

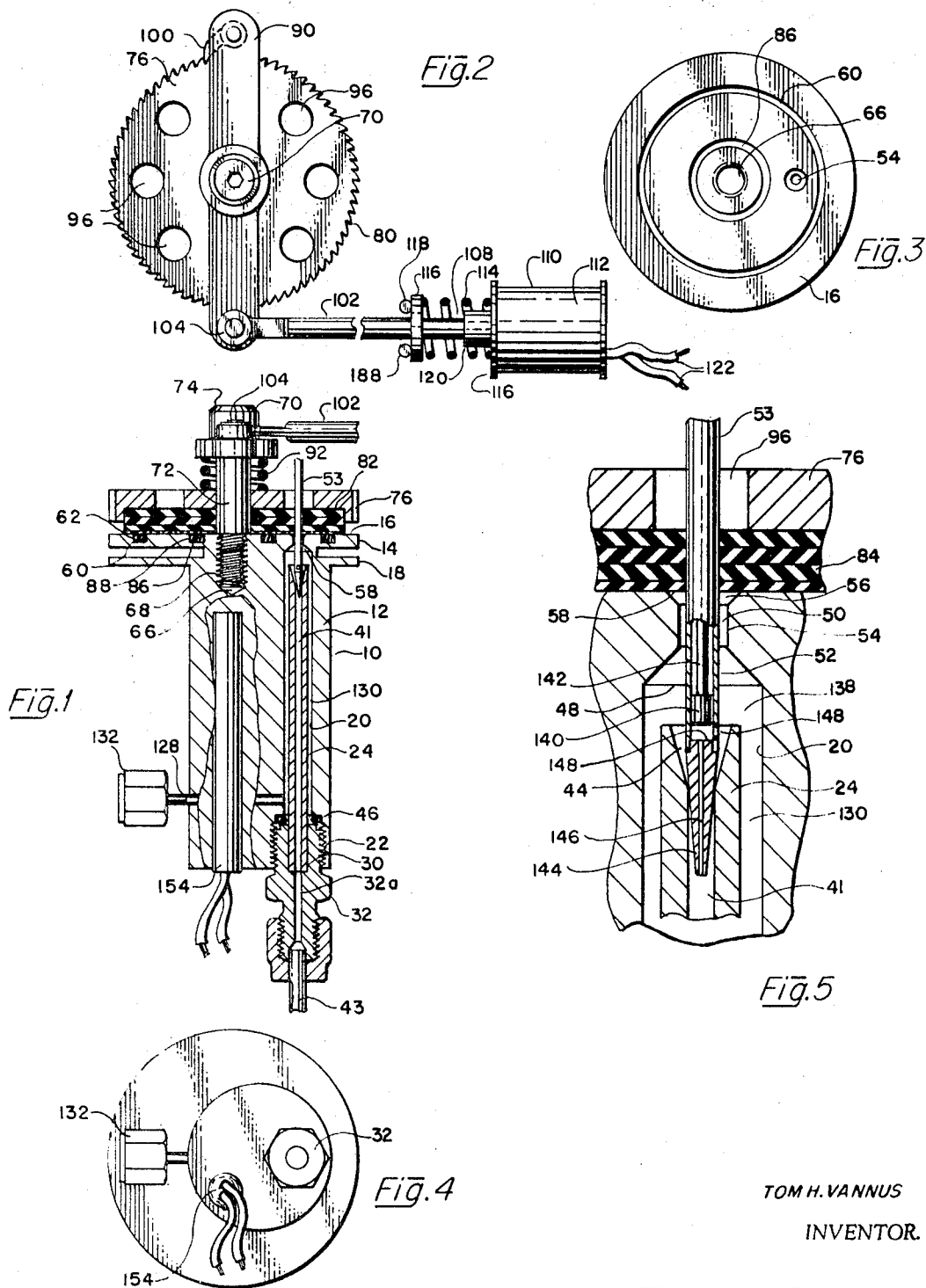
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AUTOMATIC SEPTUM CHANGING INLET

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AUTOMATIC SEPTUM CHANGING INLET
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ABSTRACT OF THE DISCLOSURE

A septum changing inlet apparatus for chromatographs having a ported body and a septum disc carried by a rotatably mounted ratchet wheel having a plurality of annularly spaced outer ports which may be successively moved into alignment with the port of the body, there being means for successively rotating the ratchet wheel to move said outer ports thereof respectively into alignment with the port in the body.

BACKGROUND OF THE INVENTION

Field of the invention

This invention relates generally to inlets for chromatographs and relates more particularly to such inlets having changeable septums.

Description of the prior art

Heretofore inlets for chromatographs have small septums that must be replaced individually after they have been penetrated or punctured a number of times. Such replacing of septums has certain disadvantages such as loss of time, for example.

SUMMARY OF THE INVENTION

The present inlet has a body with a face sealed by O-rings and a septum disc retained on a rotatably mounted ratchet wheel or gear, which has a plurality of annularly spaced ports therein, the septum disc being urged into contact with the body face and O-ring seals thereof by a spring. The body has a passage for carrier gas with an external connection and the column of the chromatograph is connected to a column adapter that extends into the body of the inlet. This adapter has a bore and the body face has a port in line with both the adapter bore and in the path of the outer ports of the septum retaining ratchet wheel so that said outer ports may be successively moved into alignment with the bore of the adapter as the ratchet wheel is moved predetermined increments of rotation, there being means for affecting such increments of rotation of said ratchet wheel.

There is a heater cartridge for heating the inlet body while cooling ribs are provided to cool the face of the body and the septum disc.

Provision is made for carrier gas to pick up samples from the inlet and carry them into the column of the chromatograph.

OBJECTS AND ADVANTAGES OF THE INVENTION

The present inlet is well suited to work in connection with an automatic injection system where the septum face can be changed to bring different septum areas into operative position.

Another object of the invention is to provide a septum for inlets of chromatographs having various areas that may be easily and quickly brought into operative position.

Still another object of the invention is to provide a septum of this character that may be automatically to bring various areas into operative position.

A further object of the invention is to provide a septum

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of this character that obviates the necessity of a worker having to change individual septums after such septums have been punctured a few times by syringe needles.

BRIEF DESCRIPTION OF THE DRAWINGS

Referring to the drawings, which are for illustrative purposes only:

FIG. 1 is a longitudinal section through an inlet embodying the present invention;

FIG. 2 is a top plan view of the same with means for automatically activating the septum wheel;

FIG. 3 is an elevational view of the face of the body with the O-ring grooves;

FIG. 4 is a view of the lower end of the device; and

FIG. 5 is an enlarged sectional view showing the adapter in place and a free end portion of the needle disposed in the bore of the adapter.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring more particularly to the drawings, there is shown an automatic septum changing inlet, having a body, indicated generally at 10, said body having a cylindrical part 12 with an annular radial flange 14 at one end, said flange being eccentric relative to the cylindrical body part 12 and having an outer flat face 16.

Face 16 is at what will be termed the front end of the body and spaced somewhat behind the flange 14 is a cooling rib 18 that is concentric with the flange 14 and serves to prevent overheating of the O-rings and the septum.

At one side of the axis of the body part 12 is an adaptor bore 20 that extends longitudinally of the body part 12 from the rear end of said body part, said bore having a tapped counter bore 22. Within the adaptor bore 20 is a column adaptor 24 of smaller outside diameter than the inside diameter of the adaptor bore 20. At the rear end said column adaptor 24 extends into a bore 30 in the inner end of a column fitting 32 and is soldered or otherwise secured in said bore 30. Fitting 32 is screwed into the tapped counter bore 22 and a fitting 40 on a column 42 is screwed onto the column fitting 32.

There is also a seal 46 at the inner end of said tapped counter bore 22 which seals about the adjacent portion of the adaptor tightly when the column fitting is tightened and retains said adaptor in place.

Column fitting has a longitudinal passage or bore 41 therethrough, the back or rear end of said passage communicating with the passage 32a of the column fitting 32 to which the column 43 is connected. The opposite or forward end of said passage 41 flares forwardly as at 44 and is normally open. The forward end of the adaptor is spaced rearwardly of the forward end 48 of the adaptor bore 20 and there is a needle orifice 50 extending forwardly from the adaptor bore 20 and of reduced diameter relative to the diameter of said adaptor bore, said needle orifice 50 being in axial alignment with the adaptor bore but of greater diameter than the outside diameter of a needle, indicated generally at 52, of a syringe, indicated generally at 53, used in connection with the present inlet and described more fully hereinafter. The interior flange 54 defining the orifice 50 flares forwardly and outwardly and said orifice communicates with a short recess 56 at the front end of the body 10. The open front end of the recess 56 comprises what is termed the inner port 58 which is at the surface or face of the flange 14.

The front or free face 16 of the flange 14 has an annular forwardly facing groove 60, concentric with the flange and co-axial with said flange. A seal or O-ring 62 is disposed in said groove and the outer part of said O-ring extends outwardly of the face 16.

The front end of the body has a tapped bore 66 at the axis of flange 14 and in which is screwed the externally

threaded end part 68 of a screw, indicated generally at 70, said screw having a cylindrical outer end part or shank 72 which is of larger diameter than the threaded end part 68 thus providing a shoulder which seats on the face 16 about the tapped bore 66. The outer end of the screw 70 has enlarged head 74.

Rotatably mounted on the shank 72 of the screw 70 is a septum wheel 76 which has peripheral ratchet teeth 80. So it may be termed a ratchet wheel as well as the septum wheel. A recess 82 is provided in the rear side of the ratchet wheel in which is disposed a septum 84 and secured for rotation with the septum wheel as by a snug fit or an adhesive of any well-known suitable character. The septum 84 may be of any suitable well-known character although the septum shown comprises three layers of rubber, the center layer being of soft silicon rubber while the outer layers are of harder rubber. Septums of this character are disclosed in the Carlton B. McKinney application for a Septum, filed Oct. 15, 1965, Ser. No. 496,337.

There is another annular groove 86 in the face 16, said groove 86 being axially arranged relative to the screw 70 and being substantially smaller in diameter than the groove 60. An O-ring 88 is disposed in said groove 86.

A lever 90 has a hole intermediate its ends for mounting said lever on the shank 72 of the screw 70 and end portions of said lever project outwardly of the ratchet wheel and said end portions are provided with holes therethrough. The lever 90 is retained on the shank 72 of screw 70 by the head 74 and there is a spring 92 disposed on said shank 72 between the lever 90 and the ratchet wheel. Spring 92 urges the septum wheel toward the face 16 of flange 14 and into sealing engagement with the O-rings 62 and 88. The seal 88 extends beyond the outer ports so that any carrier gas getting into the space defined by the seals 62 and 88 cannot leak out past seal 88 and seal 62 prevents escape of such gas adjacent the axial center of the septum. Septum wheel 76 has a plurality of annularly arranged and spaced ports 96 which are termed the outer ports. The path of ports 96 is aligned with the inner port 58 and as the outer ports 96 are equally spaced they can be successively moved into alignment with the inner port 58. Respective portions of the septum are exposed by the outer ports 96 and said portions of the septum are brought into register or alignment with the inner port 58 as the ratchet wheel is successively moved in increments equal to the spacing of said outer ports.

There is means for automatically actuating the ratchet wheel 76 predetermined increments, said means comprises a pawl 100 pivotally mounted at one end of the lever 90 and adapted to operably engage the ratchet teeth when the lever is actuated in one direction and to slide over said teeth when the lever moves in the opposite direction. Any suitable means may be used to yieldingly urge the pawl into operable engagement with the teeth such as a spring, but the means shown is gravity. An actuating rod 102 has one end pivotally connected to the opposite end of the lever 90, said pivotal connection being indicated at 104. Rod 102 has its opposite end pivotally connected, as at 106, to the free or outer end of a solenoid plunger or armature 108 of a solenoid 110 which includes a solenoid coil 112. A spring 114 reacts between the solenoid coil and a flange 116 integral with or secured to the armature 108, spring urged movement of said armature being limited by engagement with fixed pins 118. When the solenoid coil 112 is energized the armature is pulled into the coil against the force of spring 114, such movement being limited by engagement of the flange 116 with a collar 120 of the solenoid. Thus there is provided a predetermined and repeatable movement of the plunger 108 which effects a predetermined rotary movement of the ratchet wheel of equal increments so that the outer ports and the portions of the septum exposed therethrough are successively brought into register with the inner port 58 each time the solenoid is energized. Energization of the solenoid is effected by any

suitable well known switch, not shown, connected to the wires 122 of the solenoid.

A carrier gas passage 128 has its inner end communication with the annular passage 130 between the adaptor and the wall of the adaptor bore 20, the outer end or inlet 132 of the passage 128 is connected to a source of carrier gas, not shown. The forward end of the annular passage 130 communicates with a chamber 138 defined by the flange 54. The forward open end of the adaptor passage 41 is also in communication with said chamber 138.

Heating means is also provided and comprises an electric heater cartridge 154 disposed in a bore provided therefor in the body part 12.

With the needle shown in FIGS. 5 and 6, the mechanism works as follows:

Carrier gas is fed into the passage 128 from the carrier inlet 132. From passage 128 the carrier gas passes into the annular passage 130 between the column adaptor 24 and the adaptor bore 20, and into the chamber 138, thence into the adaptor passage or bore 41 and thence into the column of the chromatograph.

The needle 52 of syringe 53 is hollow with a plunger 140 carried at the inner end of a plunger rod 142. Plunger 140 is slidable within the needle which has a forwardly tapered tip 144 with a fluid passage 146 therethrough. At one side the needle has a port 148 near the forward end of the needle but spaced rearwardly of the inner end of the tip.

With the carrier gas flowing as above described and the syringe loaded with a sample, it being understood that the syringe plunger is at its forward position closing the port 148, the needle of the syringe is inserted into the outer port aligned with the inner port and through the septum portion exposed through said outer port. The tip 144 of the needle is inserted far enough through the septum to enter the flared forward end of the bore 41 of the adaptor and the adjacent end portion of the bore 41 thereby interrupting the flow of carrier gas. The syringe plunger 140 is then momentarily retracted thereby uncovering the needle port 148. Carrier gas will now flow into the needle port, through the needle and needle tip and thence into the column thereby sweeping the sample in the needle into the column. The plunger is then moved forwardly to close the needle port 148 and the needle then retracted or withdrawn from the inlet.

After the septum portion has been penetrated a number of times by needles the ratchet wheel is rotated to bring a new outer port and septum portion exposed therethrough into alignment with the inner port. In the arrangement shown, this is effected by energizing the solenoid.

It is to be understood, of course, that other means may be employed to bring a new unpunctured septum portion into operative position.

Also, the septum may be otherwise carried as on a linearly movable carrier or mounting means and various means used to move some predetermined increments to successively bring unpunctured septum portions into operative position.

I claim:

1. A septum changing inlet, comprising:

- (A) means defining a passageway for carrier gas, said passageway being adapted to have one end connected to a chromatograph column, the other end of said passageway being normally open and adapted to receive the end of a syringe needle;
- (B) an element having an outer face, said element having an inner port open at said face, said port being aligned with the passageway for carrier gas and providing access thereto;
- (C) means for supplying carrier gas to the open end of said carrier gas passageway;
- (D) septum carrying means operably positioned relative to said element, said carrying means having a

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plurality of outer ports therethrough which are spaced apart;

(E) and a septum operably attached to said septum carrying means, portions of said septum being aligned with said outer ports, said septum being in sealing relationship with the outer face of said element, movement of said septum carrying means bringing said portions of the septum into alignment with the inner port.

2. The invention defined by claim 1, including means for moving said septum carrying means.

3. The invention defined by claim 2, wherein the outer ports are spaced apart predetermined distances and the means for moving said septum carrying means is automatic means for moving said septum carrying means predetermined increments to bring said portions of said septum into alignment with the inner port.

4. The invention defined by claim 1, wherein said septum carrying means comprises a septum wheel rotatable to bring the portions of said septum into alignment with the inner port.

5. The invention defined by claim 2, wherein there is automatic means for effecting rotation of said wheel, said automatic means including a reciprocating member, stop means for limiting reciprocation of said member in both directions, and means connecting said reciprocating member with the septum wheel for effecting movement of said wheel when said member moves in one direction but permitting movement of said member in the opposite direction without effecting movement of said wheel.

6. The invention defined by claim 5, wherein said automatic means for effecting rotation of said wheel includes a ratchet and pawl mechanism, the septum wheel having ratchet teeth on the periphery thereof, and there is a lever operably carrying said pawl.

7. The invention defined by claim 6, including a solenoid having an armature connected with said lever, said armature being limited in movement in both directions by said stop means whereby the pawl will engage said ratchet teeth and effect predetermined rotative movement of said wheel.

8. The invention defined by claim 1, wherein the septum is between the septum carrying means and the outer face of said element; and resilient means urging said septum carrying means toward said face.

9. The invention defined by claim 1, wherein said other end of the passageway for carrier gas is flared toward the inner port.

10. A septum changing inlet, comprising:

(A) a body having an adaptor bore extending from one end and having an inner port at the opposite end;

(B) a column adaptor disposed in said adaptor bore, said column adaptor being of smaller outside diameter than the diameter of the adaptor bore thereby

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providing an annular fluid flow passage about said adaptor, said column adaptor having a fluid flow passage therethrough, the inner end of said adaptor being spaced from the inner port, and normally in communication with the annular fluid flow passage about said adaptor, the outer end of the fluid flow passage through the adaptor being adapted to be connected to a chromatograph column;

(C) a radial annular flange at the end of the body having the inner port, said flange having an outer face whereat said inner port opens;

(D) a septum retaining wheel rotatably mounted at the flanged end of said body with the axis of said wheel spaced laterally from said inner port, said wheel having a plurality of annularly arranged and spaced outer ports therethrough;

11. The invention defined by claim 10, wherein said septum is between the outer face of said flange and said wheel, and there is resilient means urging said wheel and septum toward said outer face of the flange.

12. The invention defined by claim 11, where the face of said flange has an inner and an outer annular grooves and seals disposed in said grooves, said seals having portions extending outwardly of the face of said flange and said septum sealingly engaging the outwardly extending portions of said seals.

13. The invention defined by claim 12, wherein said outer seal extending radially outwardly of the outer ports of said wheel while the inner seal seals against escape of fluid at the axial part of the face of said flange.

14. The invention defined by claim 10, wherein the inner end of the adaptor passage is flared toward the inner port.

15. The invention defined by claim 10, including a heater for said body.

16. The combination of the invention defined by claim 1 with a syringe having a needle inserted through a septum part, said needle being tubular and having a tapered tip inserted into the open end of the passageway for carrier gas, said needle also having a side port adjacent said tip, and a plunger slidable mounted in said needle for movement from a position closing said side port and a position whereat said side port is open.

17. The invention defined by claim 10, including a radially extending cooling vane on said body adjacent to but spaced from said flange.

References Cited

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S. CLEMENT SWISHER, Primary Examiner