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T. M. KNOWLAND ET AL

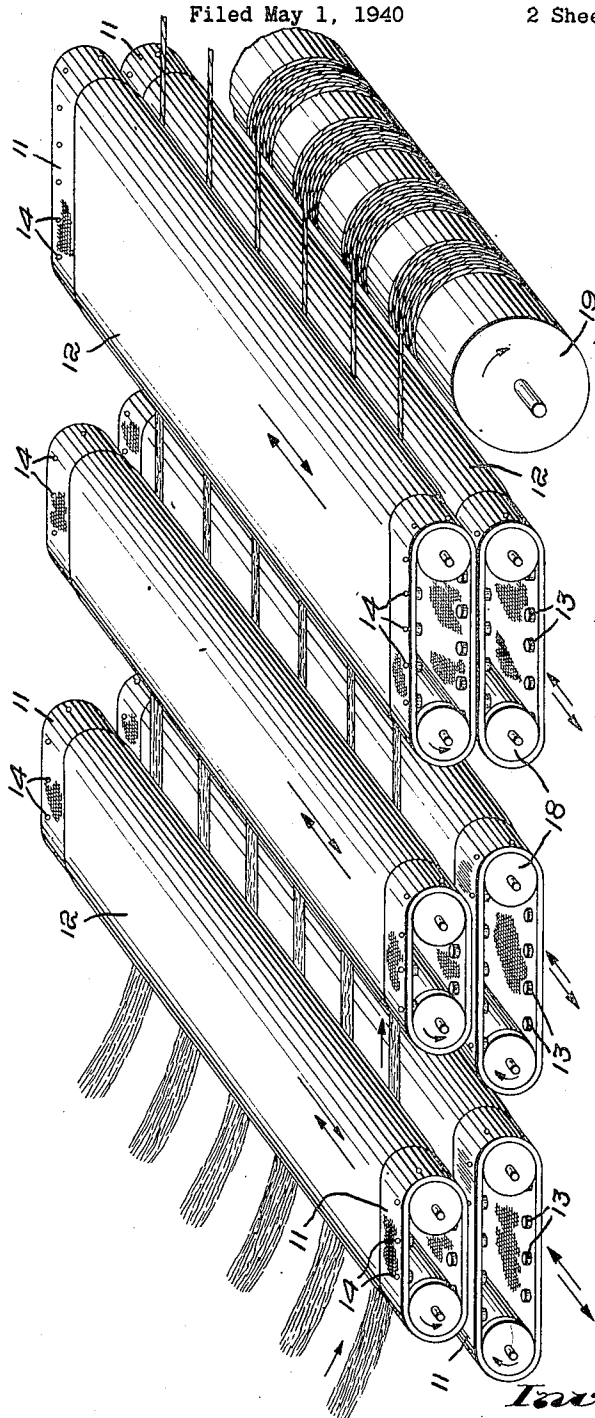
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CARD APRON

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2 Sheets-Sheet 1

Fig. 1.



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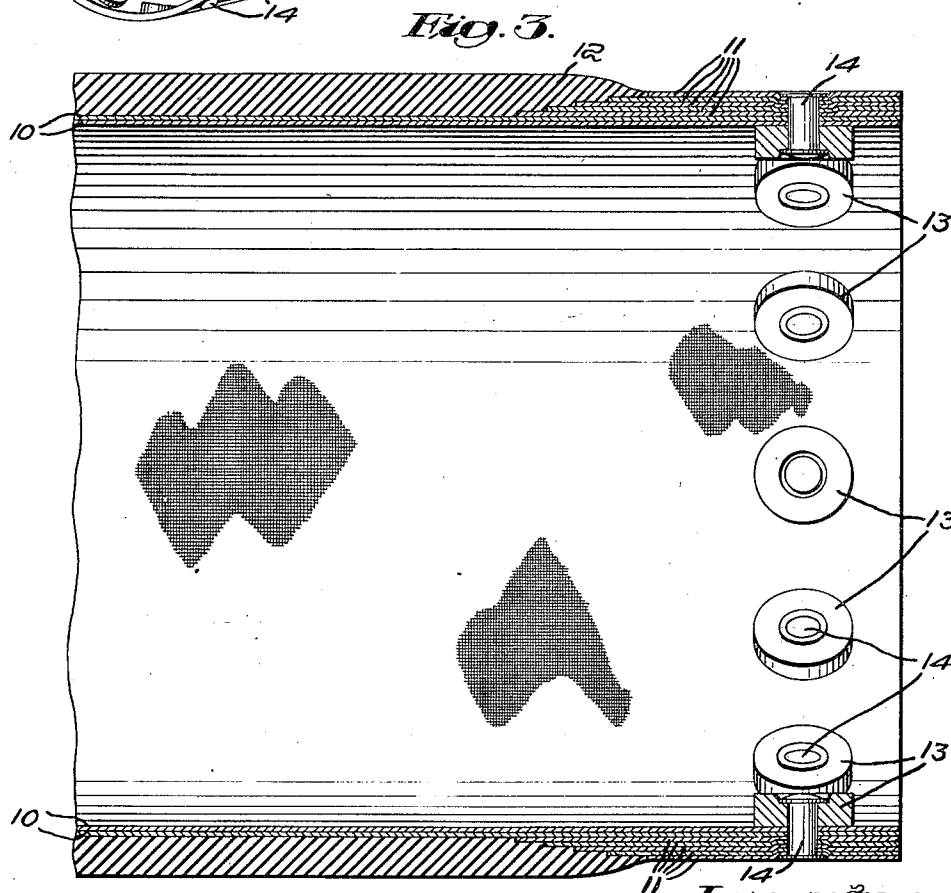
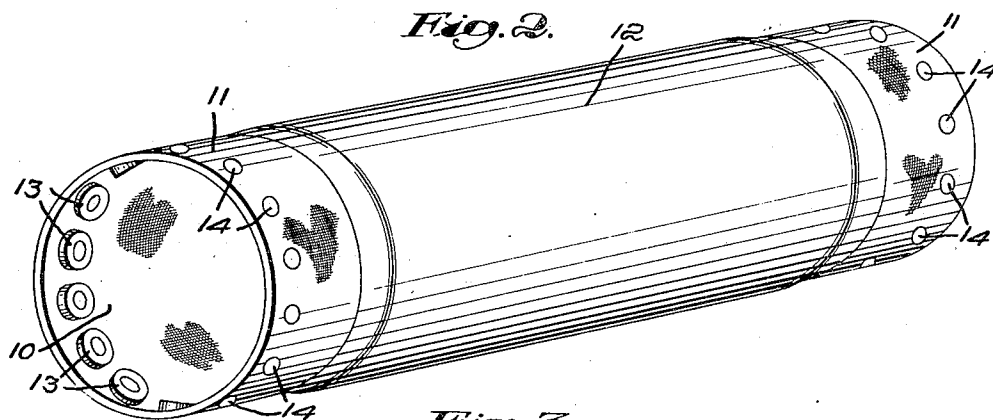
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UNITED STATES PATENT OFFICE

2,233,985

CARD APRON

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8 Claims. (Cl. 19—153)

This invention consists in an improved rubber apron for use in the condensing mechanism of carding machines for rolling and condensing slivers or rovings preparatory to spinning them into yarn. These aprons comprise short endless bands running over parallel rolls and are arranged to present opposed flat stretches between which the rovings are fed. The rolls are rotated and at the same time longitudinally reciprocated, imparting both movements to the aprons so that the rovings are subjected simultaneously to a lengthwise advancing movement and to a transverse condensing rolling movement.

For many years prior to the present invention rubbing aprons of leather have been standard equipment for condensing apparatus although many attempts have been made heretofore to provide satisfactory rubber aprons. It has been appreciated for a long time that rubber aprons are more efficient in their condensing action than leather aprons, but heretofore no rubber apron has been available which would successfully withstand the deteriorating effect of wool grease and vegetable and other oils so often in or associated with wool and similar fibres. On this account rubber aprons heretofore used have had an objectionable tendency to swell, to lose their pliability and to break down in structure. For these reasons the benefits of rubber aprons have not been generally available to the trade prior to the invention herein disclosed.

The present invention supplies the successful solution of a problem which has long baffled the industry. We have discovered that by employing rubber which is of a highly oil-resistant composition and by incorporating this in a novel manner with suitable fabric elements, an apron may be produced having a life of approximately that of a leather apron but having as much as 40% greater rubbing capacity than a leather apron. With the apron of our invention we are able to produce firmer rovings having better spinning qualities, and a heavier jack spool requiring less handling and change. We are also able to operate the whole condenser mechanism at substantially less speed than when leather aprons are employed, resulting in a great saving in mechanical wear and tear, and to maintain a more uniform friction surface throughout the life of the apron than is possible when leather aprons are used. We have found our improved rubber apron to be superior to a leather apron in respect to its flexibility and to be equally resistant to glazing and deterioration from card stains. Further, all these advantages are secured

without increased cost in any respect; in fact, it is probable that our improved rubber aprons may be installed at lower initial cost than corresponding leather aprons.

An important feature of our invention, relating particularly to the internal structure of the aprons, consists in a rubber body portion terminating at both ends of the apron in a solid fabric zone, preferably slightly reduced in thickness as compared to the body portion of the apron as a whole and supplying the apron with exceedingly tough and wear-resisting margins effective in a large measure to reinforce and protect the more delicate intermediate rubber portion of the apron and to supply firm anchorage for the buttons or guide flanges with which it is customary to equip the inner surface of such aprons to maintain them against endwise displacement on the rolls.

As herein shown the apron includes one or more plies of fabric backing coextensive with the area of the apron, a plurality of relatively narrow plies assembled to form the end or marginal zones of the apron and a rubber body portion united to and vulcanized upon the backing and the end plies of fabric. In the preferred construction, the body is slightly thicker than the end zones whereby such zones of the apron will have no spacing effect upon the cooperating bodies of the aprons by which the rubbing and condensing work on the rovings is carried out, and the marginal zones themselves are relieved of wearing contact in operation.

These and other features of the invention will be best understood and appreciated from the following description of a preferred embodiment thereof selected for purposes of illustration and shown in the accompanying drawings in which,

Fig. 1 is a view in perspective showing the organization of the condensing mechanism of a carding machine,

Fig. 2 is a view in perspective of one of the aprons, and

Fig. 3 is a sectional view on an enlarged scale showing the internal structure of the apron.

In constructing the novel apron of our invention the fabric and rubber plies are built up or assembled upon a cylindrical mandrel of the proper dimensions and then vulcanized upon the mandrel or by any other suitable commercial process of vulcanization. As suggested in Fig. 3 two plies of rubberized 8 oz. to 11 oz. army duck are first spread or wrapped upon the mandrel. Then a five-ply cap or thickened marginal zone is built up about each end of the

mandrel by wrapping five or six narrow plies 11 of rubberized duck about the mandrel outside the backing plies 10. The plies 11 preferably comprise the same material as the backing plies and are of graduated width, that is, the innermost ply is the widest of the series and the superposed plies are stepped down in their width forming at their inner ends an outwardly and upwardly sloping composite surface. The outer ends of the backing plies 10 and the binding plies 11 are built or trimmed square and all the plies together constitute solid fabric marginal bindings or caps which may be approximately $1\frac{1}{4}$ " to $1\frac{1}{2}$ " in width in their outermost ply. In general it may be said that the end construction is sufficiently strong to support the drive buttons, and to protect the ends of the rubber portion of the sleeve. The ends are also preferably somewhat thinner in gauge so that the active rubbing is done by the rubber surfaces rather than by the ends. Furthermore when running idle, the ends being of lesser gauge do not abrade one another. The composition used in rubberizing the duck of the fabric plies and in binding them together is preferably oil-resistant rubber of the character hereinafter disclosed.

Having built up the fabric portion of the apron, we next apply to its periphery and between the fabric binding portions a body 12 of oil-resistant rubber. This may be calendered onto the apron upon the mandrel to a uniform depth of about $\frac{1}{8}$ " to $\frac{5}{16}$ " or any thickness which will give the rubber coated body portion of the apron at least a slightly greater thickness than the thickness of the solid fabric marginal binding portions thereof. As shown in Fig. 3, the outer edges of the rubber body 12 are conformed to the composite sloping surface presented by the inner ends of the binding plies 11 and are beveled at their margins to meet the inner edge of the outermost binding ply 11.

As already noted it is important in constructing the apron of our invention to employ an oil-resistant rubber or rubber-like composition. One satisfactory composition for this purpose we have found may be compounded from the following formula:

Smoked sheet	100
Sulfur	3
Benzothiazyl disulfide	0.375
Diphenyl guanidine	0.375
Phenyl-beta-naphthylamine	1.50
Stearic acid	1
Zinc oxide	5
Hard coumarone resin	10
Carbon black	150

Having assembled and built up the fabric and rubber portions of the apron as above outlined, and reinforced the fabric by stitching if desired, the vulcanizing operation is next carried out and then the vulcanized apron may be removed from the mandrel. If desired, guide buttons 13 may be securely attached by rivets 14 to the inner surface of the fabric binding zones of the apron. Finally, the apron is sanded down so as to present a smooth rubber surface and it is then ready for use in its condensing capacity.

As suggested in Fig. 1, the individual belts are each positioned over a pair of horizontally disposed rollers 18 spaced apart so that the aprons present opposed flat stretches just clearing each other. The rolls 18 are rotated and reciprocated endwise as already explained to impart an advancing movement and a transverse rolling and

condensing effect to the loosely formed rovings from the carding mechanism. As shown in Fig. 1 three sets of aprons are employed and the rovings are gradually condensed in their passage between the aprons and finally wound up upon a jack spool 19 which, when full, is removed and becomes the source of supply for spinning operations. In the arrangement illustrated in Fig. 1, the first two sets of aprons comprise an upper apron built on a $5\frac{1}{2}$ " mandrel and a longer lower apron built, for example, on a $6\frac{1}{4}$ " mandrel and the final set of aprons are of the same longer length, that is to say, both having been built on a $6\frac{1}{4}$ " mandrel. Satisfactory condensing results have been achieved by rotating the rollers 18 at such a rate as to impart a linear speed of 70 to 130 ft. per minute to the aprons and reciprocating the rollers lengthwise to impart an oscillating motion of about three hundred strokes per minute which results in a maximum rubbing speed of about 90 ft. per minute to the aprons. This represents a decided reduction in speed in both aspects as compared to the usual speed of condensing mechanism employing leather belts, and yet with the improved rubber belts of our construction we are able to produce a firmer roving than heretofore and at a higher rate of production. Accordingly we are able to produce a jack spool having a greater weight of more dense roving in a shorter period than has ever been possible heretofore. In addition to the commercially important advantages incident to our novel apron which have already been pointed out, it should be noted that our construction has practically eliminated the damage of torn out ends and other mechanical difficulties heretofore rising from breaking down of aprons in use and that there is a further direct saving in the elimination of the necessity for leather apron oil and the cost incidental thereto.

While we are not able fully to explain all the reasons for the advantages flowing from our novel construction of apron, it seems clear that its more flexible surface structure facilitates the formation of more perfect grooves or recesses than heretofore to enclose and shape the roving during its lateral movement. Further, our whole construction is light and flexible so that the apron is able to bend easily around the drive pulleys without tendency to break.

It will be understood that the specific construction herein described is for illustrative purposes only and that various departures may be made from this structure within the scope of our invention, for example, in some instances a single backing ply will be found adequate instead of the double ply backing illustrated and the stepped construction of the fabric binding caps may be modified in shape and general appearance although it is very desirable that the rubber body portion of the apron should be at least slightly thicker than its fabric marginal zones.

The term rubber is used herein broadly to include artificial or synthetic rubber and rubber-like materials such as Chloroprene products or so called "Thiokoles," a typical formula of which is $C_2H_4S_4C_2H_4S_4C_2H_4$. These materials and others of equivalent composition are oil resistant and may be used in place of such rubber compositions as that of the foregoing formula and within the scope of our invention.

Having thus disclosed our invention what we claim as new and desire to secure by Letters Patent of the United States is:

1. A rubber card apron comprising a textile backing having a body portion of oil-resistant rubber composition united thereto and vulcanized thereon and bound at both margins by solid bands of textile material, said margins of the apron being thinner than the portion of the apron located therebetween but thicker than the textile backing between said margins.

2. A rubber card apron comprising a fabric backing permanently united to marginal bands of multiple ply fabric of substantial thickness, and a body portion of oil-resistant rubber united to and vulcanized upon the backing and of greater thickness than the marginal fabric bands of the apron.

3. A rubber card apron comprising a fabric backing permanently bonded along both margins to relatively thick laminated fabric bands increasing in thickness and presenting surfaces flaring outwardly from an intermediate portion of the backing fabric and having square marginal edges, and a body of oil-resistant rubber vulcanized upon the backing fabric and the flaring surfaces of the laminated marginal bands.

4. A rubber card apron comprising a fabric backing having thickened marginal bands each including an outer thick zone of uniform thickness and an inwardly tapering zone, and a body of oil-resistant rubber vulcanized upon the backing fabric and the tapering zone of the two marginal bands.

5. A rubber card apron comprising a fabric backing, multiple marginal bands united to the backing and including plies which gradually de-

crease in width and are stepped outwardly at their inner edges to present outwardly sloping composite surfaces, and a body of oil-resistant rubber of greater thickness than said marginal bands vulcanized to the backing and to the sloping composite surfaces of the marginal bands.

6. A tubular rubber card apron comprising a backing of textile sheets embodying a plurality of plies bound together by an oil-resistant rubber compound and forming an intermediate body portion between marginal edge portions, and a relatively thick layer of oil-resistant rubber vulcanized upon the outer face of the intermediate body portion of the backing and decreasing in thickness at its edge portions toward the said marginal edge portions of the backing.

7. A tubular rubber card apron comprising an intermediate body portion of oil-resistant rubber and marginal end portions of tough textile fabric firmly united to the intermediate body portion, the outside surface of the intermediate body portion being at a greater elevation than the outside surfaces of the marginal end portions.

8. A tubular rubber card apron comprising a textile backing reinforced at the two marginal end portions of the apron by a plurality of plies of textile fabric carried on the outer face of the backing, and a relatively thick layer of oil-resistant rubber located between the said marginal end portions and vulcanized to such portions and to the textile backing therebetween.

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