface of the tooth being worked upon but which, because of their small size, will not hinder the dentist in his operation.

A further object of this invention is to provide a dental debris ejector having a nozzle which normally is smaller than the outline of the tooth being worked upon and which, because of its small sized suction opening,

can be supplied with a high degree of suction by a relatively small vacuum pump.

Further objects, advantages and capabilities will be apparent from the description and disclosure in the drawings, or may be comprehended or are inherent in the device.

In the drawings:

Figure 1 is a perspective view illustrating the hand piece used with this present equipment and showing one form of nozzle and tip secured to it;

Figure 2 is a perspective view showing the manner in which a tooth is treated and showing the employment of my vacuum ejector in association with the dental hand piece;

Figure 3 is a longitudinal sectional view through the hand piece following the teachings of this invention and showing one form of nozzle and one form of tip employed with the nozzle;

Figure 4 is an exploded perspective view illustrating the valving means employed to control the opening in the vacuum line;

Figure 5 is a perspective view showing one form of nozzle for use with this equipment; and

Figures 6 and 7 illustrate alternate forms of tips used with the nozzle of Figure 5, or nozzles of other conformation.

Referring more particularly to the disclosure in the drawings, the numeral 10 designates the hand piece tube. This tube forms the main component of the hand piece and is preferably knurled on the outside as indicated at 12 to facilitate the handling of the hand piece. At one end tube 10 is fixedly secured, as by threading thereto, to the interrupter valve housing 14. At its opposite end tube 10 is formed with an enlarged or flange member providing the valve plate 16. Throughout the tubular portion of member 10, the bore 18 is straight, and then, when it enters the valve plate, it is angularly disposed for the relatively short portion 20. Adapted to coact with angular portion 20 is an angular portion 22 of the tube extending through valve member 24. With this arrangement, the abutting ends of tubes 20 and 22 can be variously positioned with respect to each other. In Figure 3 they have been shown in one extreme position where they form an actual complete shutoff between bore 18 and the tubular portion 26 of valve member 24. The opposite extreme position would be where tubes 20 and 22 are fully superimposed upon each other, thus permitting the maximum flow through the tubes.

In order to give the nurse or assistant a graduated index reflecting the settings of this valve arrangement, the valve housing 28 is provided with a ball detent 30, which is spring seated, adapted to engage any one of a plurality of depressions 32 formed in the body of tube 10. Indices are provided as at 34 on the outer end portion of housing 28 as will be noted in Figures 2 and 4. Thus it is possible to preset the valve member to provide any degree of valving action between tubes 20 and 22.

At its opposite end tube 10 has its bore axially aligned with the bore 36 of housing 14 and in alignment with this bore is the bore 38 of nozzle 40. An interrupter or shutoff valve 42 is provided having the cylindrical valve member 44 of sufficient diameter to entirely close bore 36 when it is fully depressed against the compression spring 46. To insure a complete closure of bore 36 housing 14 is recessed at 48 to accommodate the inboard end of cylinder 44. Suitable means as the nut 50 is provided to hold the valve assembly in position.

A plurality of nozzles 40 is provided for use with this ejector. These are normally made of metal but are supplied in different forms so as to readily adapt the device to different positions of use. Two such forms have been illustrated in Figures 3 and 5 respectively. The nozzles

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are provided with a snap ring 52 seated in a groove within the hub portion 54 of the nozzle and adapted to resiliently engage a companion groove in housing 14 so that the nozzle can be quickly changed as conditions require. In the various forms of nozzles the extreme outer end is tapered as at 56 so that tips of various types after the representative showings of Figures 3, 6, and 7 may be easily engaged thereon and may further be disposed in the most effective angular relationship with the nozzle.

The tips 60 used in association with nozzle 40 are preferably made of yieldable material. Rubber may be employed. However the yieldable plastics appear to be most generally useful, especially in that they may be made of transparent material and thus the engagement of the working surfaces of the same as 62 can be observed in their exact relationship with the tooth surface. Tips 60 should be provided with a plurality of different shapes in the contact surface 62 because they must be made quite small; and in this particular it is to be observed that throughout the drawings the tips themselves are shown on an exaggerated scale; it being desirable that the working surface be small enough normally to be fully contained within the projected area of the tooth upon which work is being done. In order to accommodate the tips 60 to a variety of operations the same may be provided with a round intake opening, or the openings may be elongated as indicated at 68, or the shape may be varied to suit the need, as an example, in the showing of Figure 6 in which a U-shaped opening 69 is employed. The neck portions 64 of the tips are preferably formed with a tapered bore to the end that they can be securely engaged with the tapered portion 56 of the nozzles 40 and will seat in any angular relationship thereon in a manner which will prevent any vacuum leakage at this point. When the term "small" is used in connection with tips 60 in the specification and claims, this means that the size of tips used inside of the dental cavity has a maximum cross-sectional dimension of approximately  $\frac{1}{8}$  of an inch. However, it should be pointed out that on occasions tips of a larger size are used outside of the dental cavity in such operations as shaping and polishing the teeth with a disc.

#### *Method of operation*

In preparing to use this device a suction hose is slipped onto the annularly grooved end 66 of valve member 24 and then connected to a source of vacuum pressure. Many dental engines are provided with such a source. However a relatively small vacuum pump with its own motor may be employed if desired especially in view of the fact that the whole construction of this equipment lends itself to a mode of operation in which a minimum of air enters the system due to relatively small working openings in tips 60. When the term "vacuum pump" is used in the specification and claims, this is defined as a pump producing a vacuum of a high order in comparison with such means as the usual water powered siphon used for a saliva ejector.

When the dentist has assumed his working position, his assistant holds the hand piece of the ejector after the showing of Figure 2 while the dentist works with hand piece 70 having burr 72. The assistant selects a nozzle 40 and a tip 60 which will best work with the location of the tooth and the shape of the cavity. It is important that the ejector equipment be disposed so as not to interfere with the normal working of the dentist. The assistant then, guided by past experience, will set the desired relationship between tube 10 and valve member 24 by means of the indices 34. In so doing it is normal to slightly compress spring 74 so that the adjustment may be made with a minimum of friction. This adjustment will vary in accordance with the area of the opening, as 68 or 69, and also whether it is actual tooth material being ejected or whether it may be filling material. The forefinger usually is placed upon valve member 42, depressing the same after the showing of Figure 2. When material is

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broken loose from the tooth, the valve is allowed to open momentarily so as to give the benefit of a higher degree of vacuum than otherwise would have been drawn on the bore of suction hose 76 and the various bores within the hand piece. This mode of operation also permits the minimum entry of air which entry tends to neutralize, to a degree, the vacuum drawn on the system by the vacuum pump.

Because of the expansion of gases caused by suction of air, the temperature in the surrounding area is lowered, thus proving advantageous in its effect on the tooth which is heated by the friction of the burr during the process of cavity preparation. This tendency of partial temperature control serves to lessen pain. The vacuum at the tip of the instrument may be used directly to suck in debris surrounding the nerve pulp of the tooth in cases such as where there is exposed, partially decayed nerve pulp in a cavity which is to be capped. This pulp is often removed by blowing air on the same in present practice and of course impurities could become imbedded in the pulp in the process resulting in infection.

It is believed that it will be clearly apparent from the above description and the disclosure in the drawings that the invention comprehends a novel construction of a vacuum ejector for dental debris.

Having thus disclosed the invention, I claim:

1. A hand piece forming a vacuum ejector for dental debris, comprising: a tubular body of a size to be held in a hand having a suction tip on one end, said suction tip being of small size capable of being inserted directly inside of a dental cavity, means for connecting a vacuum pump to the other end of said body, a first throttling valve in said body manually operable to be set in various positions to change the effective size of the air passageway in said tubular body at the location of said throttling valve, a second interrupter valve in said body having a push button for manual control operative to close the air passageway in said tubular body at the location of said interrupter valve upon depression of said push button, said interrupter valve having spring means biasing the same normally to an open position.

2. A hand piece forming a vacuum ejector for dental debris, comprising: a tubular body of a size to be held in a hand having a suction tip on one end, the other end of said body being flanged forming a valve plate, a valve housing slidably and rotatably mounted on said tubular body having an annular wall extending outward enclosing said valve plate and a valve member removably secured to the end of said annular wall and abutting the face of said valve plate, said valve housing having compression spring means between its inner end and said valve plate biasing said valve member against the face of said valve plate, the bore of said tubular body being straight and axially aligned except for an end portion in said valve plate which is angularly disposed in relation to the remainder of the bore, said valve member having a matching angularly disposed bore meeting the angularly disposed bore in said valve plate in one position of said valve housing whereby an adjustable throttling effect is produced by rotation of said valve housing, and said valve member having means for connecting a vacuum pump thereto.

3. The subject matter of claim 2 in which there is visible indicia on the valve assembly indicating a series of relative positions between said angularly disposed bores and said valve housing having a spring pressed detent and said tubular body having a series of depressions engaging said detent at said series of positions.

4. A hand piece forming a vacuum ejector for dental debris, comprising: a tubular body of a size to be held in a hand having a removable suction tip on one end, a vacuum pump and a tube connecting the other end of said body with said vacuum pump, a valve in said body manually operable to control the effective size of the air passageway in said tubular body at the location

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of said valve, said tip being formed of yieldable material and being secured on said tubular body by having a taper to the bore of said tip and the outer surface of the end of the tubular body to which it is secured having a corresponding taper.

5. The subject matter of claim 4 in which the exterior surface of the end of said tip and the bore therein have U-shaped contours.

6. The subject matter of claim 4 in which the exterior surface of the end of said tip and the bore therein have 10 oblong contours.

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