United States Patent

Miller

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[54] TAPE WRAPPING ARRANGEMENT

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[73] Assignee: **The United States of America as represented by the Secretary of the Army**

[22] Filed: **March 1, 1971**

[21] Appl. No.: **119,777**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 744,513, July 12, 1968, abandoned.

[52] **U.S. Cl.** **242/7.23,** 156/195, 156/425

[51] **Int. Cl.** **B65h 81/00**

[58] **Field of Search**.....242/2, 3, 7.21, 7.22, 7.23, 242/55, 157.1, 158; 156/192, 195, 184, 185, 189, 425, 426

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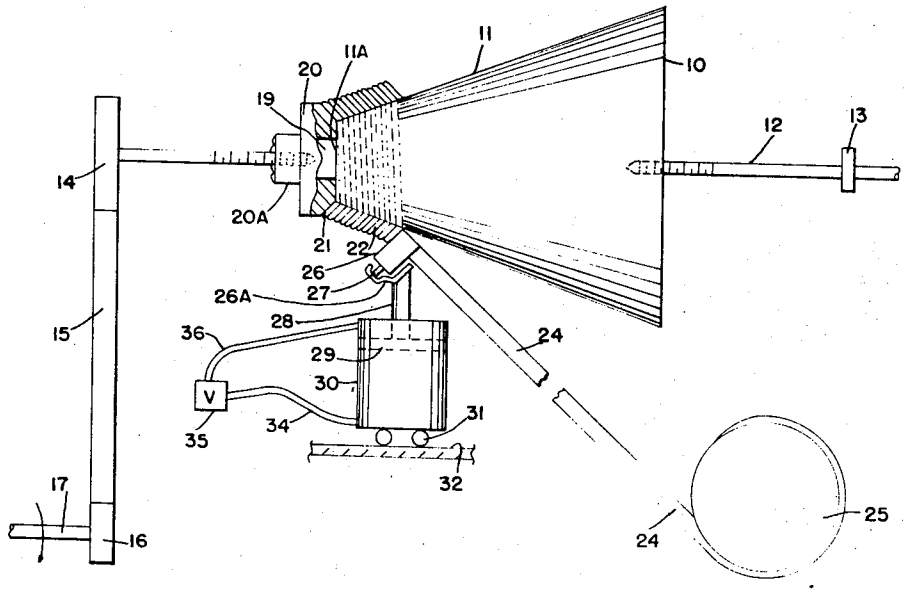
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[57] **ABSTRACT**

A tape wrapping arrangement requiring but a single drive means, in which tape is shingle wrapped about a rotating mandrel. Preimpregnated tape from its roll has its free end attached to a forward inclined surface of a sleeve carried by the mandrel and is fed in successive layers by a cylindrical roller. The roller is biased toward the mandrel by a double acting air cylinder of a free wheeling carriage. An adjustable knuckle structure interconnects the cylinder piston rod and the roller journal so that selected shingles angles may be wrapped.

7 Claims, 3 Drawing Figures



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SHEET 1 OF 2

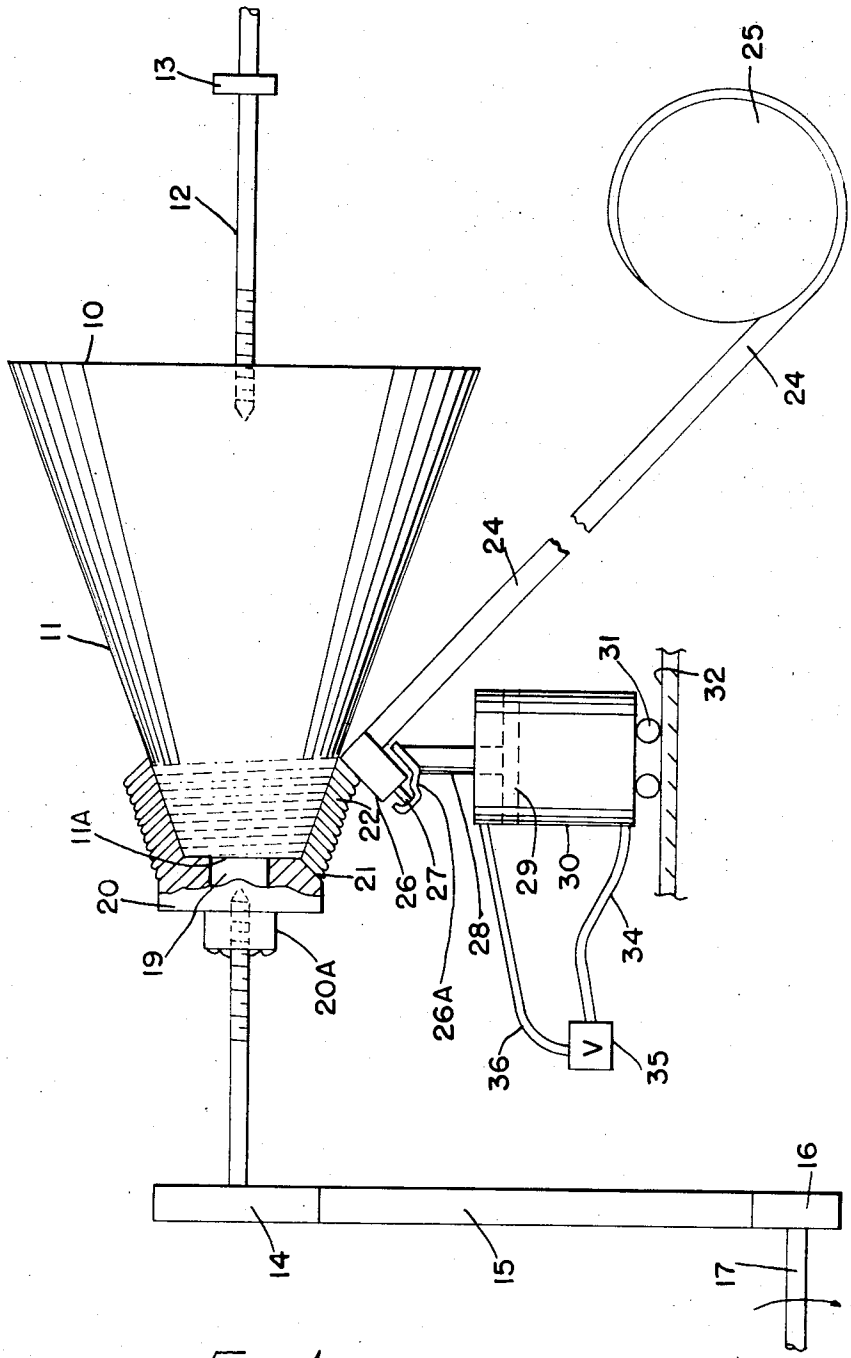


Fig. 1

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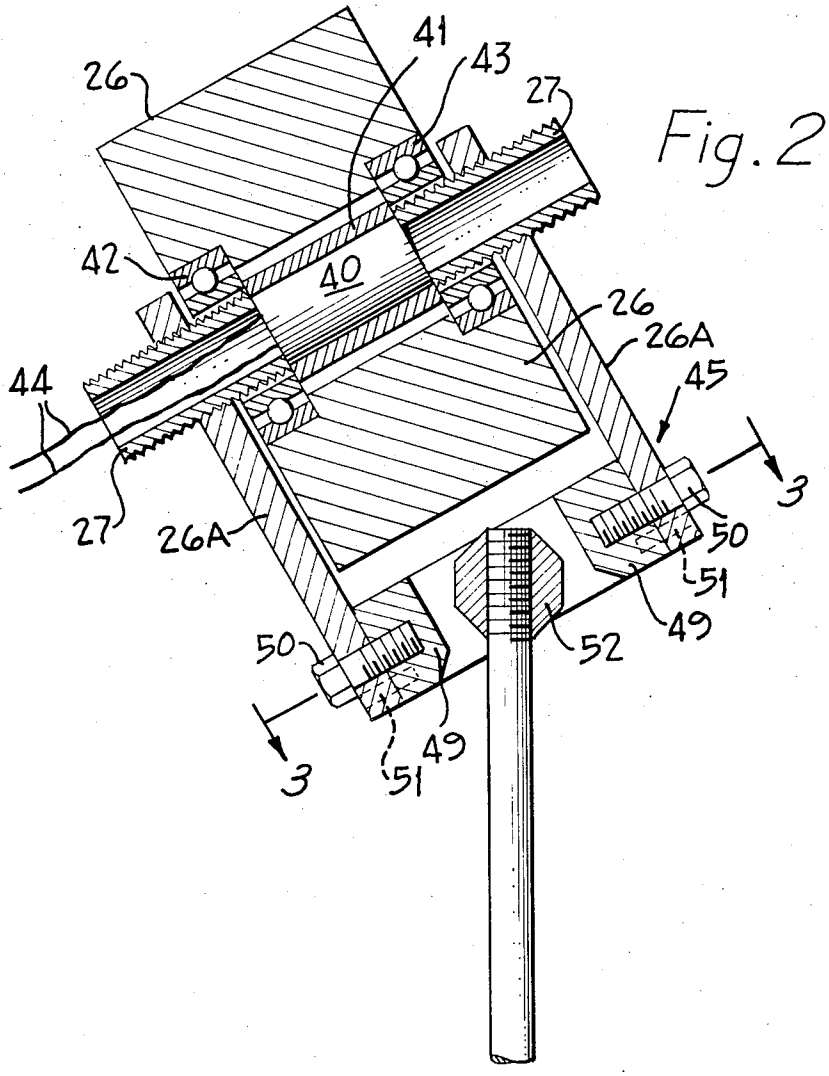


Fig. 2

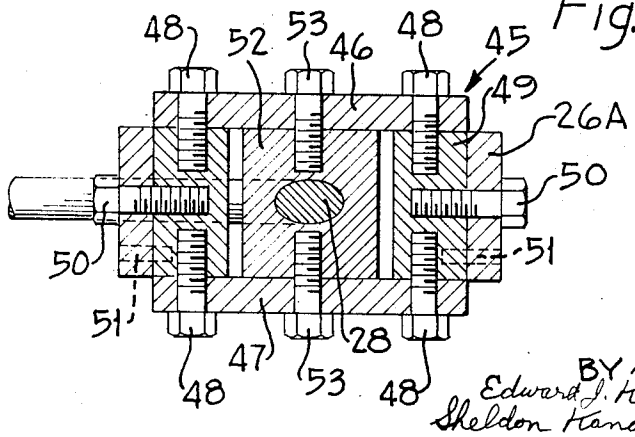


Fig. 3

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TAPE WRAPPING ARRANGEMENT

This application is a continuation-in-part of my copending application Ser. No. 744,513 filed July 12, 1968, and now abandoned.

The invention described herein may be manufactured, used, and licensed by or for the Government for governmental purposes without the payment to me of any royalty thereon.

The invention relates to tape wrapping apparatus, and more particularly, to shingle wrapping of tape about a rotating mandrel for use as insulative materials in rocket motor cases and nozzles.

One of the objects of the invention is to provide a tape wrapping arrangement requiring but a single independent drive system.

Another object of the invention is to provide such an arrangement in which a tape depositing pressure roller has a self-indexing traverse of motion.

A further object of the invention is to provide such an arrangement in which tape can be wrapped at selected shingle angles.

These and other objects, features and advantages will become more apparent from the following description and accompanying drawing in which:

FIG. 1 is a schematic view, partially in section, of the preferred arrangement embodying the principles of the invention.

FIG. 2 is an enlarged sectional view of a preferred knuckle mounting connection in the FIG. 1 arrangement.

FIG. 3 is a sectional view taken along line 3—3 of FIG. 2.

For the purpose of forming insulative material to be used in rocket nozzle construction, a rotatable mandrel 10 (FIG. 1) with a conically shaped lateral surface 11 has one end of its threadedly connected shaft means 12 appropriately journalled in support bearing 13. The other end of shaft means 12 is connected through suitable gear train 14, 15, 16 to a variable speed driving shaft 17 and its motor.

The reduced shank or stub portion 19 of the mandrel 11 is tapped and receives a selected sleeve member 20 which is secured in place against the mandrel flanged surface 11A by a suitable nut 20A. The forward face 21 of the sleeve is preferably inclined such that it, as well as the successively formed tape exposed surfaces 22, form an obtuse angle with the mandrel lateral surface 11.

The same or a similar sleeve with the desired conically shaped forward surface may be employed with a cylindrical mandrel where the objective is to provide shingle wrapped insulative materials for substantially cylindrical portions of rocket motor casings, so long as a feasible obtuse angle exists between the sleeve conical forward surface or the subsequent exposed tape surfaces and the mandrel lateral surface.

Preimpregnated tape 24 is fed from an appropriately mounted tape roll 25 through suitable tensioning nip roller means (not shown) and deposited by pressure roller 26 (FIGS. 1, 2) in successive helical turns upon the sleeve conical forward surface 21 and forwardly along or about the mandrel lateral surface 11. Pressure roller 26 is appropriately journaled and inclined such that its journal axis 27 is substantially parallel to the sleeve surface 21 which is suitable slotted to aid in initially securing the free end of tape 24 that is heated by a

cartridge heater 40 secured within a steel sleeve 41 and having electrical wires 42 leading to an appropriate potentiometer (not shown). Sleeve 41 is positioned within roller 26 and between the inner races of the roller journal bearings 42, 43 which are press fitted thereagainst. Externally threaded tubular supports 27, 27 are threaded through openings in yoke or clevis arms 26A, 26A of a knuckle mounting arrangement to firmly abut the ends of sleeve 41 and heater 40. Piston 29 is slidably mounted within the carriage cylinder 30 whose wheels 31 are oriented for longitudinal movement parallel to mandrel shaft 12 and along a suitable machine bed or track means 32. Preferably, fluid control conduits 34 and 36 sealingly connect an appropriate pressure and direction control valving device 35 with the double-acting air cylinder 30 so as to provide a predeterminedly controlled or selective effective pressure upon the underside of piston 29 during tape wrapping such that a forward edge of roller 26 is tapelocked by the sleeve surface 21 or exposed tape surface 22 and biased against the mandrel lateral surface 11. Thus, the tape depositing pressure roller 26 has a self-indexing traverse of motion, as the controlled effective pressure on piston 29 is maintained through fluid relief line 34 such that successive layers of tape build-up urge the piston away from the mandrel axis to overcome the tapelock and the carriage body freely moves in a direction normal to piston travel. The tape 24 is fed between the pressure roller 26 and the conical sleeve face 21 or successive exposed previously wrapped tape layers 22 and at a predetermined tension, linear speed and temperature.

The knuckle mounting arrangement shown generally at 45 (FIGS. 2, 3) interconnects the cylinder piston rod 28 and the clevis arm journal supports 27. Between side fram members 46, 47 are suitably secured by bolt or screw means 48 a pair of end fram members 49, 49 to which the respective clevis arms 26A, 26A are secured by bolt or screw means 50 with the aid of a dowel pin 51. An adjustable knuckle member 52, which threadedly receives the threaded end of piston rod 28, is secured in a selected position by fastening screws 53 such that the pressure roller 26 can wrap tape at any shingle angle, from one almost parallel to the mandrel surface of revolution to one almost perpendicular thereto.

Various modifications, changes or alterations may be resorted to without departing from the scope of the invention as defined in the appended claims.

I claim:

1. In a tape wrapping arrangement having a rotatable conical mandrel and means for rotating said mandrel about its longitudinal axis,

a roll of tape,

pressure roller means for shingle wrapping said tape about at least a portion of the lateral surface of said mandrel when said mandrel is rotated, said tape being deposited so that its exposed surface is inclined at an obtuse angle to the mandrel lateral surface,

a carriage, means mounting said carriage for free wheeling movement in a direction substantially parallel to said mandrel longitudinal axis with said carriage positionable in response to tape build-up along said mandrel lateral surface, said carriage

having a piston therein translatable in a direction normal to the motion of said carriage, and constant pressure control means operatively associated with said piston,

a piston rod connecting said piston with said pressure roller means and translatable in response to change in diameter of said mandrel as said pressure roller means is advanced along said mandrel lateral surface,

said tape wrapping arrangement being so constructed and arranged that a single drive mechanism for rotating said mandrel to shingle wrap said tape operates independent of said carriage and said carriage is moved along an axis parallel to said mandrel longitudinal axis in response to tape build-up.

2. The structure in accordance with claim 1 wherein a sleeve carried by said mandrel has an inclined forward surface upon which is secured a free end portion of the first turn of said tape.

3. The structure of claim 2 wherein said pressure roller means includes a cylindrical roller biased against said mandrel lateral surface, the longitudinal axis of said roller being substantially parallel to said sleeve forward surface.

4. The structure of claim 1 wherein said carriage includes an elongated fluid cylinder, the mounting means includes on said carriage wheel means journalled said constant pressure, and control means includes a fluid system connected to said fluid cylinder at points above and below the piston travel path.

5. The structure of claim 1 in which said mandrel rotating mechanism includes a variable speed drive member, and gear transmission means interconnecting said drive member with an axial shaft of said mandrel.

6. The structure of claim 1 wherein said piston rod is connected to said roller means by an adjustable knuckle arrangement, said knuckle arrangement including a frame having a knuckle member adjusting secured thereto, said piston rod threadedly secured to said knuckle member, and said frame having a pair of substantially parallel arms extending substantially transversely of said frame and containing means for journally supporting said pressure roller means.

7. The structure of claim 6 wherein said journal support means includes a pair of opposed externally threaded tubular supports in abutment with opposed ends of a cartridge heater and its surrounding sleeve, and journal bearings carried by said roller means and having a corresponding inner race in abutment with said sleeve.

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