Sept. 16, 1969 G. MILLS 3,467,056

APPARATUS FOR MAKING STEEL WOOL PADS

Original Filed March 15, 1963 3 Sheets-Sheet 1

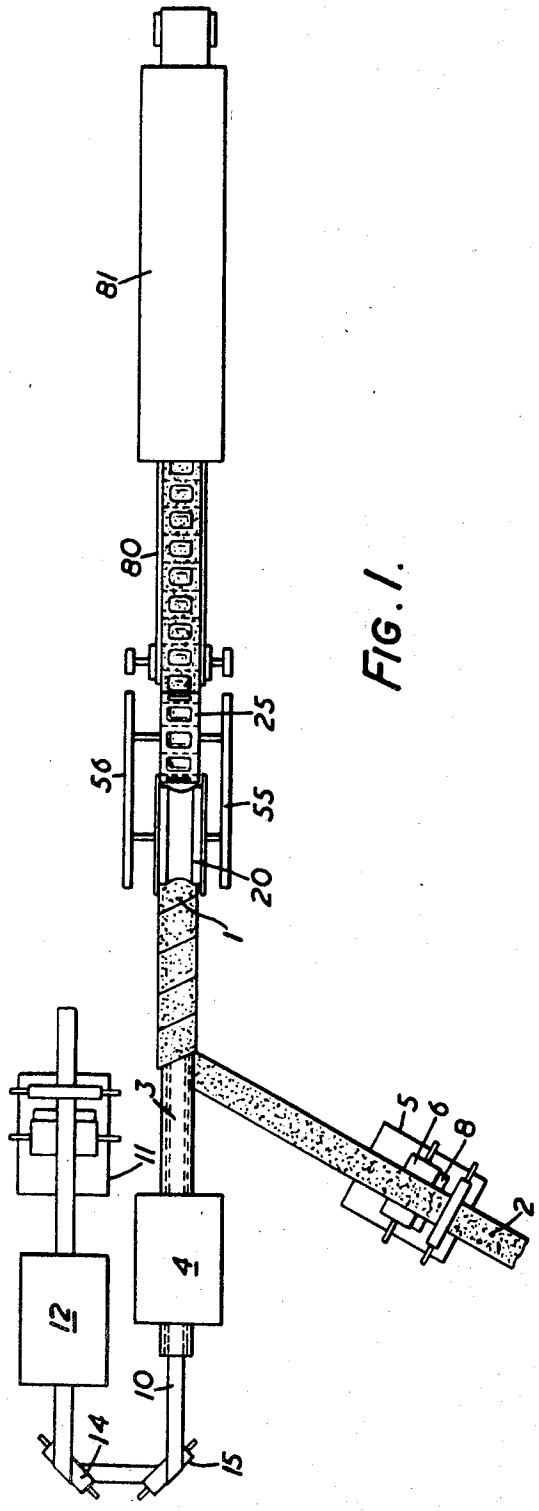


FIG. 1.

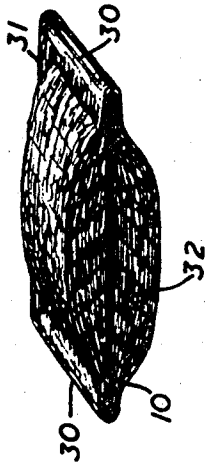


FIG. 6.

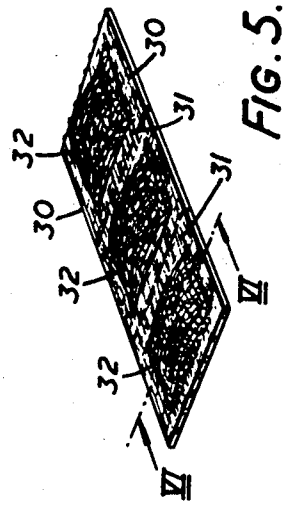


FIG. 5.

Sept. 16, 1969 G. MILLS 3,467,056

APPARATUS FOR MAKING STEEL WOOL PADS

Original Filed March 15, 1963 3 Sheets-Sheet 2

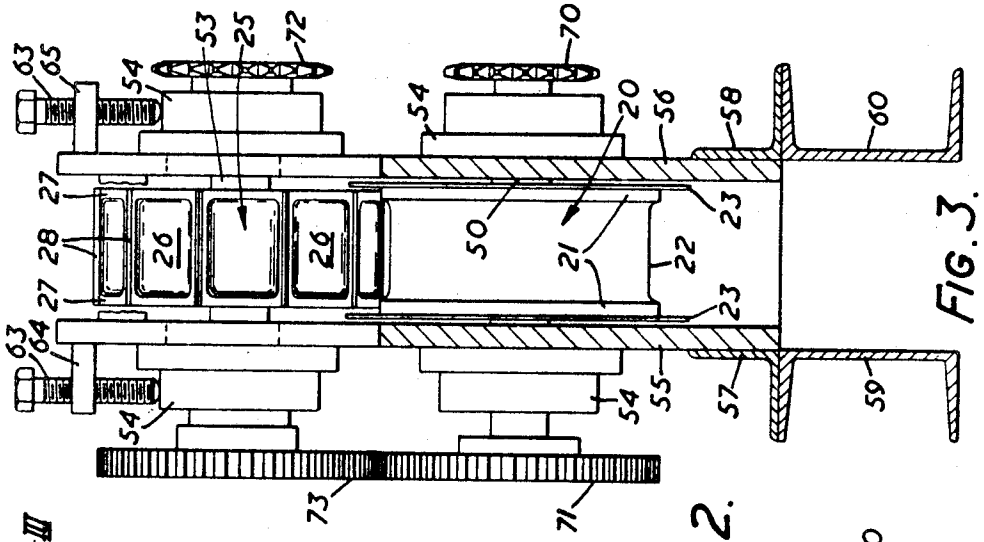


FIG. 3.

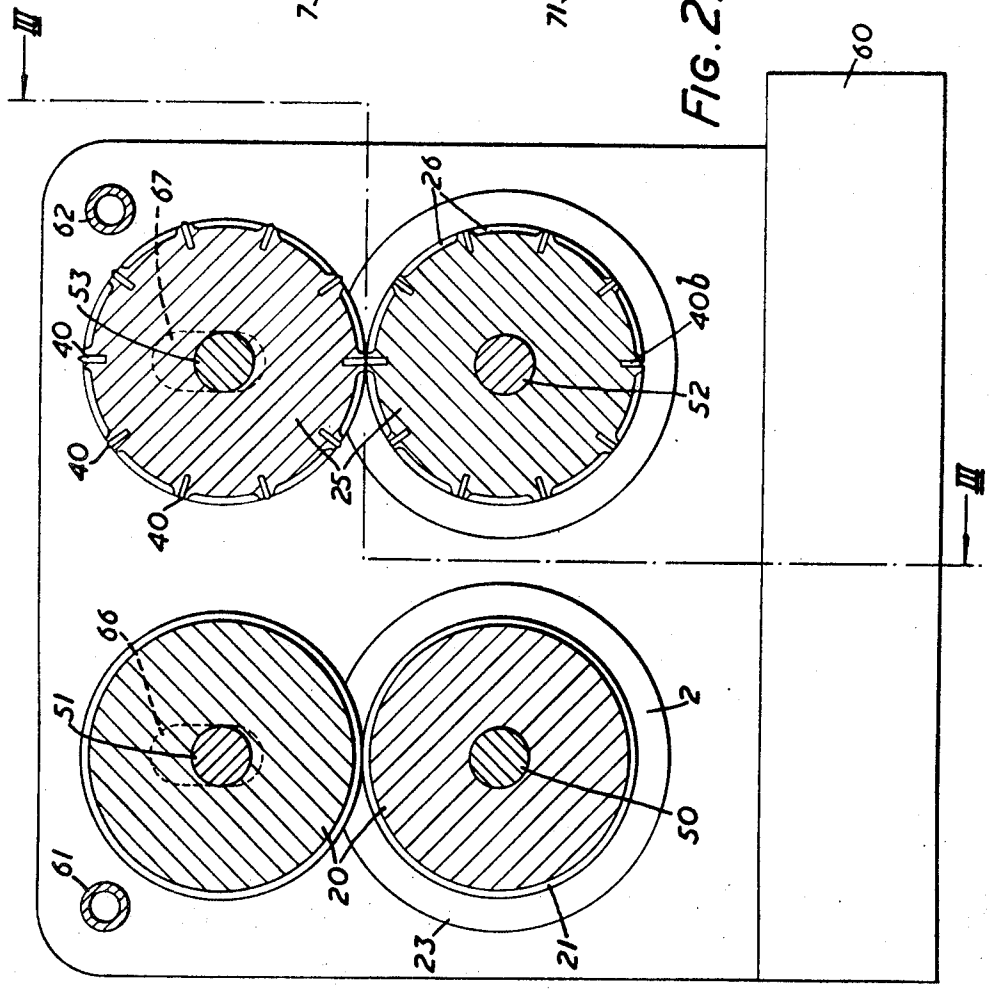


FIG. 2.

Sept. 16, 1969 G. MILLS 3,467,056

APPARATUS FOR MAKING STEEL WOOL PADS

Original Filed March 15, 1963 3 Sheets-Sheet 3

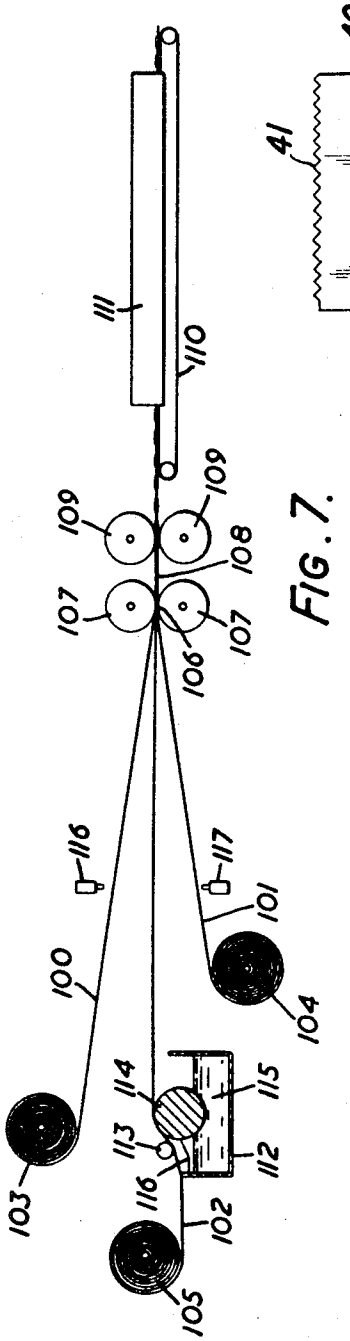


FIG. 7.

FIG. 9

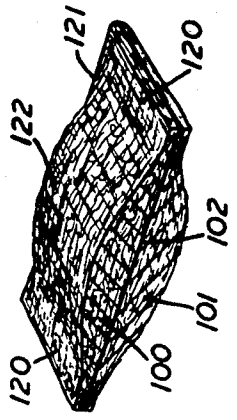


FIG. 8.

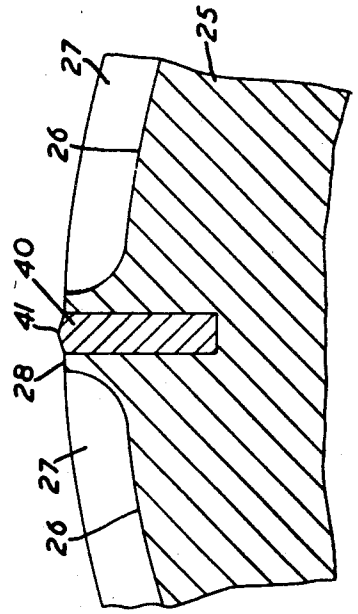


FIG. 4.

United States Patent Office 3,467,056
Patented Sept. 16, 1969

3,467,056

APPARATUS FOR MAKING STEEL WOOL PADS

George Mills, Davyhulme, England, assignor to Colgate-Palmolive Company, New York, N.Y., a corporation of Delaware

Continuation of application Ser. No. 521,758, Sept. 27, 1965, which is a division of application Ser. No. 270,131, Mar. 15, 1963, now Patent No. 3,256,583, dated June 21, 1966. This application June 8, 1967, Ser. No. 644,737

Int. Cl. B05c *11/12*; B23b *31/14*

U.S. Cl. 118—40 9 Claims

ABSTRACT OF THE DISCLOSURE

Apparatus for automatically making steel wool pads from a band containing two or more associated continuous webs at least one of which is steel wool comprises roller means through the nip of which the band is passed to compress the steel wool all along the band side edges and along transversely spaced areas corresponding to the individual pads. The roller means comprises a pair of parallel axis rollers whose peripheries are formed with pockets bounded by continuous flanges at the roller ends and transverse ribs between the flanges. Each rib carries a cutting edge, with one edge adapted to completely sever the band at the transverse compressed areas, so that partially severed strips containing the individual pads are produced. The band is precompressed along the side edges by passing through a pair of flanged rollers prior to entering the nip between the pocketed rollers. Usually the webs are impregnated with soap or detergent before being incorporated into the band.

This is a continuation of Ser. No. 521,758, filed Sept. 27, 1965, for "Apparatus for Making Steel Wool Pads," and is a division of Ser. No. 270,131, filed Mar. 15, 1963, now issued as U.S. Letters Patent No. 3,256,583 dated June 21, 1966, for "Steel Wool Pads."

This invention relates to an apparatus for making steel wool pads which may be impregnated with a filler, for example soap or some other detergent. The steel wool pads are useful, for example, for household pot scouring and general scouring purposes. The invention is particularly applicable to making steel wool pads which are to be used only once and then thrown away in contrast with the pads commonly used at the present time which are intended to be used a number of times before disposal although the invention has applications to the making of the latter kind of pads.

The making of steel wool pads comprises feeding a substantially continuous strip or a number of superposed substantially continuous strips of steel wool between a pair of pressing rolls at least one of which has circumferentially spaced recesses in its surface to produce spaced compressed regions transversely across the length or lengths. The material passing through the rolls will in places herein be referred to as a band. This term will thus be used to cover a single strip of steel wool which may or may not be spirally wound and also composites of more than one strip of steel wool, with or without strips of other material.

By producing spaced compressed regions transversely across the band the steel wool may be divided into individual pads the ends of which are heavily compressed. The side edges may be closed by virtue of the form in which the band comes to the pressing rolls; for example, a band formed from a strip of steel wool which has been diagonally rolled on a rotating mandrel will have substantially closed side edges. Nevertheless, it is preferred, even for such a band with closed side edges as well as for those without such edges, for the edges to be compressed by rolling to produce, with the highly compressed transverse regions, spaced uncompressed or lightly compressed areas each wholly surrounded by a heavily compressed margin. By providing heavily compressed margins all round the uncompressed or lightly compressed central portions there is less tendency for the pads to disintegrate in use or for some of the filler to fall out than is the case with pads in which only part of the margin is heavily compressed. Circular pads with a heavily compressed circumferential margins have already been proposed but the apparatus of the present invention produces very satisfactory pads which will usually be of the more convenient rectangular shape.

Preferably at least one of the rolls producing the transverse compressed regions has circumferentially spaced generally rectangular pockets in its periphery and thus both the transverse regions and the edges of the band are compressed. The edges of the band may be additionally compressed by rolls before reaching the rolls producing the transverse compressed regions.

The apparatus may be used to produce pads in a continuous band rather than as individual pads and this facilitates further processing e.g. drying and automatic packaging. If desired, the individual pads can be severed as by shearing the band through the centre of each transverse compressed region before or during packaging. Thus the strip or strips of steel wool may pass through a pair of rolls at least one of which is provided with knives to at least partially sever the strip or strips through the transverse compressed regions, and preferably the production of the transverse compressed regions and the severing is carried out simultaneously by the same pair of rolls. The arrangement may be such that at least one of the knives produces partial severing and at least one of the knives produces complete severing. In this way the band will be divided up into separate ribbons each consisting of a number of individual pads which are partially severed from one another. Such ribbons may be used, for example, for dispensing packs wherein the withdrawal of one partially severed pad draws the next pad into a readily accessible position, whereupon the first pad can be pulled away from the second one by tearing the unsevered connecting portion.

The production of a band of steel wool to be fed to the rollers by means of a rotating mandrel has already been referred to. In an alternative arrangement a number of strips of steel wool are fed in superposed relationship to the rolls and at least one of the strips of steel wool has substantially all its fibers coated with a water-soluble detergent material before being compressed with the other strip or strips. Any desired number of strips can be fed to the pressing rolls and one or more of the strips may be of a material other than steel wool. For instance, there may be three steel wool strips, the two outer ones being plain (unimpregnated) and the central one being already impregnated with filler. Another possibility is to use five steel wool strips employing a central impregnated strip and two plain strips on each side. A further possibility is to employ two or more impregnated strips. This is particularly useful in the case of pads which are to contain both soap and synthetic detergent. It is not easy to make a homogeneous mixture of soap and certain synthetic detergents in a form which could be used to impregnate a single strip uniformly. In such a case one strip could be impregnated with the soap and another strip with the synthetic detergent.

In addition to the steel wool strip a strip or strips of other material could be introduced, for example, a strip of fabric in order to impart greater strength to the resulting pads. Such other strips could be impregnated with a detergent and/or some other material such as a binder, of which sodium silicate is the most suitable.

According to the invention apparatus for making steel wool pads comprises roll means adapted to compress the edges of a continuous strip of steel mool fed to the roll means and to produce the spaced compressed regions transversely across the strip. The roll means may include a pair of rolls at least one of which has circumferentially spaced pockets in its periphery, the preferred shape for the pockets being rectangular. In a preferred form of the apparatus the roll means include a second pair of rolls arranged to operate on the strip before it passes to the first pair and arranged to compress the edges of the strip.

One of the pair of rolls for producing transverse compressed regions may have knife-like axially extending projections on its periphery between pockets to produce at least partial severing of the strip in the transverse compressed regions. The projections may be provided by inserts in axially extending grooves in the respective roll and the other roll of the pair may have similar inserts adapted to co-operate with the knife edges.

The invention may be performed in various ways and two forms of apparatus for manufacturing impregnated steel wool pads and a number of examples of pad produced by the apparatus will now be described by way of example with reference to the accompanying drawings, in which:

FIGURE 1 is a diagrammatic plan view of the first form of apparatus;

FIGURE 2 is a side view of the pad-forming rolls of the apparatus of FIGURE 1 to a larger scale;

FIGURE 3 is a part elevation and part section of the rolls shown in FIGURE 2 taken on the line III—III in FIGURE 2;

FIGURE 4 is a fragmentary view to a larger scale of one of the upper pad-forming rolls shown in FIGURE 2;

FIGURE 5 is a perspective view of part of a ribbon of pads formed by the apparatus shown in FIGURES 1 to 4;

FIGURE 6 is a section on the line **6**—**6** of FIGURE 5;

FIGURE 7 is a diagrammatic side elevation of the second form of apparatus;

FIGURE 8 is a section through a pad formed by the apparatus shown in FIGURE 7; and

FIGURE 9 is a sectional view of a cutting knife having a serrated edge to partially sever the band.

Referring firstly to the apparatus shown in FIGURES 1 to 4, a continuous cylindrical wound strip **1** of steel wool is formed by diagonally feeding a web **2** of steel wool direct from a wool-making machine not shown on to a hollow rotating mandrel **3**. The mandrel **3** is mounted in a pedestal **4** containing a bearing and drive means for the mandrel. In its passage from the wool making machine the web of steel wool passes through a soap or synthetic detergent impregnation unit **5**. This unit which is similar to the unit shown in longitudinal section in FIGURE 7 comprises a small roller **6** under which the web passes and a larger roller **7** over which the web passes and against which the web is tightly held. The roller **7** dips into a bath of soap or detergent solution which is transferred by the roller on to the web, the rate of impregnation being controlled by a conventional doctor blade **8**.

A further web **10** to form the core of the continuous cylinder to be formed on the mandrel **3** is fed down the hollow centre of the mandrel. The web **10** passes through an impregnation unit **11** similar to the unit **5**, through a drying unit **12** and is turned through two right angles by angled rolls **14** and **15** before entering the mandrel. The web **10** may, for example, be of steel wool or of some other material such as paper or fabric to impart

greater strength to the resulting pads. The unit **11** may be used to impregnate the web **10** with a material which has, for example, bonding or rust-resisting or pH adjusting or detergent properties or a combination of such properties.

The spirally wound cylinder of steel wool and the core formed by the web **10** are drawn from the mandrel between a pair of rolls **20** whose profiles can be accurately seen from FIGURE 3. Each roll **20** has flanges **21** at the edges and a flat-bottomed groove **22** between them. The lower of the two rolls **20** has a thin disc **23** on each side of it, the discs being of greater diameter than the flanges **21** and serving to guide the cylinder of steel wool to prevent lateral displacement.

The passage of the continuous strip between the rolls **20** causes the central portion to be somewhat flattened while the edges are fairly heavily compressed and the cored steel wool leaves the rolls **20** as a somewhat flattened continuous band of constant cross-section. The continuous band then passes between a second pair of rolls **25** whose circumferential surfaces are formed with ten circumferentially spaced generally rectangular pockets **26**. The pockets **26** leave a continuous flange **27** on either side of the pockets and ten ribs **28** extending axially from flange to flange between the pockets. The passage of the continuous pad between the rolls **25** causes the longitudinal edges **30** to be even more firmly compressed and causes spaced intermediate portions **31** extending transversely across the pad to be compressed to substantially the same extent, thus leaving longitudinally spaced areas **32** in which the steel wool is lightly compressed, each area being surrounded by a highly compressed margin.

Between each pocket in each roll **25** there is an insert **40** of tungsten steel set in a groove in the roll and extending right across the circumferential face of the roll. All the inserts of the upper roll of the pair of rolls **25** have a serrated cutting edge **41** as shown in FIGURE 9, nine out of ten having the shallow apex of that shown in FIGURE 4 while one insert **40***a*, has a more pronounced knife edge. All the inserts in the lower roll, with the exception of the insert **40***b* co-operating with the knife **40***a*, have flat faces flush with the ribs **28**. The insert **40***b* has a V-shaped recess to receive the knife edge of the insert **40***a*. The effect of the inserts when the pad is passed between the rolls **25** is to form partial severings across the pad in nine out of every ten of the transverse highly compressed regions **31** between adjacent lightly compressed regions **32**. The inserts **40***a* and **40***b* co-operate to effect complete severing of the strip across the centre of every tenth transverse highly compressed region. The continuous pad is thus divided up into ribbons of ten contiguous individual pads, the individual pads, of each ribbon being partially severed from one another.

The ribbons, each of ten pads pass from the rolls **25** on to a belt conveyor **80** and pass through a drying or cooling tunnel **81**, from which they pass to a packing station not shown. The ribbons may be packed concertina fashion in the cartons.

The pairs of rolls **20** and **25** are mounted on parallel shafts **50** and **51**, **52** and **53** respectively. The shafts are carried in bearings **54** in a pair of massive parallel support plates **55** and **56** which are secured along their lower edges by angle irons **57** and **58** to channels **59** and **60** forming part of the steelwork on which the whole apparatus is mounted. The support plates **55** and **56** are connected together at their upper corners by tubes **61** and **62**. The bearings **54** of the upper roll **20** and the upper roll **25** are mounted in vertical slots **66** and **67** in the support plates **55** and **56** and the pressures between the upper and lower rolls of each pair can be adjusted by manipulation of a pair of screws **63** which are threaded into brackets **64** and **65** on the supporting plates **55** and **56** and whose ends bear against the bearing **54**.

The shaft **50** carrying one of the rolls **20** is driven from an electric motor, not shown, by a chain which passes round a chain wheel **70** which in fast on the shaft

50. The shaft 50 also carries a spur gear 71 which meshes with an identical spur gear on the shaft 51 of the other roller 20 and not visible in FIGURES 2 or 3 so that the rolls 20 rotate in synchronism. The shaft 51 carries a chain wheel which is coupled by a chain to a chain wheel 72 on the shaft 53 of the upper of the rolls 25. The shaft 53 also carries a spur gear 73 which meshes with an identical spur gear on the shaft 52 of the lower of the rolls 25. Thus all four rolls 20 and 25 are driven by the motor at the same speed.

Two specific examples of the use of the apparatus shown in FIGURES 1 to 4 to produce pads of the form shown in FIGURES 5 and 6 will now be described.

EXAMPLE 1

The web 2 of steel wool was taken directly from the wool-making machine through the impregnation unit 5. The bath of the impregnation unit 5 contained a soap of 66.5% moisture content and manufactured from palm oil fatty acids and palm kernel/coconut oil fatty acids using an alkali mixture of potassium hydroxide and sodium hydroxide in a ratio of eight to one, both in terms of equivalent Na_2O. The web 10 consisted of ordinary cotton bandage and was passed through the impregnation unit 11 the bath of which contained a sodium silicate solution of 45% solids and with a ratio of Na_2O to SiO_2 of 1:3.26. The web 10 was partially dried in the drying unit 12 before entering the mandrel 3.

EXAMPLE 2

The procedure of Example 1 was followed except that before entering the impregnation unit 5 the steel wool web 2 was sprayed with a solution having 1% sodium dodecylbenzene sulphonate and 1% sodium silicate.

In the apparatus shown in FIGURE 7 the web is formed from two continuous strips 100 and 101 of steel wool and a strip 102 of textile or paper, the strips being fed from reels 103, 104 and 105 respectively. The three strips are fed into the nip 106 of a pair of rolls 107 which are of the same construction as the rolls 20 described with reference to FIGURES 1 to 4. These rolls effect a partial compression of the central portion of the combined web 108 while the outer edges are heavily compressed to hold the three individual strips together. The composite web so formed then passes between a pair of rolls 109 which are of the same construction as the rolls 25 described in relation to FIGURES 1 to 4 and which further compress the edges 120 of the web and form spaced transverse highly compressed regions 121 leaving spaced lightly compressed regions 122 each surrounded by a heavily compressed margin. The rolls 109 also divide the web into separate ribbons each of ten contiguous individual pads partially severed from one another. The ribbons pass on to a conveyor 110 which carries them through a drying or cooling tunnel 111 to a packing station which is not shown.

Between the reel 105 and the nip 106, the web 102 of textile or paper, passes through an adhesive applying station 112 which is of similar construction to the impregnation units 5 and 11 shown in FIGURE 1 and includes a roller 113 under which the strip passes and a roller 114 over which the tape passes in close contact. The lower surface of the roll 114 dips into a bath 115 of adhesive the rate of application of which is determined by an adjustable doctor blade 118.

Each of the strips 100 and 101 of steel wool is subjected to a spray of soap or synthetic detergent from spray nozzles 116 and 117 respectively after it leaves the reel and before it passes between the rolls 107.

Clearly the apparatus shown in FIGURE 7 may be employed with other numbers of strips than three, all the strips or only some of the strips being of steel wool.

I claim:

1. Apparatus for making steel wool pads from a continuous band of steel wool comprising roller means including a first pair of spaced rollers rotatable on parallel axes defining a nip through which the band is passed, said first pair of rollers having cylindrical peripheral surfaces that are annularly recessed between their ends to provide cooperating narrow pairs of band pressing end flanges, a second pair of spaced similar axially co-extensive rollers rotatable at the same peripheral speed upon parallel axes with each of said second rollers having a cylindrical peripheral surface formed with a series of recessed pockets of the same size and equally spaced circumferentially around the roller periphery, said pockets providing at the ends of said second rollers continuous narrow parallel band pressing flanges extending along opposite sides of said pockets and a series of parallel band pressing ribs extending between said flanges and separating said pockets, said flanges and ribs of each second roller being of substantially the same height so as to lie substantially in a common cylindrical envelope about each second roller, and means mounting said second rollers with their peripheral band pressing surfaces in close proximity so that each second roller end flange is aligned with a corresponding end flange of the other second roller and corresponding ribs on the respective second rollers enter the nip between the second rollers in radial alignment during roller rotation, said band pressing end flanges of said first rollers being spaced a distance approximately equal to the distance between said band pressing flanges of said second rollers, so that as the steel wool band passes between the nip of said first pair of rollers the side edges of said band are precompressed by the end flanges of said first rollers and as the steel wool band subsequently passes through the nip between the second rollers the side edges of said band are compressed tightly by the opposed coacting end flanges of the second rollers and transverse areas of the band are similarly and simultaneously compressed tightly between pairs of aligned ribs of said second rollers, and the areas of said band between said second roller flanges and ribs are only lightly compressed in said pockets and are surrounded by highly compressed marginal regions.

2. The apparatus defined in claim 1, wherein at least one of said ribs of said second rollers is provided with a cutting edge adapted to sever the band passing through said roller means at one of said compressed transverse areas.

3. The apparatus defined in claim 1, wherein one of said ribs of said second rollers is provided with a cutting edge adapted to completely sever said band at one of said transverse compressed areas and the other ribs are all provided with cutting means for partially severing the band at all of the transverse compressed transverse areas between the completely severed regions so partially severed strips of the formed band are produced by said roller means.

4. The apparatus defined in claim 3, wherein said cutting edge is a transverse knife insert of harder material than the rollers, and said cutting means is a transverse insert of a hard material formed with a serrated edge.

5. The apparatus defined in claim 1, wherein means is provided for relatively adjusting the second rollers toward and away from each other in a plane containing their axes for determining the size of the nip between them and so controlling the compression of the band at said areas.

6. The apparatus defined in claim 5, wherein said second rollers are mounted on parallel shafts having intermeshed gears of the same size, and drive means is provided for rotating one of said shafts.

7. The apparatus defined in claim 1, wherein means is provided for incorporating a soap or detergent into the band before entering said roller means.

8. The apparatus defined in claim 1, wherein said band comprises at least one continuous web upon which is spirally wound a continuous web of steel wool, and wherein means is provided for spirally winding said steel

wool web about and along the other web before said band enters said roller means.

9. The apparatus defined in claim 8 wherein means is provided for impregnating each of said webs with a liquid treatment medium prior to said winding operation.

References Cited

UNITED STATES PATENTS

1,967,726	7/1934	Sherman	156—589
2,145,048	1/1939	Hagen	19—144.5
2,262,493	11/1941	Guinzberg	156—515 X
2,320,858	6/1943	Field	118—44 X
3,068,933	12/1962	Klar	156—582 X

FOREIGN PATENTS

508,584	12/1954	Canada.

ROBERT W. MICHELL, Primary Examiner

L. G. MACHLIN, Assistant Examiner

U.S. Cl. X.R.

15—209; 29—4.51; 156—589