

Aug. 29, 1961

J. W. GIFFEN
PRECISION GRINDING

2,997,827

Filed July 30, 1958

3 Sheets-Sheet 1

Fig. 1

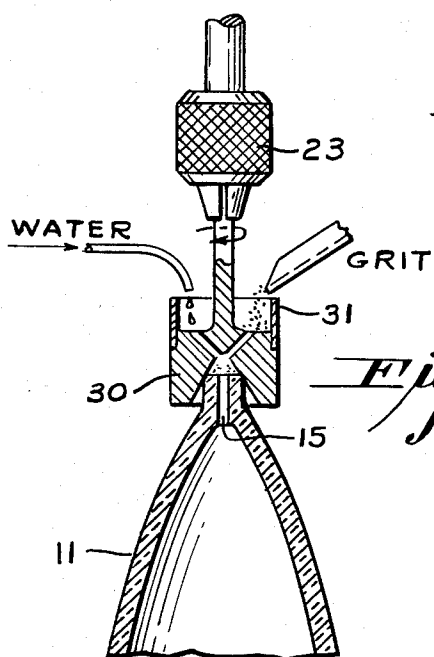
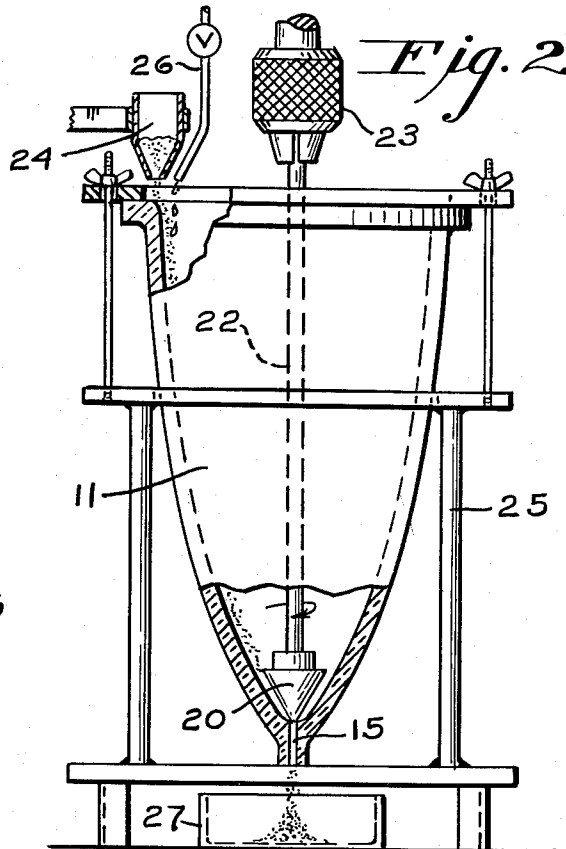
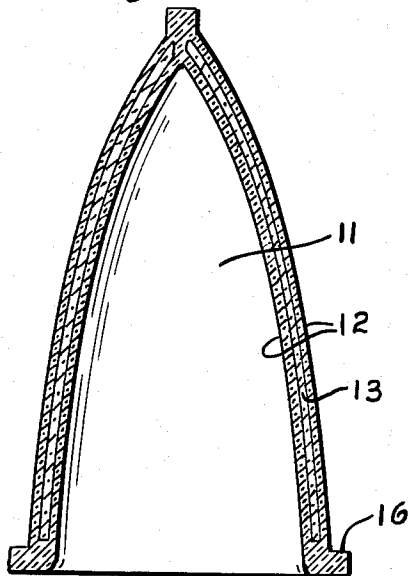


Fig. 3

INVENTOR.
JAMES W. GIFFEN
BY
Clarence R. Patten, Jr.
ATTORNEY

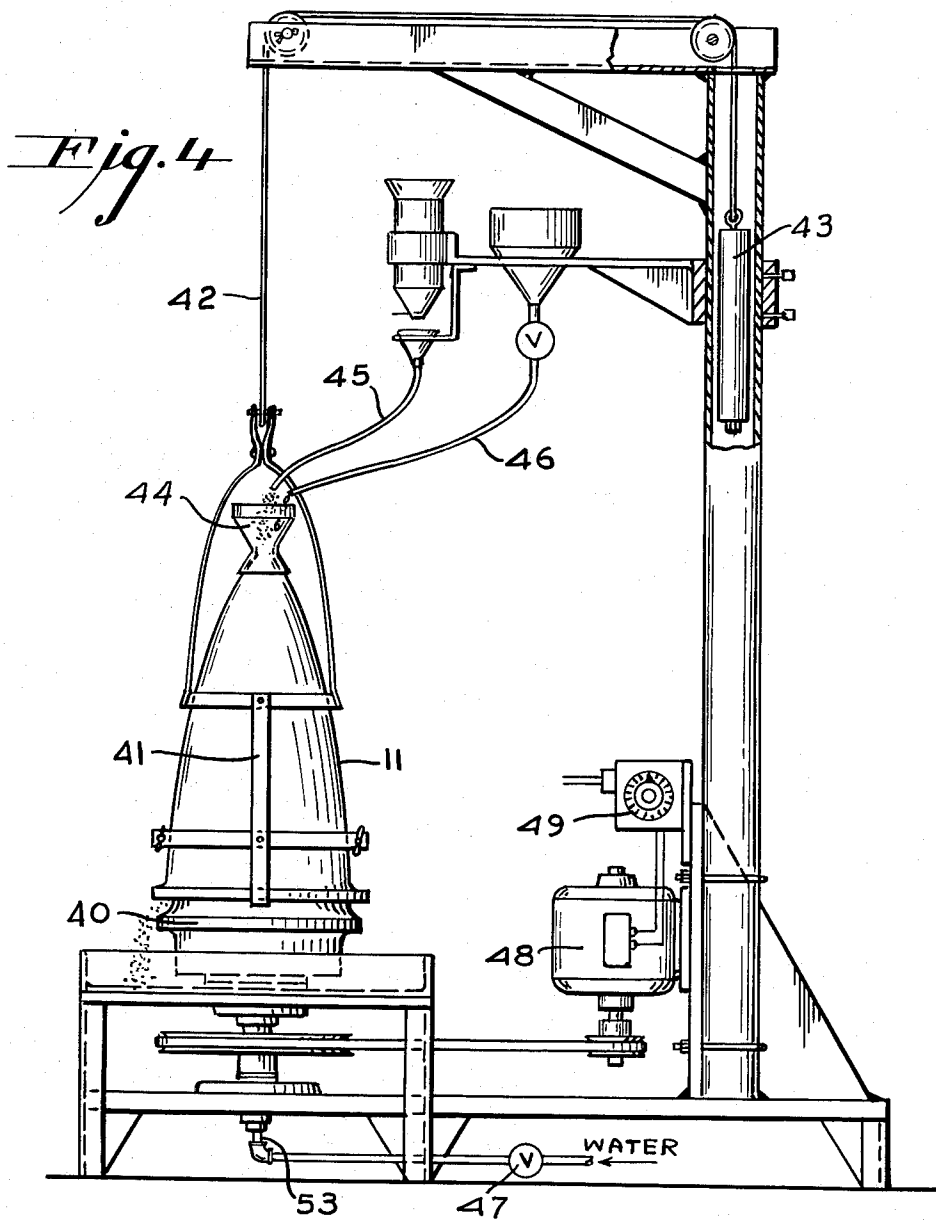
Aug. 29, 1961

J. W. GIFFEN
PRECISION GRINDING

2,997,827

Filed July 30, 1958

3 Sheets-Sheet 2



INVENTOR.
JAMES W. GIFFEN
BY Clarence R. Poth, Jr.
ATTORNEY

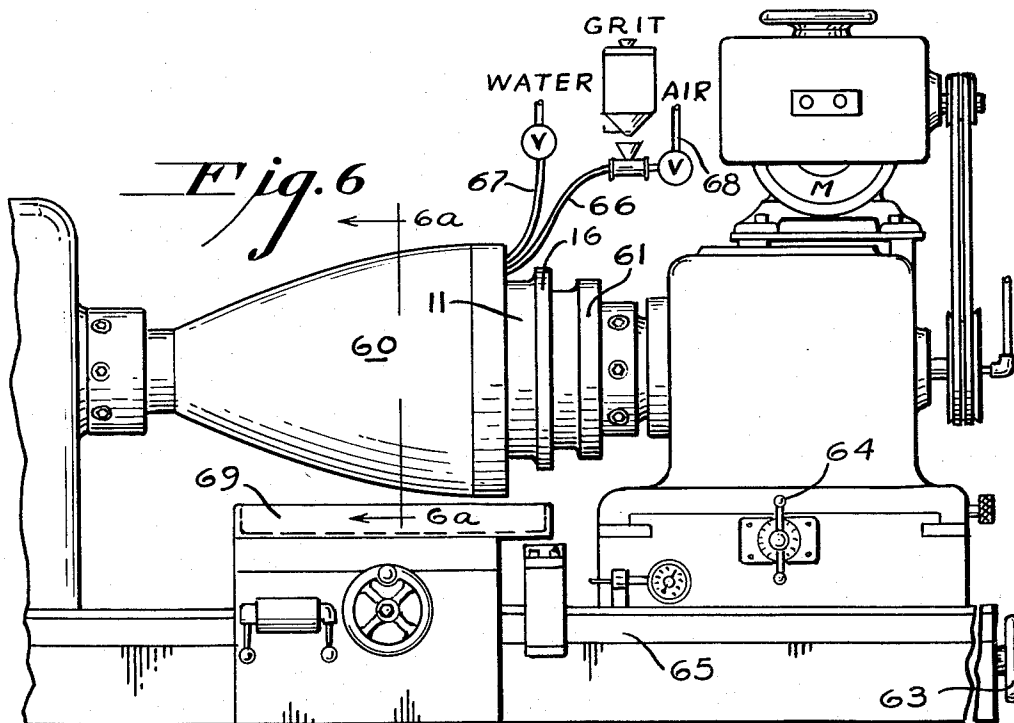
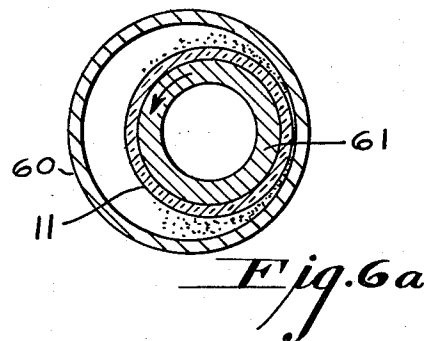
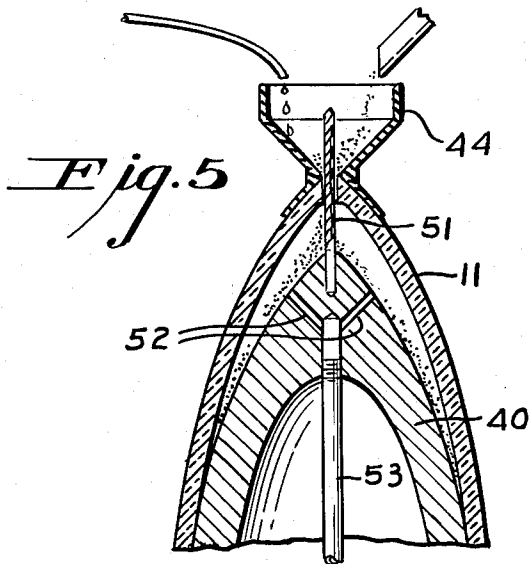
Aug. 29, 1961

J. W. GIFFEN
PRECISION GRINDING

2,997,827

Filed July 30, 1958

3 Sheets-Sheet 3



INVENTOR.
JAMES W. GIFFEN
BY *Clarence R. Paffy, Jr.*
ATTORNEY

1

2,997,827

PRECISION GRINDING

James W. Giffen, Corning, N.Y., assignor to Corning Glass Works, Corning, N.Y., a corporation of New York

Filed July 30, 1958, Ser. No. 751,955
4 Claims. (Cl. 51—326)

The present invention relates to the grinding to precision dimensions massive articles, such for example as radomes usually comprising ogive shaped hollow cones of highly refractory material and employed as the enclosing shells or tips of large ballistic missiles. To aid in comprehension of the problems involved it is pointed out that the blanks cast for such radomes may be thirty inches in length and thirteen inches in diameter or larger and weigh fifty pounds or over. Moreover, the wall thickness of the finished radomes must be of extreme uniformity.

According to the invention, a plunge form type of grinding is employed, using a slurry comprising loose abrasive particles of silicon carbide or similar abrading material and water as a carrier. This slurry is backed up against the article to be ground by a metal form or lap of the shape ultimately to be imparted to the article. Motion is introduced to the lap which causes the particles of abrasive to dig in, abrade and chip out the surface it comes into contact with as pressure is applied.

In grinding a radome blank, to provide the internal lap with a continued flow of new abrasive the tip of the blank, which is rotated about a vertical axis with its tip end uppermost, is provided with a small aperture. Such aperture also enables the proper grinding of the entire inner surface of the tip region of the blank by later inverting it and feeding abrasive between it and a small lap. When grinding the inner surface of such a radome blank the lap and blank are arranged concentrically and therefore contact is made eventually over the whole inner surface of the blank from which stock is being removed at one time. When grinding the outer surface however the lap, which runs the length of the blank, contacts it at a line of tangency.

For a better understanding of the invention reference will be made to the accompanying drawings illustrating machinery that may be employed to carry out the method, a radome blank as initially formed and its conversion into a finished radome.

In the accompanying drawings:

FIG. 1 shows a sectional view of a radome blank and by varied crosshatching the material removed therefrom to leave a finished radome.

FIG. 2 is a view of a fixture with a radome blank, shown partly in section, arranged therein having its inner tip end surface being ground.

FIG. 3 is a view showing the tip end of a blank, in section, and its outer tip end surface being ground.

FIG. 4 is a view of a fixture with a blank suspended therefrom over a lap employed to grind its inner surface.

FIG. 5 is an enlarged view in section of a part of the structure and of the blank shown in FIG. 4.

FIG. 6 is a view of the blank arranged in a lathe in which the outer surface of such blank is being ground by an external lap.

FIG. 6a is a sectional view taken on line 6a—6a of FIG. 6.

Referring to the drawings in detail, as shown in FIG. 1, at the outset there is a radome blank 11 as initially formed, the material to be removed therefrom being designated 12 and the core 13 of which represents the fully ground radome.

The first operation necessary is the drilling of a hole

2

such as 15 (FIG. 2) through the blank 11. The blank is then clamped in inverted position in a suitable cage 25 and the inner surface of its tip end ground out by means of a small lap 20 secured to a shaft 22 mounted for rotation by a drill chuck 23. The necessary abrasive for effecting grinding is fed down the inner surface of the blank 11 through a funnel 24 while water is supplied via a valved line 26. The used slurry passes through hole 15 into a catch basin 27.

In the second operation the blank 11 (FIG. 3) is arranged base down beneath the drill chuck 23 which has been provided with a tip grind-off lap 30 provided with a reservoir from which water and abrasive material are fed to the lap and blank engaging surfaces as the chuck 23 rotates the lap to remove the blank tip.

In the third operation, the blank 11 is clamped in a harness (FIG. 4) 41 and suspended from one end of a cable 42 over an internal lap 40. The cable 42 is attached at its other end to a suitable counterweight 43 enabling an operator to readily bear down on the blank to regulate the grinding operation. A funnel 44 is placed on the blank tip for the purpose of receiving abrasive material and water from suitable supply lines such as 45 and 46, respectively. As will be observed from FIG. 5, the lap 40 has a drill 51 secured in its tip that extends up into the funnel 44 and that, upon rotation of the lap functions as a screw to force feed the abrasive slurry within the funnel down onto the lap 40. Rotation of the lap is effected by a direct current motor 48 under control of a rheostat 49.

To effect removal of the internally ground blank 11 from the lap 40 such lap is provided with passages (FIG. 5) 52. These passages are in communication with a water supply line 53 provided with a foot valve (FIG. 4) 47 operable to direct water into passages 52 and thus lift the blank from the lap.

The blank 11 is now ready for the grinding of its external surface. For this operation it is mounted on a mandrel 61, (FIG. 6) which may actually be the previously used internal lap 40. Mandrel 61 is arranged for rotation about a horizontal axis by means of a motor driven tailstock spindle of a lathe 65 adapted for lineal movement, as by a feed screw 63 to appropriately position the blank into an external lap 60 the exact desired distance.

The external lap 60 has an internal diameter several inches greater than that of the blank which is brought into tangential grinding relation with the lap as illustrated in (FIG. 6a) by feeding the blank in a direction perpendicular to its axis, as by means of a transverse feed screw 64. Water and abrasive supply tubes such as 67 and 66 project into the space between the blank 11 and the surface of the lap 60 above it. Air from an associated supply line 68 is employed to aid in maintaining a cushion of the resultant abrasive water mixture between the blank and the lap. Best results are obtained by revolving the lap clockwise, so as to pick up the mixture and carry it to the contact area, and revolving the blank in the opposite direction. A catch basin 69 is provided for the spent mixture issuing from the lap 60. Preferably the lap is rotated between ninety and three hundred revolutions per minute and the blank from twenty to sixty revolutions per minute. Removal of the blank from mandrel 61 is effected in the same manner as removal of the blank from lap 40.

The final finishing operations comprise cutting off the base flange 16 (FIG. 1) and grinding the hole 15 in the tip to concentricity. These operations may be carried out by conventional methods.

What is claimed is:

1. The method of grinding the outer surface of a

hollow article of revolution, which comprises rotating the article about the axial center of its inner surface, arranging a lap about the outer surface of the article and rotating it about the article along an axis parallel to the article axis, effecting relative movement between the lap and article in a direction perpendicular to their axes to bring inner and outer surfaces of the lap and article into tangential relation and feeding an abrasive to such surfaces to effect grinding of the article surface to a desired dimension.

2. A method such as defined by claim 1 wherein positive pressure is applied in feeding of the abrasive.

3. The method of grinding the wall of a hollow, generally conically, shaped article to a precision shape and thickness, which comprises establishing a passage through the tip thereof coextensive with its geometric axis, grinding the surface of the article in the region bordering the inner end of such passage to a desired dimension, grinding the surface of the article in the region bordering the outer end of such passage to a desired dimension, suspending such article in an upright position over and in close proximity to an inner surface lap, funneling abrasive particles and a liquid into the interior of the article and over the upper end of the lap through such passage while rotating the article about its geometric axis to grind its inner surface to a desired dimension, supporting and rotating the article about its geometric axis while in a horizontal plane with a lap arranged thereabout, effecting a relative movement of such lap and article in a direction perpendicular to their axes to bring surfaces

of the lap and article in tangential relation, rotating the lap in a direction opposite to the direction of rotation of the article and in the meantime feeding an abrasive and a liquid carrier between such surfaces to grind the outer surface of the article to a desired dimension.

4. The method of grinding the outer surface of a hollow article of revolution, which comprises rotating the article about the axial center of its inner surface, arranging a lap about the outer surface of the article and rotating it about the article along an axis parallel to the article axis, effecting relative movement between the lap and article in a direction perpendicular to their axes to bring the lap and article into eccentric relation and feeding an abrasive to the closely opposed surfaces of the article and lap to effect grinding of the article surface to a desired dimension.

References Cited in the file of this patent

UNITED STATES PATENTS

20	704,428	Allen	July 8, 1902
	1,560,033	Bart	Nov. 3, 1925
	1,925,751	Diffenderffer	Sept. 5, 1933
	2,155,072	Zimmerman	Apr. 18, 1939
25	2,260,016	Fink	Oct. 21, 1941
	2,367,069	Styberg	Jan. 9, 1945
	2,431,907	Barna	Dec. 2, 1947
	2,464,032	Franz	Mar. 8, 1949
	2,648,179	Manes et al.	Aug. 11, 1953
30	2,649,670	Martin et al.	Aug. 25, 1953
	2,819,569	Angenieux	Jan. 14, 1958