May 9, 1967 F. R. KUEHN ETAL 3,318,206

UNITIZED ROTARY SCORER

Filed Oct. 18, 1966

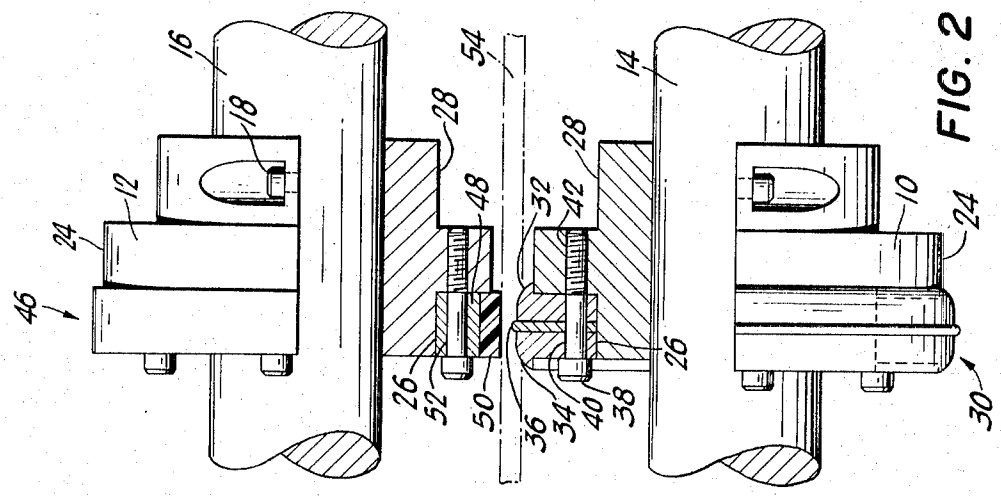


FIG. 2

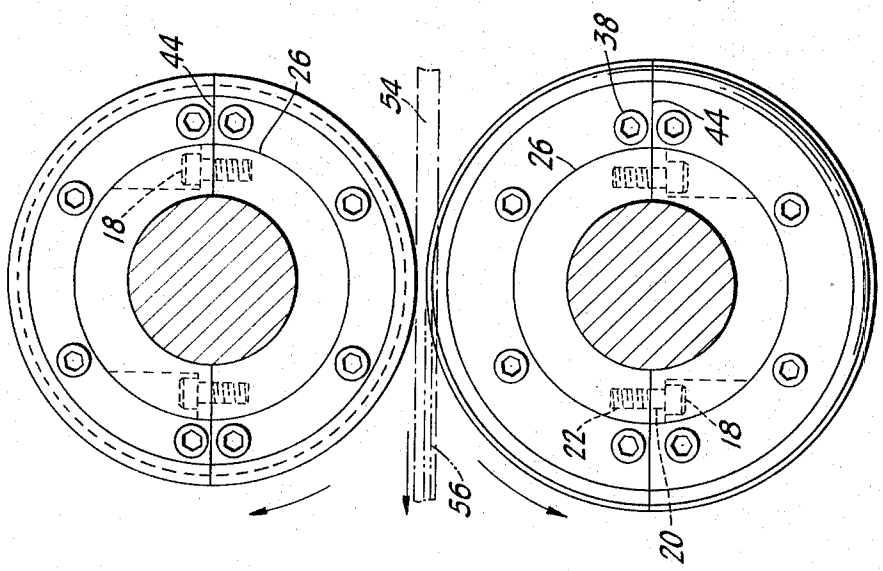


FIG. 1

INVENTORS
FREDERICK R. KUEHN &
WILLIAM K. BARNES

BY Boyce C. Dent
their Attorney

United States Patent Office 3,318,206 Patented May 9, 1967

3,318,206

UNITIZED ROTARY SCORER

Frederick R. Kuehn and William K. Barnes, both of Baltimore, Md., assignors to Koppers Company, Inc., a corporation of Delaware

Filed Oct. 18, 1966, Ser. No. 587,445
2 Claims. (Cl. 93—58.1)

This invention relates generally to box machines and more particularly to rotary scorers for box machines.

In the production of corrugated paper boxes it is necessary to make score lines both during forming of the web and subsequently in the box blanks to facilitate folding of the blanks to form completed boxes. To accomplish this, rotary scorers are used on the slitter-scorer machine in the web forming operation and on the printer-slotter machine during final forming of box blanks. For simplicity, the material to be scored will hereafter be referred to as the web.

Conventional rotary scorers comprise pairs of coacting score heads mounted on parallel driven shafts between which the web is passed to have a score formed therein. One head of the pair, usually the lower, has a male scoring profile for coaction with a corresponding female profile on the opposite head. The female profile may alternatively be flat rather than contoured to match the male profile. Recently, the flat female profile has been made of an elastomer such as polyurethane. Thus, when the male profile exerts sufficient pressure to deform the web to the male contour, the web deforms the elastomer accordingly.

Customarily, the male and female profiles have been made integral with the score heads. But, because of the nature of the working environment, such heads are frequently damaged, necessitating the replacement of a complete head. In addition, it is also desirable to keep on hand a variety of different profiles to suit customer requirements. Obviously, this is quite costly and requires suitable storage facilities and handling.

Although it has become known to provide male scoring profiles which are demountable from the supporting head, no complete interchangeability has been provided. For example, it is sometimes desirable to be able to reverse the male and female profiles so that the score is formed on the reverse side of the blank. To do this now requires that the complete heads be reversed on the respective shafts. It is also desirable to be able to change from one style of profiles to another. Sometimes it is desirable to mate two elastomeric female profiles to act as pull rolls. There are numerous other attachments which could be advantageously utilized with score head constructed for interchangeability.

Accordingly, it is an object of the present invention to provide improved scoring apparatus so constructed that rapid changes of auxiliary attachments can be made to each of the respective scorers and interchangeably between them and particularly to provide for unitized demountable scoring profiles for both male and female scorers.

The objects of this invention are generally accomplished by providing a pair of identical scoring heads capable of mounting either a male profile comprising a score ring sandwiched between two back-up rings or a female profile comprising a metallic inner ring surrounded by an elastomeric outer ring, the profiles coacting to form a score in a corrugated paper web passing between the scorers.

The above and further objects and novel features of the invention will appear more fully from the following detailed description when the same is read in connection with the accompanying drawings. It is to be expressly understood, however, that the drawings are not intended as a definition of the invention but are for the purpose of illustration only.

In the drawings wherein like parts are marked alike:

FIGURE 1 is an axial view of a pair of the novel scorers operating upon a web passing therebetween; and

FIGURE 2 is a radial view in partial cross-section of the scorers taken along line II—II of FIGURE 1 showing the unitized construction of the scoring elements and supporting heads.

Referring now to the figures, there is illustrated a pair of score heads **10** and **12** of which the lower head **10** will be referred to as the male head since it carries the male score profile and conversely, the upper head **12** will be referred to as the female head or anvil. The heads **10** and **12** are mounted for rotation upon a pair of parallel driven shafts **14** and **16**. Although only one pair of heads is shown, it will be understood that the pairs are normally used in sets of two or four on the slitter-scorer machine and in sets of three on the printer-slotter machine. Any number of sets may be used depending on the number of scores desired to be formed in the web or box blanks.

The heads **10** and **12** are clamped to the shafts **14** and **16** in the conventional manner, that is, by splitting them diametrically in half. The splitting operation removes a small quantity of metal thereby leaving a small gap between the halves of the head. In this manner a pair of locking screws **18** placed in counter-bored holes **20** in one half of the head and threaded into correspondingly threaded holes **22** in the opposite half of the head serve to clamp the head for rotation upon its driven shaft. If desired, a key (not shown) can be placed in corresponding keyways cut in the shaft and head to assure that no relative slippage occurs between the shaft and the head.

The heads **10** and **12** are preferably identical, not only to avoid duplicity of parts, but to provide for the interchange of the male and female profiles (to be described) between the upper and lower heads. The reason for this is that it is sometimes desirable to form a score in the top of the web rather than on the bottom. Thus, the need for interchanging the complete head is obviated.

The heads **10** and **12** are preferably made of cast iron since there is no longer any need for making them from the more expensive steel, the scoring profiles described herein being made separately from, rather than being formed integrally with, the heads.

As previously mentioned, both male and female heads are identical, each having a major diameter **24** located substantially in the axial center of the head with shoulder portions **26** and **28** of reduced diameter formed adjacent to either side of the major diameter **24**. It should be understood that shoulder portion **28** is not essential but is preferable from the standpoint of material savings and to make the head of lighter weight. Its diameter may or may not correspond to the diameter of shoulder portion **26**. Shoulder portion **26** is made with a suitable diameter and width to accommodate mounting of the scoring profile to the head.

Referring now to the lower or male scorer of FIG. 2, the preferred embodiment of the male scoring profile is illustrated as comprising a separable unitized multi-element assembly **30**. Male profile **30** itself comprises an inner back-up ring **32** and an outer back-up ring **34** between which is sandwiched a score ring **36**. Inner and outer rings **32** and **34** are identical so that it matters not which one is located adjacent the major diameter **24**.

The rings comprising the profile **30** are diametrically split at line **44** to permit ease of mounting and demounting around shoulder **26** of heads **10** and **12**. The rings are secured to the heads by several cap screws **38** passing

through axial mounting holes 40 extending through all the rings and threaded into matching holes 42 provided in the flange defined by major diameter 24. The number of mounting holes may vary, depending on head diameter, but preferably at least four holes are used in each ring segment. Two of the holes are best located near the split line 44 as illustrated in FIGURE 1. The hole pattern should be symmetrical so that the rings can be universally mounted.

Score ring 36 has an inner diameter substantially the same as shoulder 26 so as to be supported by the shoulder. The outer diameter of ring 36 is preferably radiused to meet the flat sides of the ring although it may have only a rounded or axially arcuate periphery resulting in something less than a full radius. As illustrated, the outer diameter of ring 36 is greater than the major diameter 24 of heads 10 and 12. Ring 36 is preferably made of hardened steel, being protected against chipping by the inner and outer rings 32 and 34. However, if made from soft steel which wears faster, it is easily and cheaply replaced.

Back-up rings 32 and 34 likewise have an inner diameter substantially the same as shoulder 26 so that they too are supported by the shoulder. The outer diameter of rings 32 and 34 is smaller than the diameter of score ring 36, extending about to the point where the radius meets the side face of ring 36. The determining factor is the depth of score bead desired to be formed in the web.

Rings 32 and 34 may be rectangular in cross-section with rounded outer corners but preferably they have one side face undercut as illustrated so that the rounded corner portion overlaps the major diameter 24. This permits the combined width of the profile 30 to fit on the head 10 without making the head and profile assembly extremely wide. It will be appreciated that a narrow assembly is desirable to reduce the minimum axial distance between parallel score profiles. The rounded corners of rings 32 and 34 may be made in accordance with the score profile desired in the web. If desired, the rings 32 and 34 may be of a diameter so as not to penetrate the web, thus, only a bead score will be formed in the web by score ring 36. However, it is generally preferable to have a portion of rings 32 and 34 also penetrate the web as best illustrated in FIGURE 2.

Referring now to the upper or female anvil of FIGURE 2, the preferred embodiment of the female profile is illustrated as comprising a composite ring 46 having an inner metallic ring portion 48 and an outer elastomeric ring portion 50 bonded to the inner ring portion. Inner ring 48 has an inner diameter to fit shoulder 26 of head 12 and a plurality of mounting holes 52 similar to those in profile 30. Ring 46 is secured to head 12 in the same manner that profile 30 is secured to head 10. Elastomeric ring portion 50 is preferably polyurethane because of its excellent wear properties although it can be made of rubber, either natural or synthetic, or some other form of plastic. Ring 50 can be bonded to ring 48 by any of a number of known methods. The hardness of ring 50 is preferably Shore durometer 88, scale D, for general purpose work. When the durometer is below 75, the polyurethane offers too little support for the web being scored by profile 30. When the durometer exceeds 95, the polyurethane is not resilient enough to prevent crushing of the usual type web being supported. This range is not critical however and may be varied to suit the particular application. As shown, elastomeric ring 50 extends beyond major diameter 24 of head 12 so that only the axial width of the ring 50 touches the web.

Not illustrated is a variation of ring 46 in which no elastomeric portion is used. Instead, metallic ring portion 48 is the same size as composite ring 46. The outer diameter of the variation can be flat but usually has a female profile cut in it to correspond to the male profile 30. Thus, the web is deformed into a shape corresponding to the spaced apart male and female profiles.

In operation, the heads 10 and 12 are clamped in axial alignment to shafts 14 and 16 respectively by means of clamp screws 18. Profiles 30 and 46 are secured to the heads as previously described. Conventionally, upper shaft 16 is mounted for driving rotation in journal bearings supported by spaced apart side frames (not shown). Lower shaft 14 is similarly mounted except that the journal bearings are supported by eccentric housings which can be rotated in the known manner to raise or lower the lower shaft 14 with respect to upper shaft 16. The effect of this is to control the gap between the lower and upper profiles 30 and 46 and thereby control the depth of the score formed in a web 54 passing between the profiles. As illustrated in FIGURE 1, the heads are rotated in opposite directions so as to pull the web between them and form a score 56 in the web.

In summary, the foregoing construction provides a unitary rotary scorer having great versatility. The user need not purchase a complete scoring head including a profile formed on it. As the profiles wear, they alone may be replaced, simply and cheaply. Little capital investment is required to stock a full comlement of spares. In addition, different profile shapes may be stocked for making different scores as the need occurs. To change from one profile to another is a quick, simple operation.

The scorer is versatile in other ways as well. For example, a composite ring 46 may be substituted for profile 30 to provide cooperating elastomeric rings for pulling the web through the machine.

In another example, both profiles 30 and 46 may be replaced by a pair of slitter knives for cutting the web. These knives are similar to outer ring 34 except that the outer periphery is formed into a knife edge sloping from one side face to the other. In this case, the upper blade is faced opposite to the lower blade and their diameters are such that they overlap so that they cooperate like a pair of scissor edges.

In another example, profile 30 may be replaced by a single score ring having a V-profile to coact with a fully metallic ring in place of profile 46. These components from a V-shaped score completely through the web.

In another example, elastomeric ring 46 can be placed on lower head 10 and serrated cutting knives of known character placed on upper head 12 for cutting conventional stitch flaps on blanks passing therebetween. In this case, the serrated knives are of a diameter to extend completely through the blank and into the elastomeric ring.

In another example, profile 46 may be replaced by a creaser-bender ring for scoring and bending flaps in blanks passing therebetween. In this case, the creaser-bender ring resembles a slitter knife except that its edge is flattened to avoid cutting the blank. With the space between the male profile and the creaser-bender less than blank thickness, the blank will be scored and one edge of the blank will be forced to bend upward.

Thus, it can be seen that the design of the heads 10 and 12 as well as the various rings adapted for operation with them results in very versatile apparatus for the box making industry. Those parts of the assembly which form the score in the web and consequently wear faster than the supporting heads are easily and cheaply replaced. The amount of investment required to maintain adequate spares and alternates is substantially reduced.

Having thus described our invention in its best embodiment and mode of operation, what we desire to claim by Letters Patent is:

1. Rotary scoring apparatus for scoring a web, comprising:

a pair of identical diametrically split cooperating scorers respectively secured for rotation with a pair of parallel adjacent shafts;

each of said scorers adapted for mounting either a male or female diametrically split profile upon a shoulder portion of reduced diameter adjacent one end of said scorers by a plurality of screws extending axially through said profiles into the major portion of said scorers;

said female profile comprising a composite ring having an inner metallic portion with an outer elastomeric portion bonded thereto of greater diameter than said scorer for supporting said web opposite the other of said scorers; and

said male profile comprising a score ring sandwiched between a pair of identical back-up rings of lesser diameter than said score ring for forming a score

in said web conforming substantially to said male profile.

2. The scoring apparatus of claim 1 wherein said back-up rings each have a reduced diameter axial undercut in the side face opposite the face adjacent said score ring whereby one of said back-up rings overlaps the major diameter of the head supporting said male profile to reduce the axial width of said scorer.

References Cited by the Examiner

UNITED STATES PATENTS

2,139,890	12/1938	Pitchett	93—58.1
2,223,503	12/1940	Wilson	93—58.1

BERNARD STICKNEY, *Primary Examiner.*