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## (54) A core covering for winding rolls of film and paper.

(57) The present invention concerns a core for winding deformable web materials such as film or paper. The core includes a cylindrical surface (10) with an outer covering of a microcellular polyurethane foam (12).

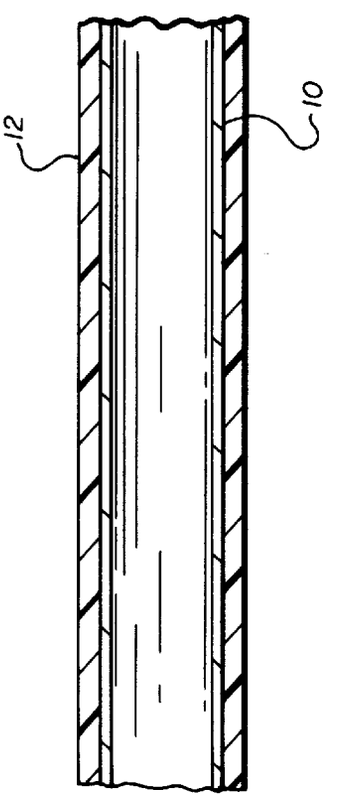



FIG. 1

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## Field of the Invention

This invention relates to cores for winding webs of deformable material. More, particularly, this invention relates to cores which reduce waste in the winding of film and paper.

## Background of the Invention

Core impressions are a major source of waste when winding webs of paper or film. Core impressions are distortions in a web at or near the core and are apparent after unwinding. The impressions are caused by tape, the web itself, dirt particles, foldovers in the web, or any other surface irregularities at or near the core. Although solutions to these problems have been suggested in the prior art, see for example German Offenlegungsschrift No. 3,610,557, these solutions are not always completely successful. In this reference the described solution is to provide the core with a covering of elastically or plastically deformable material which deforms to accommodate the irregularity so that the first turns of a web on the core do not have to deform to accommodate the irregularity.

However, it has been found that when a web of photographic base material is wound on a core such as described in Offenlegungsschrift No. 3,610,557, the very high pressures progressively created cause the wound web to collapse radially inwards. These collapses are known as buckling, spoking or starring and cause a greater amount of waste than that produced by the problems of core impressions.

The present invention solves the problems caused by core impressions while providing greater protection against the tendency for buckling, spoking or starring of the wound web.

## Summary of the Invention

The present invention is an apparatus for winding a web of deformable material. The apparatus comprises a central cylindrical core having an outer surface, which can be made of cardboard, plastic or metal. To the outer surface is attached a microcellular polyurethane foam.

In a preferred embodiment, the microcellular polyurethane foam has an average pore size of approximately 100 microns.

## Brief Description of the Drawings

Figure 1 shows a sectional view of the core of the present invention.

Figure 2 shows a comparison of average impressed footage of core impressions for various materials.

For a better understanding of the present invention together with other objects, advantages and capabilities thereof, reference is made to the following description and appended claims in connection with the above-described drawing.

## Description of the Preferred Embodiment

Due to pressures involved in the winding of a roll of film or paper, the lap end of the web and the tape at the core are impressed into the layers above it causing a lap and tape imperfection. German Patent Application No. 3,610,557 describes the use of foam on cardboard cores in reducing that imperfection. However, after a series of winding experiments with both wide and narrow paper web, using a variety of foam covered cardboard cores, it was found that many soft foam materials, such as commercially available closed or open cell polystyrene, polyethylene or polyurethane found having a density of less than 10 lbs/ft$^3$, that would help reduce the lap and tape impression, as compared with plain cardboard cores, would buckle, spoke or star locally and cause an imperfection just as bad or worse than the lap or tape impression.

Shown in Figure 1 is a sectional view of a core 10 for winding a web of flexible deformable material. The core is surrounded by a layer 12 of foam material. The preferred thickness of this layer is from about 1/64 inch to about 3/8 inch.

The foam material can be applied to the cardboard core in a variety of ways. A paper backer can be applied to the foam material which is then spirally wrapped and glued to the cardboard core. This is similar to the method of manufacture of cardboard cores. An alternate method of applied foam to the core is wrapping and gluing the material around the core and butting the two ends to each other.

Experiments were conducted by winding a multiple number of rolls of a 2.75 inch polyethylene resin coated paper on cores with three different types of core surface material at two different web temperatures. The rolls were stored for 24 hours at the winding web temperature of 100°F and 24 hours at room temperature, then unwound and evaluated for core impressions. The types of core surfaces included in the experiment described were:

A. Plain cardboard

B. .065 inch thick polystyrene (Styrofoam) on cardboard.

C. 0.055 inch thick high modulus microcellular polyurethane foam on cardboard (Poron® 4701-05) manufactured by Rogers Corp.

All cores had an eight inch inside diameter and an outside diameter of nine inches plus core covering thickness. The winding speed used was 200 ft/min. The rolls were surface wound with a 0.375 inch thick, 70 Shore A durometer surface winder drum to a two inch pile height. The contact force used was 15 pli.

The inspection and evaluation of the web involved slowly unwinding the stored roll and visually scanning the web for.lap marks, tape marks, core impressions, buckles, spokes or stars and any other imperfections. A high intensity spotlight fixture was used in reflection mode to aid in the inspection. This light helped to enhance the imperfections. As a roll was unwound, it was stopped to closely examine the web without tension. Also the lap number and footage were noted when an imperfection was found. The results obtained are shown graphically in Figure 2.

As seen in Figure 2, a 65% reduction in core impressions is possible using a high modulus microcellular polyurethane foam like Poron® 4701-05 foam covered cores, as compared with polystyrene covered cores. This is a very significant and unexpected result. The material of choice is a high density microcellular open-celled urethane. The average cell size is approximately 100 microns. The properties of the Poron 4701-05 material are as follows. The density is approximately 320 kg/m$^3$. The compression force for a 25 percent material deflection at a 0.2 in./min. strain rate is 125 +/-35 kPa. The material compression set is less than 2 percent at 70°F per ASTM 1667. The tensile strength measured at a 20 in./min. strain rate is 1030 kPa. The material hardness is a 24 Shore O.

An additional advantage is that a cardboard core covered with Poron is excellent for many reuses as compared with other coverings and is very durable for tape removal. Finally, this material is easier to clean and is less likely to generate particulate matter than other foam core coverings.

While there have been shown and described what are at present considered the preferred embodiments of the invention, it will be obvious to those skilled in the art that various alterations and modifications may be made therein without departing from the scope of the invention.

## Claims

1. An article of manufacture for winding a web of deformable material comprising:
   a central cylindrical core having an outer surface; and
   a microcellular polyurethane foam affixed to the outer surface of said cylindrical core.

2. The apparatus according to claim 1 wherein said central core comprises cardboard.

3. The apparatus according to claim 1 wherein said central core comprises plastic.

4. The apparatus according to claim 1 wherein said central core comprises metal.

5. The apparatus according to claim 1 wherein said microcellular polyurethane foam has a thickness of approximately 1/64 inches to approximately 3/8 inches.

6. The apparatus according to claim 1 wherein said microcellular polyurethane foam has an average pore size of approximately 100 microns.

7. The apparatus according to claim 1 wherein the compression force of said microcellular foam is from about 90 to about 160 kPa.

8. The apparatus according to claim 1 wherein the tensile strength of said microcellular foam is approximately 1030 kPa.

9. The apparatus according to claim 1 wherein the density of said microcellular foam is approximately 320 kg/m$^3$.

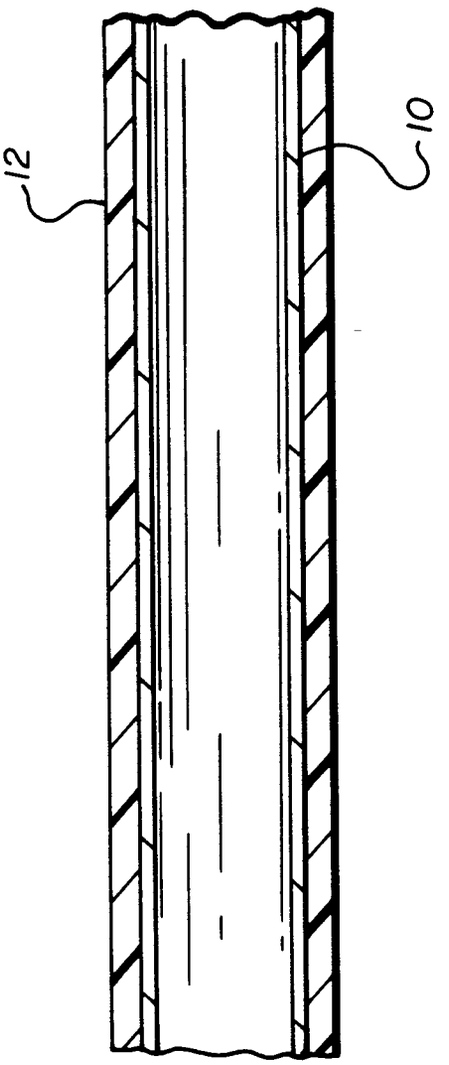



FIG. 1

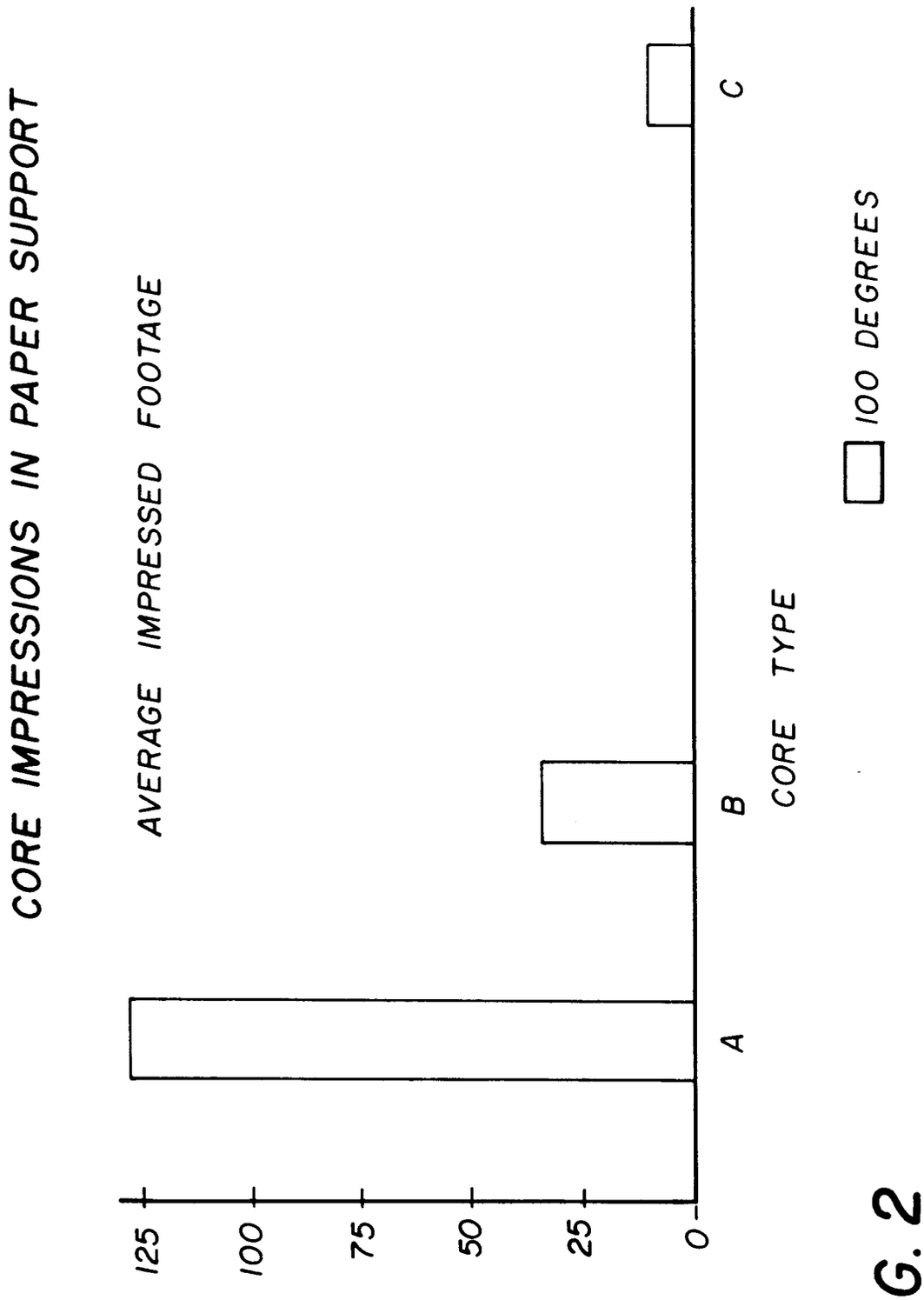

CORE IMPRESSIONS IN PAPER SUPPORT
AVERAGE IMPRESSED FOOTAGE
125
100
75
50
25
0
A
B
C
CORE TYPE
100 DEGREES

FIG. 2

European Patent Office

# EUROPEAN SEARCH REPORT

Application Number

## DOCUMENTS CONSIDERED TO BE RELEVANT

EP 94420060.9

| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (Int. Cl.5) |
|---|---|---|---|
| D,Y | DE - A - 3 610 557 (FELIX SCHOELLER JUN.GMBH & CO.KG) * Totality * -- | 1,4 | B 65 H 75/00 |
| Y | US - A - 4 734 232 (HOESMAN) * Claims * -- | 1,4 | |
| Y | US - A - 3 605 848 (F.G.LOMBARDI) * Fig. 2 * ---- | 1 | |

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

B 65 H
D 01 H
B 29 C
B 29 D

The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| VIENNA | 27-05-1994 | NETZER |

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
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E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

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