

**Feb. 14, 1956**

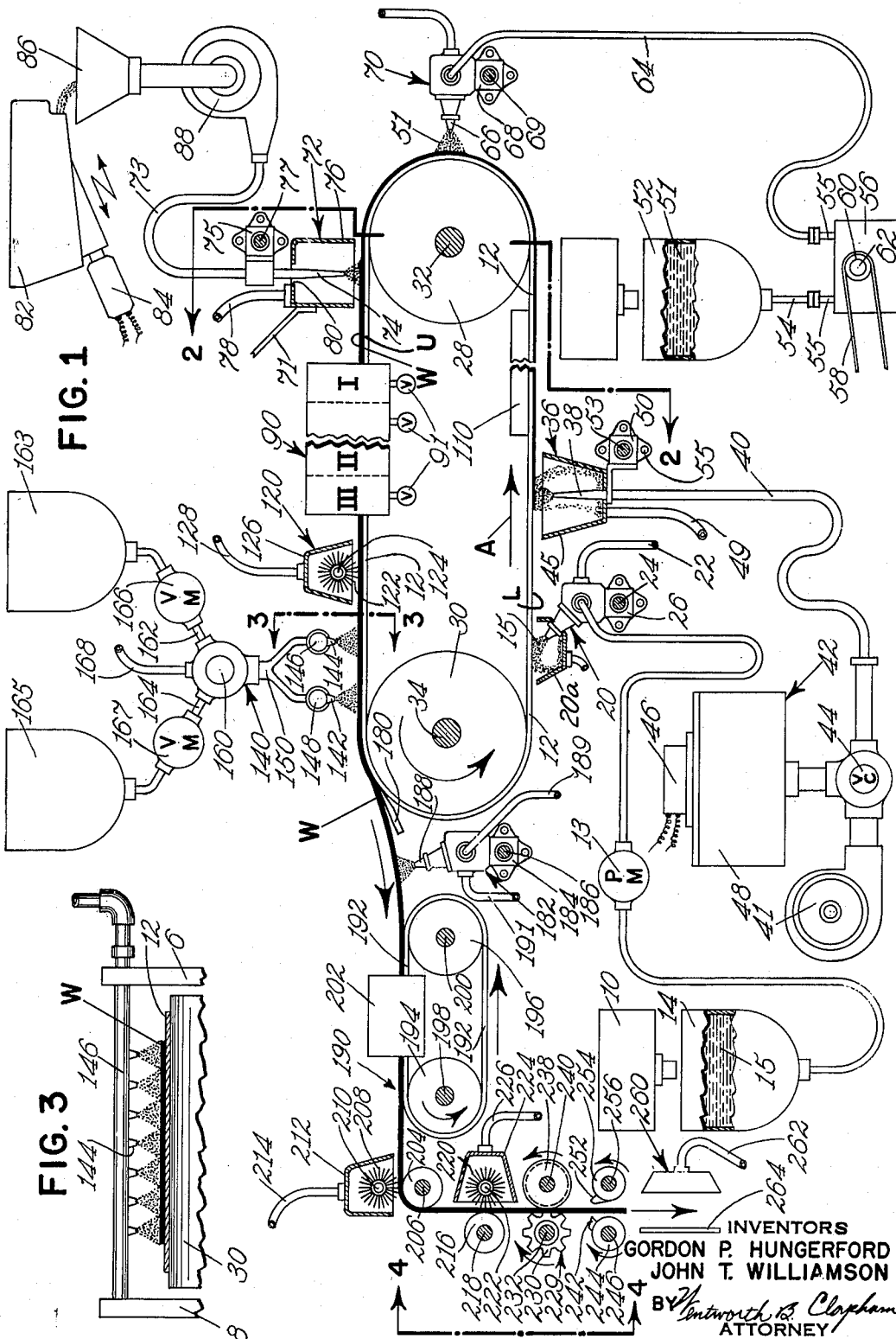
G. P. HUNGERFORD ET AL

**2,734,513**

## METHOD AND APPARATUS FOR MAKING TOBACCO SHEET MATERIAL

Filed April 10, 1951

2 Sheets-Sheet 1



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METHOD AND APPARATUS FOR MAKING TOBACCO SHEET MATERIAL

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2 Sheets-Sheet 2

FIG. 2

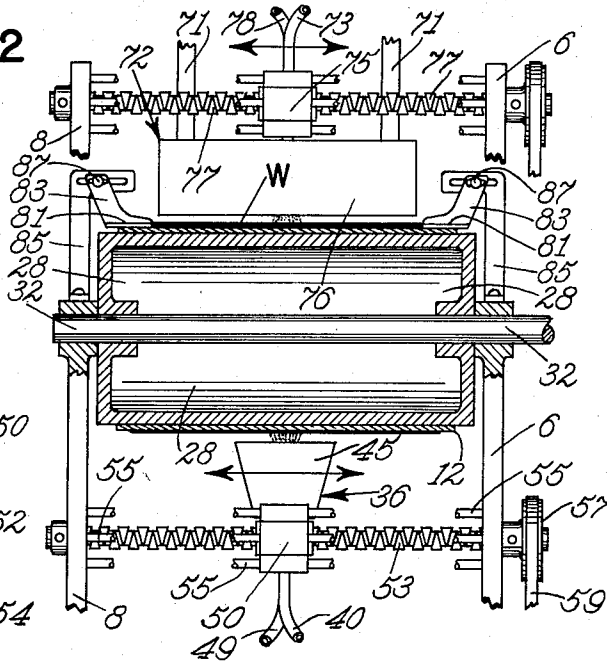


FIG. 5

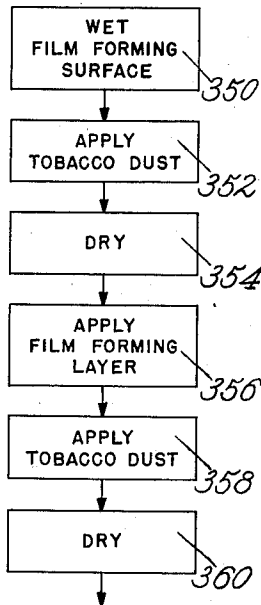


FIG. 6

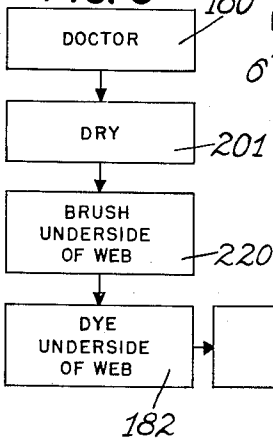
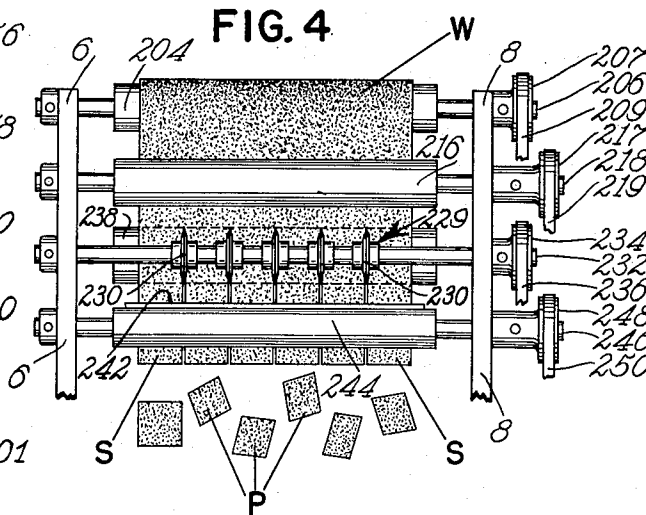


FIG. 4



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2,734,513

## METHOD AND APPARATUS FOR MAKING TOBACCO SHEET MATERIAL

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Application April 10, 1951, Serial No. 220,174

28 Claims. (Cl. 131—140)

This invention relates to improved tobacco sheets, films, webs, strips and filaments, and to improved methods of producing the same.

The manufacturer of tobacco products generally buys tobacco in the form of whole leaves as removed from the tobacco plant by the farmer. In processing this tobacco, the stem is frequently first removed and then further processing proceeds as desired. In the case of a cigarette manufacturer, this processing includes aging, blending, casing and cutting the strip, which is the tobacco leaf portion or portions remaining after removal of the stem, into shreds and then drying, cooling and screening the shredded tobacco, followed by packaging. In all these operations, which involve much handling of the tobacco, waste fines and dust are formed. At the present time these waste materials, stems, field scrap (farm damaged leaves), fines and dust have essentially no value to the tobacco manufacturer, and are sold to manufacturers of fertilizers, insecticides, and others who use waste tobacco material in their products, at a fraction of a cent per pound. Much of this waste tobacco material is of good quality from a smoking standpoint. Indeed it is believed that this waste tobacco material contains a disproportionately high percentage of the very best quality smoking tobacco, since the latter comprises the thinnest, lightest, most friable leaves which would most readily break up into fine particles and dust on handling. These high quality fines are useless not only because of their physical form. A technique for processing this good tobacco into a form which would render it usable in smoking articles without essential change in its smoking characteristics would therefore be attractive to a tobacco manufacturer because it would increase the yield, and of course reduce manufacturing costs.

It has been suggested previously that tobacco sheets and films be made by wet milling a mixture of tobacco in water to form therefrom a slurry which can be converted, as by any well-known casting and drying method, into continuous self-supporting sheets and films.

Other attempts to solve the problem of forming a satisfactory tobacco sheet material could be cited, such as by forming tobacco paper using well-known paper making techniques. However, despite these attempts, little success has been achieved, and to our knowledge, none of these processes has ever been used commercially.

The present invention constitutes a solution to the problem of converting tobacco materials into webs, films, sheets or filaments which can be used in the same manner as natural leaf tobacco in tobacco products such as cigarettes, cigars and the like. Films and webs, strips, sheets and filaments, made in accordance with our invention, are elastic, flexible, tough, self-supporting and continuous, and possess dry and wet strengths comparable to that of natural leaves or pieces of tobacco, and in general retain substantially all natural characteristics and properties of tobacco, including color, aroma, and taste on smoking. This is necessarily true, since in accordance

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with our invention, the natural tobacco raw material is never subjected to any radical treatment, but is merely dry ground. The dry ground particles are adhered together into the form of a sheet or strip in a novel manner according to the invention by a small proportion of a film forming material, preferably a specially developed food adhesive, and does not change the characteristic properties of the tobacco thus processed. It will be evident, therefore, that the invention alters only the physical form of the tobacco used as the raw material.

The resulting tobacco sheet material has a high ratio of surface area to mass which causes it to burn more completely than natural tobacco of the same type would when used in smoking articles. This results in a smoother, milder, less irritating smoke.

The characteristic mildness of the smoke from tobacco sheets or strip made according to the invention is especially significant when certain harsh, low grades of tobacco are used as the raw material. Thus, the invention enables a quality improvement in low grade tobacco sufficient to permit the use of the tobacco sheets or strip produced thereby in high quality smoking articles.

The strong, flexible nature of the reconstituted tobacco sheet produced in accordance with the invention yields long shreds, when used in a cigarette "blend," thus tending to minimize the quantity of objectionable "shorts" which fall out of the end of a cigarette or get onto a smoker's tongue, and which may tend to cause non-uniform cigarettes. The invention therefore, contributes to decreased manufacturing costs by simplifying plant operations, and by reducing the amount of good tobacco material which is presently discarded as waste primarily because its physical form makes it unusable in the blend. In addition, the invention effects a quality improvement in cigarettes, since cigarettes containing shreds of tobacco or strip made in accordance with the invention, have less tendency to lose "shorts" from the ends than have cigarettes containing only natural tobacco shreds. It has also been observed that cigarettes containing tobacco sheet or web material strip made in accordance with the invention are milder, smoother, and less irritating than standard blend cigarettes. It is believed that this results from the poly-particulate structure of our novel strip which gives a very high ratio of surface to mass and extreme porosity, providing ready ignition and more complete burning. If desired, whole leaf tobacco or tobacco strip may be used in forming our novel tobacco sheet or film material.

It is an object of our invention to provide an apparatus for an improved method of making tobacco sheets, strips, webs, films or filaments, wherein fine tobacco particles or tobacco dust are adhered to both faces of a web of film forming material and form an integral part of the composite tobacco material produced.

It is a further object of our invention to provide an apparatus for an improved method of making self-supporting, continuous flexible tobacco sheets, webs and the like in which a layer of tobacco dust is coated with a thin layer of a film forming material, the exposed surface of which is also coated with tobacco dust to form a composite tobacco sheet material consisting primarily of tobacco dust.

The invention further consists in the provision of an improved method of increasing the yield of tobacco by improving the physical characteristics of certain types of tobacco which normally are unsuitable for handling and processing into smoking articles by converting such tobacco into thin, self-supporting, tough, porous sheet form in which such tobacco in small particle size is adhered to both surfaces of a thin web of film forming material to form thereby a composite tobacco sheet material consisting principally of tobacco.

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It is a further object of the invention to produce novel smoking articles, such as cigarettes, containing as a part of the cigarette tobacco filler shredded tobacco sheet material or strip produced in accordance with the invention. Such cigarettes are milder, smoother, and less irritating than standard blend cigarettes. This is believed to be due to the poly-particulate structure of the tobacco sheet material or strip which gives a very high ratio of surface to mass and extreme porosity, providing ready ignition and more complete burning.

The invention also consists in the provision of apparatus for and method of forming tobacco sheet materials, webs, films, filaments and the like by applying tobacco dust to a moistened surface to which the tobacco dust adheres, after which a thin layer of a suitable film forming material is applied to the layer of tobacco, and tobacco dust is applied to the exposed surface of the web of film forming material, which is then dried, the sheet or web material thus produced consisting of a central thin layer of film forming material having substantially permanently adhered thereto on both of its surfaces substantial quantities of tobacco dust. The sheet material thus produced can be cut into desired lengths and formed into shreds or filaments suitable for use in the manufacture of cigarettes or used in sheet form in the manufacture of cigars and like smoking articles.

It is a further object of the invention to provide a novel type of improved tobacco sheet or web material.

With these and other objects not specifically mentioned in view, the invention consists in certain features which will be hereinafter fully described, and then set forth in the claims hereunto appended.

In the accompanying drawings, which form a part of this specification, and wherein the several reference characters designate the same or like elements:

Fig. 1 is a side elevation of a preferred form of apparatus according to the present invention, supporting or framing means being omitted;

Fig. 2 is a sectional view taken on line 2—2 of Figure 1;

Fig. 3 is a sectional view taken on line 3—3 of Figure 1;

Fig. 4 is an end elevation as seen from line 4—4 of Fig. 1;

Fig. 5 is a view showing diagrammatically a modified method of producing our novel tobacco sheet material; and

Fig. 6 is a view showing diagrammatically a modified method of finishing our novel tobacco sheet material and preparing it for use.

Referring to the drawings, Figure 1 shows a preferred form of apparatus for forming the novel tobacco sheet material in accordance with the invention, and for carrying out the steps covering the preferred method of our invention. Numeral 10 designates a device for forming a wetting solution or liquid wetting material 15 which is applied to the top surface of endless belt 12, after which tobacco dust is substantially immediately applied thereto as by blowing the dust thereupon. Any suitable mixing device may be used for forming wetting solution 15. This can be a vertical mixer similar to that illustrated in De Huff Patent 1,781,321, issued November 11, 1930. However, any other conventional type of mixer may be used.

A substantially uniform layer of fine tobacco particles or tobacco dust is adhered to belt 12. A method, which has been found satisfactory for adhering fine tobacco particles to belt 12 is to wet belt 12, as described hereinafter. It has been found that this technique insures that fine tobacco or tobacco dust coated upon belt 12, will cling thereto and form a substantially uniform layer. This is necessary in an apparatus such as shown in Figure 1, where tobacco dust is deposited upon the exposed surface of the lower lap of belt 12. It is also highly desirable in a case where a longer belt 12 is used and tobacco dust is applied to the upper lap thereof. This is due to the fact that if a loose layer of tobacco dust

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were applied to belt 12, during the subsequent operation of spraying a layer of film forming material upon the layer of tobacco dust, the latter in all probability would be dispersed, or a large proportion thereof would be removed from belt 12, and hence the desired results would be unobtainable. In the apparatus such as shown and in performing the preferred method of the invention, a substantially uniform continuous layer of tobacco is adhered to belt 12 and very satisfactory results are secured.

Solution 15 is piped into a container 14 and is pumped or flows by gravity to a device 20 of suitable design, which atomizes it and sprays it upon belt 12 preferably driven continuously. Device 20 in the illustrated embodiment travels back and forth relative to belt 12 in applying wetting solution 15 thereupon. If desired, a stationary spraying mechanism provided with a plurality of stationary spray heads so disposed as to apply a substantially uniform coating of solution 15 on belt 12, could be used.

When sprays are used as application means, it may be desirable to recover the spray droplets which do not adhere to the belt surface. This may be done by a hood 20a surrounding device 20 connected to a suitable air-droplet separating device by a suitable conduit.

In order to control the amount of wetting solution 15 deposited on belt 12, a suitable metering device 13 of conventional design is employed. This may be a metering pump or the combination of a flow meter with a control valve. Compressed air, supplied through conduit 22 in known manner to device 20, atomizes the solution for application upon belt 12 in a uniform thin layer. In order to secure uniform distribution of wetting solution on belt 12, device 20 is mounted for movement back and forth across belt 12. In the apparatus illustrated, the desired movement of device 20 is secured by means of an interrupted thread drive shaft 24 which engages with and drives carriage 26 supporting device 20. Shaft 24 is driven by a motor or other suitable source of power during the operation of the apparatus. As shown in Figure 1, spraying device 20 is located beneath belt 12. This arrangement makes it possible to use a shorter belt and conserve space. Obviously, if desired, belt 12 could be longer, and wetting solution 15 could be applied to the upper lap thereof instead of the lower lap, as shown, and the same results obtained.

Wetting solution or liquid wetting material is principally a water solution and its use is designed primarily to provide a wetted surface to which a layer of tobacco will cling until it is covered with a layer of suitable film forming substance, referred to hereinafter in detail. Solution 15, as used herein, contains a small amount of low viscosity carboxymethylcellulose, to assist in bonding the tobacco particles to the main strength-giving film. This may be omitted if desired. The concentration of CMC used in solution 15 preferably ranges between 0.5% and 1½% by weight and the thickness of the film solution 15 applied preferably ranges between 3 and 10 mils. But other concentrations and thicknesses can be used. If desired, and in order to aid solution 15 in wetting belt 12, a small quantity of a suitable detergent is used as an ingredient of solution 15. One-tenth of one percent of "Dreft," a synthetic detergent, in the solution 15, has proven to be satisfactory.

Belt 12 moves in the direction of arrow A. It is supported upon driving pulley or drum 28 and driven pulley or drum 30 on shafts 32, 34, respectively and has an upper lap U and a lower lap L. Shaft 32 is driven continuously from a motor or other suitable source of power and at a speed commensurate with the proper practice of the invention.

Following the application of solution 15 to belt 12, the belt moves to a tobacco dust applying zone where a device, designated generally 36, applies tobacco dust or fine particles of tobacco to the wetted portion of the surface

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of belt 12. Tobacco dust in quantity greater than that which will adhere to the wetted surface of belt 12 is blown thereupon by an air blast nozzle 38 fed by a conduit 40 from a conventional type of dry material feeding mechanism 42. The device illustrated diagrammatically in Figure 1 is a Dry Chemical Feeding Mechanism made by Wallace and Tiernan Co., Belleville, N. J. Any other conventional type of feeder may be employed as long as it can be used for the efficient and effective distribution and application of dust onto belt 12. Blower 41 connected in the operating conduit system of feeding mechanism 42, forces air through chamber 44 where tobacco dust, fed by a screw conveyor element (not shown) in mechanism 42, is taken up and sprayed or blown upon the wetted portion of belt 12. It has been found that an air velocity ranging between 3300 and 5000 cu. ft./min. at the nozzle tip gives satisfactory results. An electric vibrator 46 attached to the hopper 48 of feeding mechanism 42, assists in the proper movement of tobacco dust to the feeding screw conveyor element (not shown) in hopper 48. As the result of the operation of device 36, a substantially continuous unbroken layer of tobacco dust is deposited upon the wetted portion of the surface of belt 12 where it remains as the movement of belt 12 brings it to and passes it through the next operating station where a thin layer of film forming solution is applied to the tobacco dust adhering to belt 12.

A large excess of tobacco dust is applied by nozzle 38. Dust which does not adhere to belt 12 is recovered by a recovery system including a hood 45 surrounding nozzle 38, and a suction conduit 49 connected to a suitable air separating unit, such as a conventional "Cyclone" Separator (not shown), or a bag filter. Dust recovered is returned to hopper 48 for re-use. As shown in Figure 1, the nozzle of unit 20 preferably is directed away from dust applying mechanism 36. This arrangement insures that tobacco dust, issuing from nozzle 38, will be substantially free of the danger of being coated by wetting solution 15 which might render it less suitable for recycling and re-use.

Spraying or blowing nozzle 38 may be one of a plurality of nozzles extending transversely across the path of travel of belt 12 or a single nozzle extending entirely across the path of movement of belt 12. As shown in the illustrated embodiment, however, it consists of a single nozzle 38 attached to conduit 40 and mounted on a carriage 50 supported upon and moved back and forth relative to belt 12 by interrupted thread shaft 53 of conventional design. See Figure 2. The ends of shaft 53 are supported in bearings in side frames 6 and 8 of the machine. Attached to one end of shaft 53 is a pulley 57 on which runs a driving belt 59 running on a driving pulley (not shown) driven by any suitable source of power, as a motor (not shown) or main drive shaft of the apparatus (not shown). Stabilizing rods 55 having their ends attached to frames 6 and 8, pass through horizontal parallel bores in carriage 50 and maintain the latter and nozzle 38 in proper operative position during its continuous travel back and forth relative to belt 12 while the apparatus is in operation. The portion of belt 12 which is coated with tobacco dust next moves to a coating zone where a thin layer of a suitable film forming material is applied over the layer of tobacco.

In forming the novel reconstituted tobacco sheet or web material described hereinabove, the film forming material used in making the base web of our sheet or web material can be any film forming material which possesses adequate strength and retains the tobacco particles well. It is also essential that a film forming material be used which has adhesive qualities and which on smoking the final reconstituted tobacco sheet or web does not cause an unsatisfactory taste, aroma or harshness. Suitable film forming materials are water soluble salts of carboxymethylcellulose and carboxymethylhydroxyethylcellulose, or carboxymethylcellulose and carboxymethylhydroxy-

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ethylcellulose, which are respectively cellulose glycolic acid and cellulose hydroxy glycolic acid, the latter two being insoluble in water but which are capable of being formed into stable water dispersions in a manner described in copending application Serial Number 130,858, filed by Newton Heimbach on December 2, 1949, for Water Insoluble Coatings, Films, and Adhesives and Method of Making Same. These dispersions are capable of being cast to form a wet web, which when dried, becomes a self-supporting, water insoluble film. The terms "CMC" and "CMHEC" where used herein, mean the free acid forms of cellulose glycolic acid or carboxymethyl cellulose, and cellulose hydroxy glycolic acid or carboxymethyl hydroxyethyl cellulose, respectively.

If desired, a cross linking agent, such as glyoxal may be added to improve further the water resistance of the already water resistant CMC. If desired, a humectant may be added to the film forming dispersion.

Typical dispersions can be prepared as follows: a  $\frac{1}{16}$  inch diameter stream of a 3.75 percent high viscosity sodium carboxymethylcellulose solution in water is extruded into about twice its weight of 20 percent sulfuric acid solution. The sodium carboxymethylcellulose solution forms threads which are allowed to stand in the acid two hours to complete the acidification of the sodium carboxymethylcellulose. The threads of reacted carboxymethylcellulose are then removed from the acid by means of a suitable screen. The insoluble carboxymethylcellulose is then washed with a stream of water until the pH of a dispersion formed by processing a sample of the carboxymethylcellulose threads in a Waring Blendor is 2.4. At this point, the washing may be discontinued. The carboxymethylcellulose, which is now in the form of semi-solid, long, gelatinous strands, is then ground in a colloid mill, Waring Blendor, or similar device to produce a fine dispersion of carboxymethylcellulose in water. In general, we may use a technique similar to that disclosed in copending Heimbach application, Serial Number 130,858, filed December 2, 1949, for Water Insoluble Coatings, Films, and Adhesives and Method of Making Same.

In forming satisfactory aqueous carboxymethylcellulose dispersions, it is found that good results are obtained when the concentration of the sodium salt of carboxymethylcellulose solution ranges between 2 and 8% by weight, and the final sulfuric acid concentration is between 5 and 25%. The time of acidification may vary over wide limits, as may the washing time. The pH of the final carboxymethylcellulose dispersion may also vary from about 1.5 to 5.0.

To make a dispersion suitable for coatings, the concentrated carboxymethylcellulose, prepared as described above, may be diluted to the desired concentration by the addition of water, and if desired, suitable quantities of a humectant, such as glycerine can be added, and if desired, glyoxal may also be added.

The techniques described for forming aqueous dispersions of cellulose glycolic acid are followed in making aqueous dispersions of carboxymethyl hydroxyethyl cellulose which for our purpose has characteristics similar to those of cellulose glycolic acid. A satisfactory dispersion of acid carboxymethylhydroxyethyl cellulose for use in forming films, web, sheets and the like, was made as follows: The sodium salt of carboxymethylhydroxyethyl cellulose was dissolved in water to form a thick paste. The paste was extruded through a  $\frac{1}{16}$  inch diameter orifice into 20% sulfuric acid and was permitted to stand in the acid for two hours. The hardened spaghetti-like threads of the insoluble acid form of carboxymethyl hydroxyethyl cellulose were removed from the acid, drained and washed with running water for twenty minutes. The washed threads were then dispersed in a manner similar to that described above to form an aqueous dispersion which was formed into a wet web which was coated with

tobacco dust and dried to form a continuous reconstituted tobacco sheet and web material.

The amount of film forming material applied depends on the physical strength desired in the final sheet or strip. It has been found that when an amount of dispersion equivalent to 0.8 gram CMC per square foot of sheet is used, the dry breaking strength of the final sheet is about 700 grams per inch of width. In this sheet the belt wetting solution 15 was applied in an amount such that the sheet contained 0.15 gram per square foot of low viscosity CMC. This sheet was adequately strong to pass through the same process and the processing equipment used for natural leaf tobacco without any significant mechanical degradation. Obviously, if greater or less strength is required, the amount of film forming material may be adjusted to obtain the desired strength.

The dispersion, designated generally 51, is contained in a suitable container 52 having a conduit 54 connected to tube 55 of a metering pump 56, the rotor of which (not shown) is driven by a belt 58 from a suitable source of power such as a motor (not shown). Belt 58 runs on pulley 60 attached to rotor shaft 62. Any conventional type of metering pump may be used so long as a constant quantity of dispersion is forced through conduit 64 to and through nozzle 66 of applying device 70. The pump shown diagrammatically in Figure 1 may be similar in construction and operation to that illustrated in U. S. Patent No. 1,848,024 issued March 1, 1932, to Owens, for pumping metered quantities of dispersion 51 to nozzle 66. Applying device 70 includes a carriage 68 supporting nozzle 66. Carriage 68, which may be similar in construction and operation to carriage 26, is mounted on interrupted rotary shaft 69 suitably supported in side frames 6 and 8 of the machine for movement back and forth above belt 12, in order that film forming material may be sprayed by nozzle 66 upon the layer of tobacco particles adhering and clinging to the wetting solution 15 on belt 12. If desired, a hood (not shown), similar to that used in connection with spraying device 20, may be provided for recovering sprayed dispersion 51 not actually forming the film covering the layer of tobacco particles.

Following the application of the thin layer of film forming material 51, and while it is still wet, belt 12 moves the wet layer into a tobacco dust applying zone where a tobacco dust depositing device, designated generally 72, such as a travelling blowing nozzle 74, applies a heavy coating of tobacco dust to the wet exposed adhesive surface of the layer of film forming material 51. In the embodiment illustrated in Figure 1, nozzle 74 applies tobacco dust to the wet exposed surface of the layer of film forming material 51 on the upper lap U of belt 12. Excess tobacco dust is caught by hood 76, attached to the machine frame by brackets 71, and conducted by a suitable suction system including a conduit 78 to the dust air separator referred to hereinabove for re-use. It will be noted that hood 76 is provided with a transverse slot 80 through which nozzle 74 projects into tobacco dust applying position to belt 12 and along which it travels as it moves back and forth across belt 12. The desired movement of carriage 75, which supports nozzle 74 in the illustrated embodiment, is secured by an interrupted thread driven shaft 77 of conventional design driven from a suitable source of power continuously during the operation of the machine. Tobacco dust is fed by a vibratory feeder, designated generally 82, which is vibrated in known manner during the operation of the machine by a motor 84 attached thereto. Tobacco fed from feeder 82 is delivered into chute 86 whence it is conducted into blower 88 of suitable conventional design, and forced with air delivered by blower 88 through conduit 73 and nozzle 74 and onto the surface of the wet exposed surface of the layer of material 51, as stated above.

Belt 12 preferably is provided with a polished imper-

meable surface. Belt 12 as used herein, is made of metal and for that reason is subject to expansion and contraction during its passage through dryer 90 which removes moisture from the composite web carried thereby.

It has been found that unless the dimensions of belt 12 at certain stages of the drying process are controlled, undesirable checks and cracks may be formed in the web W. It is believed that these checks and cracks occur when belt 12, carrying an already solidified web W, is allowed to continue to rise in temperature, thus expanding the belt. Since the solidified web W adheres firmly to the belt and cannot stretch appreciably before cracking, expansion of belt 12 could cause the observed cracks.

Since web W is normally solidified and set before it is completely dry, belt 12, carrying web W, normally is exposed to heat after solidification of the web takes place, in order to complete the drying. This heating expands the belt and could cause checks and cracks. It has been found that if the belt is heated before it enters the portion of dryer 90 where the web W has been solidified, the aforementioned checks and cracks are substantially prevented. Therefore, in order to insure that the composite tobacco sheet material web W will be substantially free of checks and cracks which would be undesirable, means are provided for heating belt 12 in order to expand it prior to its reaching the point in dryer 90 where solidification of web W occurs. As shown in Figure 1, dryer 90 may be divided into several zones in which different conditions of temperature, air velocity and humidity may exist. In addition, individual control of temperature and/or air velocity may be provided for the spaces faced by both top and bottom of the belt in each zone. Thus, by adjusting the rate of heat transfer to the side of the belt not covered by web W and by adjusting temperature and/or air velocity, the temperature of the belt may be controlled, thus enabling the prevention of checks and cracks in web W as explained above. Any suitable conventional type of control valve may be used for securing the proper heat transfer required in each zone I, II and III and controlling this independently in each zone. A suitable valve, indicated generally at 91, is a thermally actuated valve, the degree of opening of which is controlled by the temperature of the air passing through the exhaust ducts of each dryer zone. In the case of a gas fired dryer valves 91 control the quantity of gas being burned in each zone.

If desired, the belt may be pre-heated in order to expand it by a heating element suitably mounted on the frame of the machine. Heating element 110, which may be of any suitable conventional design, extends transversely across belt 12, as indicated in Figure 1, and when heat is generated therein, the heat results in expansion of belt 12 such that cracks and checks in web W are prevented, as stated above.

When heating element 110 is provided, the amount of heat transfer to the belt itself in dryer 90 may be less than when element 110 is not provided since the desired expansion of belt 12 has already been effected by element 110. On the other hand, under some conditions, it may prove desirable to again heat belt 12 to insure its proper expansion before it reaches the point in dryer 90 where web W is solidified.

Located between hood 72 and dryer 90 along the path of travel of belt 12, are flexible blades 81, preferably formed of rubber or thin flexible steel, which bear against the upper surface of belt 12. The positions of the inner edge of each of these blades 81 determine the width of the final web W since these blades scrape off and remove the edge portions of the web. In this manner, the width of the web passing into dryer 90 is maintained substantially constant.

Blades 81 are mounted on brackets 83 adjustably secured in slots in brackets 85 suitably attached to the side

frames 6 and 8 of the machine. The position of each blade 81 can be adjusted as desired by loosening wing nuts 87, moving brackets 83 inwardly or outwardly, and then tightening the wing nuts in the desired adjusted position.

Upon emergence of the portion of belt 12 which carries web W from dryer 90, it moves beneath a brushing unit designated generally 120 which includes a rapidly rotated brush 122 mounted on a continuously driven shaft 124, suitably journaled for rotation in the side frames of the machine 6, 8, and driven in any desired manner by a motor or other source of power (not shown). Unit 120 also includes a hood 126 supported in any desired manner by the side frames of the machine and extending transversely across belt 12. Hood 126 preferably has downwardly tapered side, and ends (not shown) and has connected thereto, as indicated in Figure 1, a suction conduit 128 connected to the above referred to air separator, such that loose tobacco dust and particles, brushed from the top surface of web W, are conducted from hood 126 through conduit 128 and returned for re-use.

After the brushing operation just described, belt 12 moves web W through a moistening device designated generally 140. This device can be employed for the sole purpose of applying moisture, as by spraying water, upon the exposed surface of the brushed composite web W, or, as shown in Figure 1, it can perform the dual function of rehumidifying and applying a suitable dye to the exposed surface of the web in order that the resulting web product may suit the color requirements of the manufacturer who is to use the product. In the embodiment selected for purposes of illustration, device 140 consists of two sets of spray nozzles, 142 and 144 projecting downwardly from conduits 146, 148 respectively, extending transversely of belt 12. The ends of conduits 146 and 148 are suitably supported in side frames 6 and 8 of the machine, Figure 3. Conduits 146 and 148 are connected by a Y unit 150 to a mixing valve 160. A conduit 162 connects valve 160 to a source of supply of water 163. A conduit 164 connects valve 160 to a source of supply of dye 165. Conduit 162 is provided with a metering device 166, and conduit 164 is provided with a metering device 167. In this manner, the metered quantities of water and dye flowing from containers 163 and 165 respectively through valve 160 to conduits 146 and 148 can be controlled as desired by proper manipulation of mixing valve 160. The flow of dye to nozzles 142 and 144 may be stopped completely. The same is true with respect to water flowing from container 163. As shown in Figure 1, the flow of water or dye to nozzles 142 and 144 is effected by gravity. Obviously if desired, this could be accomplished by a pump. A compressed air conduit 168 operatively connected to valve 160 provides compressed air for atomizing the mixture of water and dye, or water alone, depending upon the fluid flowing into Y unit 150 from containers 163 and 165, or 163 alone, as the case may be. Compressed air is furnished to conduit 168 from any suitable conventional source of supply (not shown).

Under some conditions, the degree of drying accomplished in dryer 90 can be controlled such that web W can be removed from belt 12 without remoistening by device 140. Under these conditions, device 140 may be used to apply dye only; or if dye is not required, device 140 may be eliminated entirely.

The moistened composite tobacco sheet or web material W is removed from belt 12 by means of a conventional type of doctor blade 180. The composite tobacco sheet material web W after being removed from the surface of belt 12, is moved therefrom onto an endless conveyor designated generally 190. As shown in Figure 1, located between the delivery end of belt 12 and the receiving end of conveyor 190, is a dye applying device designated generally 182 which consists of a carriage 184 mounted for movement back and forth relative to the undersurface of web W as the latter moves onto con-

veyor 190. This movement is effected by means of an interrupted threaded shaft 186 similar in construction and operation to shafts 53 and 77, which during the operation of the machine is driven continuously so that so long as web W is being delivered from belt 12, spraying device 182 applies dye to the undersurface of web W. Of course, if it is not desired to apply dye to the undersurface of web W, the rotation of shaft 186 is prevented by suitable means (not shown), and hence the movement of carriage 184 is also prevented. In order to provide for this operation, means, such as a valve (not shown), are provided for preventing the flow of dye and compressed air to nozzle 188. Dye is conducted to nozzle 188 through flexible conduit 189 from a source of supply, such as container 163 and a suitable metering device, similar in construction and operation to metering device 167. Compressed air for atomizing purposes is conducted to nozzle 188 by means of flexible conduit 191 from any suitable conventional source of supply (not shown). Suitable hoods (not shown) may be provided for use with devices 142 and 182 for recovering dye spray droplets, thereby preventing possible waste of the relatively expensive dye.

Conveyor 190 preferably comprises an endless traveling belt 192 formed of canvas or like material. Belt 192 runs on drums 194 and 196. Drum 194 is attached to driving shaft 198 which is driven in any desired manner as by a motor or from the main shaft of the machine. Shaft 198 is rotatably supported in bearings (not shown) in side frames 6 and 8 of the machine. Drum 196 is mounted on a driven shaft 200 also rotatably supported in side frames 6 and 8 of the machine. Belt 192 carries moistened web W through a dryer 202 of suitable conventional design in which, as the web passes therethrough, moisture is removed until as the web leaves the dryer, the desired moisture content is present in the web. This may be from 10 to 15% moisture by weight. Obviously the dryer may be so adjusted in known manner as to control the amount of moisture contained in web W as it leaves the dryer and is delivered by conveyor 190 to a roller 204 mounted on a continuously driven shaft 206. As web W is fed positively and continuously from continuously moving conveyor 190, it passes beneath a rotating brush 208 supported by a continuously driven shaft 210. Shafts 206 and 210 are also rotatably supported in side frames 6 and 8 of the machine. Shaft 206 is driven by a pulley 207 on which runs a driving belt 209 running on a driving pulley (not shown) driven from any suitable source of power. Brush 208 performs the function of removing from the surface of the composite tobacco sheet material web W any loose particles of tobacco dust which may be present therein. These are received within a hood 212, which is attached to side frames 6 and 8 of the machine in any suitable manner. A suction conduit 214 connected to the air-tobacco separator above referred to delivers all reclaimed tobacco dust to a suitable receptacle for re-use.

After being brushed, web W is passed between a continuously driven roller 216 mounted on a continuously driven shaft 218 and a coating, rotating brush 220 attached to continuously driven shaft 222. Shaft 218 is driven by a pulley 217 by a belt 219 running on a suitably driven driving pulley (not shown). Brush 220 is enclosed in a suction hood 224 similar in construction to hood 212, and by means of a suction conduit 226, loose tobacco is removed from the under-surface of web W and conducted to the above referred to receptacle (not shown) for re-use. If desired, finished web W may be rolled into reels for further processing. It is preferred, however, to cut it to a desired size since this enables it to be handled more readily and packed for shipment or for immediate use in a plant, such as a cigarette factory. As indicated in Figures 1 and 4, a gang of equally spaced rotary knives designated generally 229 may be used for cutting web W longitudinally in the direction of its travel. Gang knives 229, shown in Figure 4, is made up of five

knives 230 secured to continuously rotating shaft 232 journaled for rotation in side frames 6 and 8 and driven by means of a pulley 234 and belt 236 from a motor or other suitable source of power such as the main drive shaft of the machine (not shown). Obviously more or less knives 230 could be used, depending upon the width of strips desired. Increasing the number of knives 230 and closely spacing them, web W can be cut into filaments or shreds. Knives 230 coact with grooves in a metal roller 238. Roller 238 is mounted on a shaft 240 journaled in side frames 6 and 8 and driven in a manner similar to shaft 232. Strips of webs are further cut into pieces P, such as shown in Figure 4, by means of a rotary cutter consisting of a transverse blades 242 mounted on a roller 244 secured to shaft 246 having a pulley 248 on which runs a belt 250 driven from a suitable source of power (not shown). A ledger blade 252 carried by roller 254 on continuously rotated shaft 256 operatively supported in side frames 6 and 8 and driven in a manner similar to that of shaft 246, coacts with blade 242 to cut the pieces which fall into a suitable receptacle (not shown). Since there may be a loosening of tobacco dust particles at the lines of cut as the result of the cutting operations of knives 230 and 242, and it is desirable to reclaim such tobacco dust for further use, it is preferred to provide a suction reclaiming device indicated generally as 260 having a suction conduit 262 operatively associated therewith, which conduit conducts the tobacco dust to the air separator for separation and storage. As shown in Figure 1, sheets or pieces of the novel tobacco sheet or web material P dropping from transverse cutting blade 242, pass between a plate 264 and suction reclaiming device 260 which has a low suction such that each sheet or piece P is free to continue its fall, but tobacco dust and particles are sucked off and collected for re-use in the manner stated.

In some cases, it is desirable to brush the underside of web W before it is dyed in order to avoid uneven dyeing of the underside and thereby insure uniform coloring thereof. Figure 6 illustrates diagrammatically the steps involved and suitable apparatus which can be used in carrying out these steps. In Figure 6, 180 indicates a doctor blade which removes web W from belt 12, whereupon web W moves through a dryer 201 similar in construction and operation to dryer 202, shown in Figure 1. The underside of web W is then brushed by a brush 220, dye is applied by an applying device, designated generally 182, described hereinabove, and the web is then passed through dryer 202. Dried web W upon emerging from dryer 202, is moved through slitting and cutting device 229, and any loose fine tobacco particles or dust are removed by device 260 shown in Figure 1. The finished sheet material is then packed, or processed directly into smoking articles such as cigarettes.

It is believed that the description and operation of the apparatus shown in Figures 1 to 4 inclusive, will make clear the manner in which a preferred method of forming our novel tobacco sheet or web material is effected. Figure 5 shows a modified form of method for producing our novel tobacco sheet or web material. In general, the modified method is essentially the same as that described in connection with the apparatus shown in Figures 1 to 4 and is set forth as follows: Referring to Figure 5, a film forming surface similar in construction and operation to belt 12, disclosed in Figure 1, is wetted as at 350 with a wetting solution similar to solution 15 used in the preferred method. Tobacco dust or fine tobacco particles are then applied in excess quantity by a suitable blowing device indicated at 352, which device may be similar in construction and operation to that shown in Figures 1 and 2. The excess tobacco dust and/or tobacco particles are recovered in the manner described above for re-use. The film forming surface is then moved to a drying device indicated at 354 in Figure 5 where the layer of tobacco clinging to the film

forming surface is dried. A thin layer of film forming material, such as described in the preferred method above referred to, is then applied in a uniform thin layer as at 356 by a spraying device, such as device 70, over the dried layer of tobacco dust and/or tobacco particles on the film forming surface. As in the preferred method described hereinabove, a large quantity of tobacco dust is blown as at 258, by a mechanism similar to device 72 shown in Figure 1, upon the wet exposed surface of the layer of film forming material, and the excess quantity of dust or tobacco particles is recovered for re-use. The resulting composite web, consisting of a bottom layer of tobacco dust or particles, an intermediate thin layer of film forming material, and a top layer of tobacco dust and/or particles, is then dried as at 360 as the result of the film forming surface being passed through a suitable dryer such as dryer 90 shown in Figure 1. The steps employed subsequent to the drying operation are the same as set forth in connection with the description of the preferred method. The resulting tobacco sheet or web material is then cut to size and either packed for shipment to a processing plant, or used directly in the formation of smoking articles. If the material is to be used in the formation of cigarettes, it is shredded in any suitable manner and admixed with shredded cigarette tobacco, or can be admixed in sheet or strip form with cigarette tobacco strip, which mixture is shredded before being formed into cigarettes.

While several embodiments of the invention have been described, it is to be understood that the invention is not confined to the specific apparatus or method steps for carrying out the methods set forth herein by way of illustration, as it is apparent that changes and variations may be made therein by those skilled in the art without departing from the spirit of the invention or exceeding the scope of the claims hereunto appended.

What we claim is:

1. Apparatus for forming self-supporting continuous tobacco films and sheets comprising a substantially impermeable moving film forming member having a film supporting surface, means for applying a liquid wetting material upon successive portions of said moving surface, a device for applying finely divided tobacco particles in a continuous layer upon said wetted portions of said moving surface, means for applying a spray of an adhesive film forming material upon said layer of tobacco particles adhering to said moving wetted surface, a device for applying a layer of fine tobacco particles upon the exposed wet surface of said layer film forming material on said moving surface, and a dryer located in the path of travel of said moving surface for evaporating said liquid wetting material and drying the composite layer thus produced to form a composite continuous self-supporting tobacco film or sheet.

2. Apparatus for forming self-supporting continuous tobacco sheets and films comprising an endless substantially impermeable film forming member having a film forming surface and having an upper lap and a lower lap, mechanism for moving said surface continuously, a surface wetting station located adjacent said lower lap, means for applying a liquid wetting material to said surface of said lower lap as said surface moves past said station, a device for applying finely divided tobacco particles to said moving wetted surface of said lower lap as it moves through said station, whereby a thin continuous layer of tobacco particles adheres to said wetted moving surface, means for applying an adhesive film forming material upon said layer of tobacco particles adhering to said wetted surface and forming a thin continuous film covering and bound to said layer for tobacco particles, a device for applying a layer of fine tobacco particles to the exposed wet surface of said layer of film forming material on said upper lap, a dryer located in the path of movement of said upper lap of said moving surface for removing moisture from said wet composite web thereby solidifying said composite tobacco bearing layer into a self-supporting con-

tinuous tobacco sheet, and means for removing said dried sheet from said surface.

3. The apparatus defined in claim 1 including a mechanism mounted adjacent said first-named tobacco applying device for heating and expanding said surface prior to the movement of said wetted tobacco particle bearing portions of said moving surface into the range of operation of said means for applying a spray of film forming material to said tobacco adhering to said wetted surface.

4. The apparatus defined in claim 1 wherein said dryer includes a plurality of drying zones, the first zone of which applies heat to the under side of said surface, whereby said film bearing surface is expanded prior to the passage of the film bearing portions of said surface through the remaining zones to prevent cracking and checking of said web as said portions of said surface move through said remaining zones.

5. Apparatus for forming self-supporting continuous tobacco films and sheets comprising an endless imperforate band conveyor having a moving film forming surface, means for applying a liquid wetting agent and wetting successive portions of said moving surface therewith, a device for applying finely divided tobacco particles in a continuous substantially uniform heavy layer upon said wetted portions of said moving surface, said device including suction means for recovering free excess fine tobacco particles, means for applying a spray of a film forming material upon said layer of tobacco particles adhering to said moving wetted surface, a device for applying a substantially uniform heavy layer of fine tobacco particles upon the exposed wet surface of said layer of film forming material on said moving surface, a drying means located in the path of travel of said moving surface for removing said liquid wetting agent and drying the composite layer thus produced to form a composite continuous self-supporting tobacco film or sheet, means for brushing both faces of said web, means for moistening said web, and means for removing said web from said surface.

6. Apparatus for forming self-supporting continuous tobacco films and sheets comprising a moving substantially impermeable film forming device having a film supporting surface, means supporting said surface for movement in different spaced planes, means for applying a temporary liquid wetting agent upon successive portions of said surface while moving in one of said planes, a device for applying finely divided tobacco particles and dust in a continuous layer upon said wetted portions of said surface moving in said last-named plane, means for applying a spray of an adhesive film forming material upon said layer of tobacco particles and dust adhering to said wetted surface while moving in another plane, a device for applying a layer of tobacco dust and fine tobacco particles upon the exposed wet surface of said layer of film forming material on said surface while moving in another plane, means for removing said temporary liquid wetting agent and substantially simultaneously drying said tobacco covered film or sheet, means for removing said composite tobacco film or sheet from said surface, and means for dyeing said film or sheet.

7. Apparatus for forming self-supporting continuous tobacco films and sheets comprising an impermeable moving film forming member having a film supporting surface, means for applying a liquid wetting material upon successive portions of said moving surface, a device for applying finely divided tobacco particles in a continuous layer upon said liquid wetting material on said wetted portions of said moving surface, means for applying a spray of a film forming material upon said layer of tobacco particles adhering to said moving wetted surface, a device for applying a layer of fine tobacco particles upon the exposed wet surface of said layer of film forming material on said moving surface, a dryer located in the path of travel of said moving surface for drying the com-

posite layer thus produced to form a composite continuous self-supporting tobacco film or sheet, a device for removing loose tobacco from the top surface of said web as said sheet or film is moved out of said dryer by said moving surface, a moisture applying unit, means for providing said unit with a moistening fluid for moistening the upper surface of said dried sheet or film, means for removing said moistened web from said surface, a second moisture applying unit located beneath the advancing portion of said film or sheet removed from said surface, means for supplying a moistening fluid to said last-named unit, and means for reducing the moisture content in said moistened tobacco film or sheet to between 10 and 15%.

8. Apparatus for forming self-supporting continuous tobacco films and sheets comprising an endless band having an impermeable film forming surface, driving and driven pulleys for moving said band continuously, means located beneath said band and adjacent the lower lap of the film forming surface thereof for applying a liquid wetting material upwardly onto successive portions of said moving lower lap of said film forming surface, a device located beneath said lower lap of said film forming surface for applying a heavy load of finely divided tobacco particles in a continuous layer upon said wetted portions of said lower lap of said moving surface, means for applying a spray of adhesive film forming material upon said layer of tobacco adhering to said moving wetted surface, a device located above and adjacent the upper lap of said moving surface for depositing a heavy load of fine tobacco particles upon the exposed wet adhesive surface of said layer of film forming material on said surface, a dryer located in the path of travel of said upper lap of said moving surface for drying the composite layer thus produced to evaporate said liquid wetting material and form a composite continuous self-supporting tobacco film or sheet, means located above said upper lap of said moving surface for removing loose tobacco from the heavily tobacco loaded top surface of said film or sheet as said film or sheet is moved out of said dryer by said moving surface, means for removing said composite film or sheet from said surface, and means for brushing the underside of said film or sheet to remove excess tobacco therefrom.

9. Apparatus for forming self-supporting continuous tobacco films and sheets comprising a moving substantially impermeable film forming member having an upper and a lower lap, means for applying a liquid wetting material and wetting successive portions of said lower lap of said moving member, transversely movable means for applying finely divided tobacco particles in a continuous substantially uniform layer upon said wetted portions of said lower lap of said moving member whereby said tobacco particles cling to said wetted member, suction means located beneath said lower lap of said member for recovering free excess fine particles of tobacco, means for applying a spray of a film forming material upon said layer of tobacco particles adhering to said upper lap of said moving wetted member, a device located above and adjacent said upper lap of said member for applying a substantially uniform layer of fine particles of tobacco upon the exposed wet surface of said layer of film forming material on said upper lap of said moving member, and drying means located in the path of travel of said upper lap of said moving member for evaporating said liquid wetting material and for drying the composite layer thus produced to form a composite continuous self-supporting tobacco film or sheet.

10. The method of forming self-supporting continuous reconstituted tobacco sheets and films comprising applying a liquid wetting material to a substantially imperforate film forming surface, depositing a substantially uniform layer of fine tobacco particles upon said wetted substantially imperforate film forming surface, coating said layer of fine tobacco particles with a thin layer of a film forming material, and depositing a substantially uniform layer of fine tobacco particles upon the exposed wet surface of said film forming material to form said sheets and webs.

11. The method of forming self-supporting continuous reconstituted tobacco films comprising applying a liquid wetting material to a substantially imperforate film forming surface, depositing a heavy layer of fine tobacco particles upon said wetted substantially imperforate film forming surface, coating said layer of tobacco particles with an adhesive film forming material, depositing a heavy layer of fine tobacco particles upon the exposed wet adhesive surface of said film forming material to form composite heavily tobacco particle loaded films, and removing excess and loose tobacco dust and particles from both faces of said films to complete the formation thereof.

12. The method of producing continuous, self-supporting tobacco sheets and webs comprising applying a liquid wetting material to a film forming surface, depositing a substantially uniform layer of finely divided tobacco upon said wetted surface, coating said layer of finely divided tobacco adhering to said surface with a thin layer of an adhesive flexible film forming material, depositing a substantially uniform layer of finely divided tobacco upon the exposed wet adhesive surface of said layer of film forming material, applying heat to said surface to dry said composite tobacco web or sheet thus produced and evaporate said liquid wetting material, and removing excess finely divided tobacco from the faces of said composite tobacco sheet or web.

13. The method defined in claim 12 including the steps of expanding said film forming surface beneath said film forming material prior to the drying of said composite sheet or web whereby to prevent checking and cracking of said sheet or web, and humidifying said resulting sheet or web to a moisture content between 10 and 15%.

14. The method of producing self-supporting continuous reconstituted tobacco sheets and films comprising applying a liquid wetting material to a moving surface, applying finely divided tobacco substantially uniformly over said wetted portion of said moving surface, forming a dispersion of cellulose glycolic acid, applying said dispersion in a thin substantially continuous layer upon finely divided tobacco adhering to said surface and binding said tobacco particles forming said layer together, applying a substantially uniform coating of finely divided tobacco upon the wet exposed surface of said cellulose glycolic acid dispersion layer, drying said composite film, humidifying said film to between 10 and 15% moisture content and cutting said film into sheets or filaments.

15. The method of producing self-supporting continuous reconstituted tobacco sheets and films comprising applying a liquid wetting material to a smooth moving surface, applying tobacco dust substantially uniformly over said wetted portion of said moving surface, said tobacco dust adhering in a substantially uniform layer to said wetted portion of said surface, removing tobacco dust not adhering to said surface, forming a dispersion of cellular glycolic acid, applying said dispersion in a thin substantially continuous layer upon said tobacco dust adhering to said surface and binding said tobacco particles forming said layer together, applying a substantially uniform coating of finely divided tobacco dust upon the wet exposed surface of said cellulose glycolic acid film, removing tobacco dust not adhering to said cellulosic glycolic acid dispersion layer, drying said composite film, moistening said films to between 10 and 15% moisture content and cutting said film into sheets or filaments.

16. The method of forming self-supporting continuous composite tobacco sheets and films comprising temporarily adhering a thin substantially uniform layer of fine tobacco particles on a film forming surface, coating said layer of tobacco particles with a flexible film forming material having natural adhesive qualities, said material comprising a cellulose ether derivative, depositing a layer of fine tobacco particles upon the exposed wet adhesive surface of said film of cellulose ether derivative, film forming material, drying said film of cellulose ether derivative, and

removing said composite tobacco sheets and films from said surface.

17. The method defined in claim 16 wherein said film forming material is cellulose glycolic acid.

18. The method defined in claim 16 wherein said film forming material is a soluble salt of cellulose glycolic acid.

19. The method defined in claim 16 wherein said film forming material is carboxymethyl hydroxyethyl cellulose.

20. The method of forming self-supporting continuous composite sheets and films comprising applying a liquid wetting material to a film forming surface, depositing a layer of fine tobacco particles upon said wetted surface of said film forming surface, coating said layer of fine tobacco particles with a thin film of cellulose glycolic acid, said film presenting an exposed adhesive surface, depositing a layer of fine tobacco particles upon the exposed wet adhesive surface of said film of cellulose glycolic acid, and drying said film to form said self-supporting continuous composite tobacco sheets and films.

21. The method of forming self-supporting continuous composite sheets and films comprising applying a liquid wetting material to a film forming surface, depositing a layer of fine tobacco particles upon said wetted surface of said film forming surface, coating said layer of fine tobacco particles with a thin film of cellulose hydroxy glycolic acid, said film presenting an exposed adhesive surface, depositing a layer of fine tobacco particles upon the exposed wet adhesive surface of said film of cellulose hydroxy glycolic acid, and drying said film to form self-supporting continuous composite sheets and films.

22. The method of forming self-supporting continuous composite sheets and films comprising temporarily adhering a layer of fine tobacco particles upon a film forming surface, coating said layer of fine tobacco particles with a thin film of a soluble salt of cellulose glycolic acid, said film presenting an exposed adhesive surface, depositing a layer of fine tobacco particles upon the exposed wet adhesive surface of said film of a soluble salt of cellulose glycolic acid, and drying said film to form said self-supporting continuous composite sheets and films.

23. The method of forming self-supporting continuous composite sheets and films comprising temporarily adhering a layer of fine tobacco particles upon a film forming surface, coating said layer of fine tobacco particles with a thin film of a soluble salt of cellulose hydroxy glycolic acid, said film presenting an exposed adhesive surface, depositing a layer of fine tobacco particles upon the exposed wet adhesive surface of said film of a soluble salt of cellulose hydroxy glycolic acid, and drying said film to form said self-supporting continuous composite sheets and films.

24. The method of forming a self-supporting continuous composite tobacco web comprising temporarily adhering a substantially uniform layer of tobacco particles upon a film forming surface, coating said layer of fine tobacco particles with a thin layer of a naturally adhesive film forming material, depositing a substantially uniform heavy layer of fine tobacco particles upon the exposed wet adhesive surface of said film forming material to heavily load said material with tobacco particles, drying said film forming material to form said composite tobacco web, removing excess tobacco particles from the heavily tobacco particle loaded exposed surface of said web, moistening said web, dyeing said exposed surface of said moistened web, removing said web from said film forming surface, drying said web, removing excess tobacco from the other surface of said web, dyeing said last-named surface of said web, and redrying said web to complete it.

25. The method of forming a self-supporting continuous composite tobacco web comprising temporarily adhering a substantially uniform layer of tobacco particles upon a film forming surface, coating said layer of fine tobacco particles with a thin film of a dispersion containing cellulose glycolic acid, depositing a substan-

tially uniform layer of fine tobacco particles upon the exposed wet surface of said film, drying said film to form said composite tobacco web, removing excess tobacco particles from the exposed surface of said web, moistening said web, dyeing said exposed surface of said moistened web, removing said web from said film forming surface, drying said web, removing excess tobacco from the other surface of said web, dyeing said last-named surface of said web, and redrying said web.

26. The method of forming self-supporting continuous tobacco sheets and films defined in claim 11 including the step of expanding said film forming surface prior to the coating of said layer of tobacco particles on said surface with said film forming material.

27. The method defined in claim 14 including the step of expanding said film forming surface prior to the application of said dispersion of cellulose glycolic acid over said finely divided tobacco adhering to said wetted portion of said surface.

28. The method of forming self-supporting continuous composite tobacco sheets and films upon a film forming surface comprising applying a thin adhesive layer of flexible film forming material on said surface, applying a substantially uniform heavy layer of tobacco dust and particles upon the adhesive exposed surface of said film of film forming material, drying said tobacco impregnated film, expanding said film forming surface relative to said tobacco particles and layer of flexible film forming material whereby when dried, said composite tobacco films or sheets are substantially free of checks, cracks

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and voids, and removing excess tobacco dust from said composite tobacco films or sheets to complete the formation thereof.

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