May 16, 1944. F. A. IRVINE 2,348,817

BOARD FINISH APPARATUS

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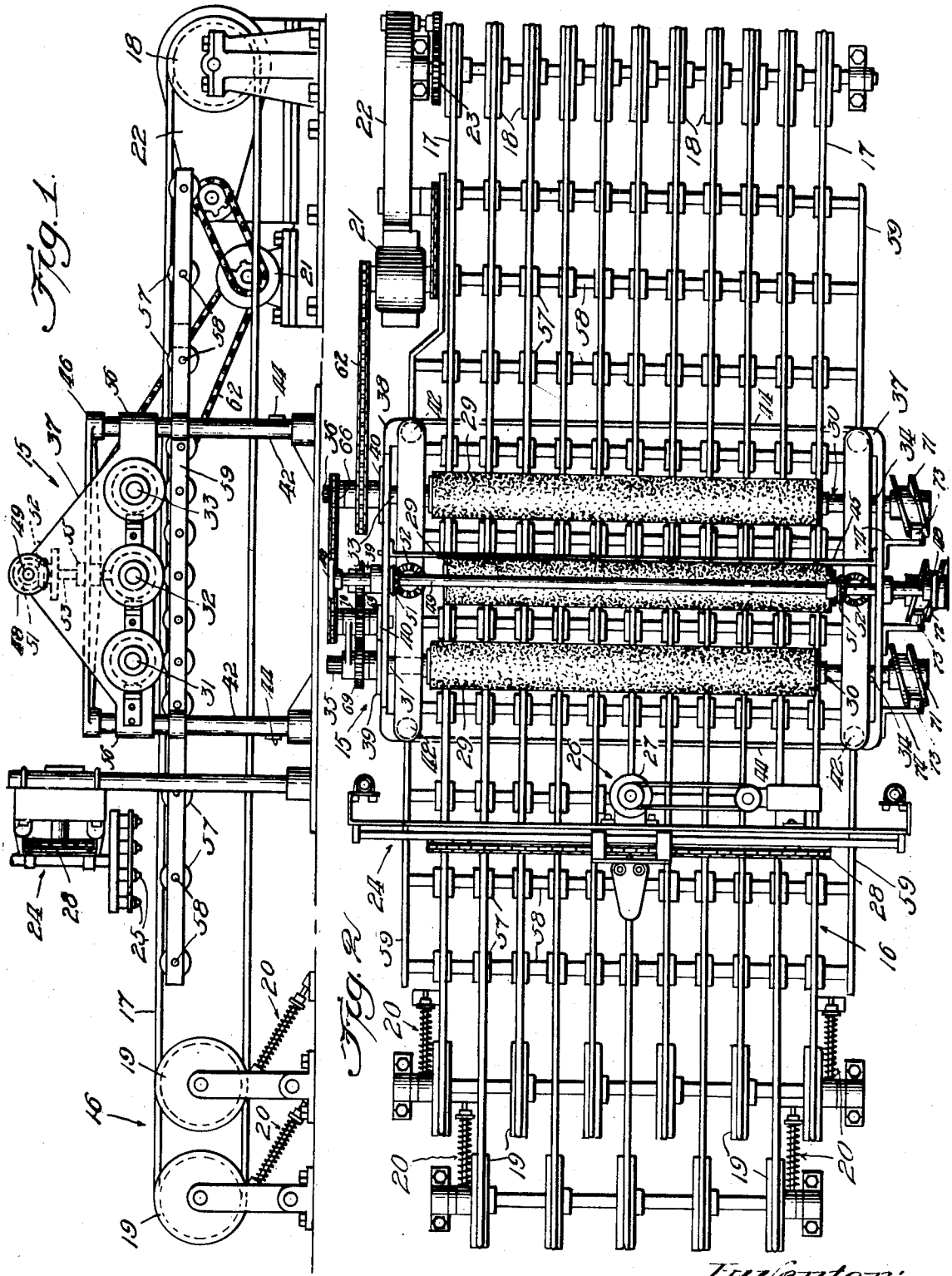


Fig. 1.

Fig. 2.

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Fig. 3.

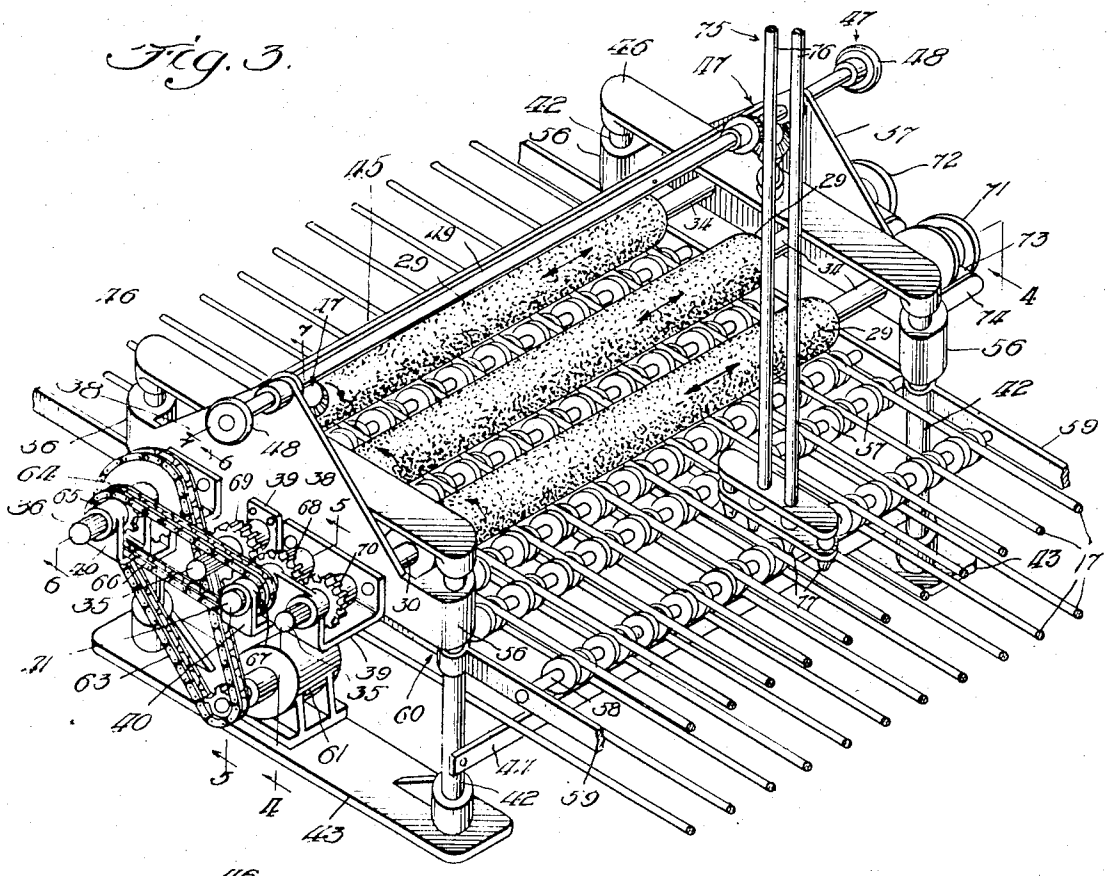


Fig. 4.

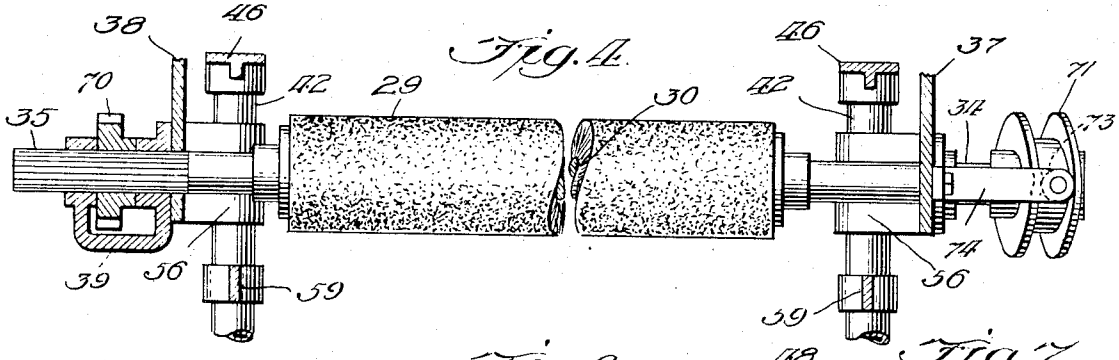


Fig. 5.

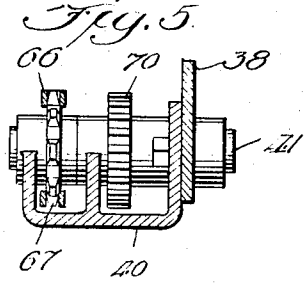


Fig. 6.

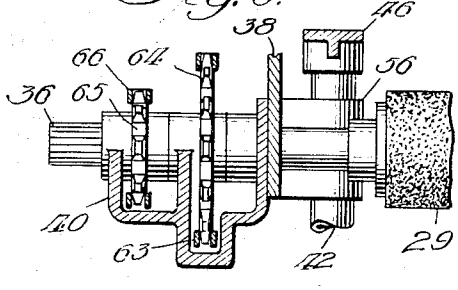
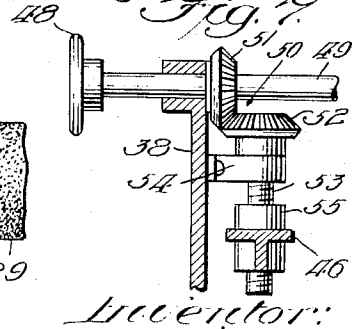


Fig. 7.



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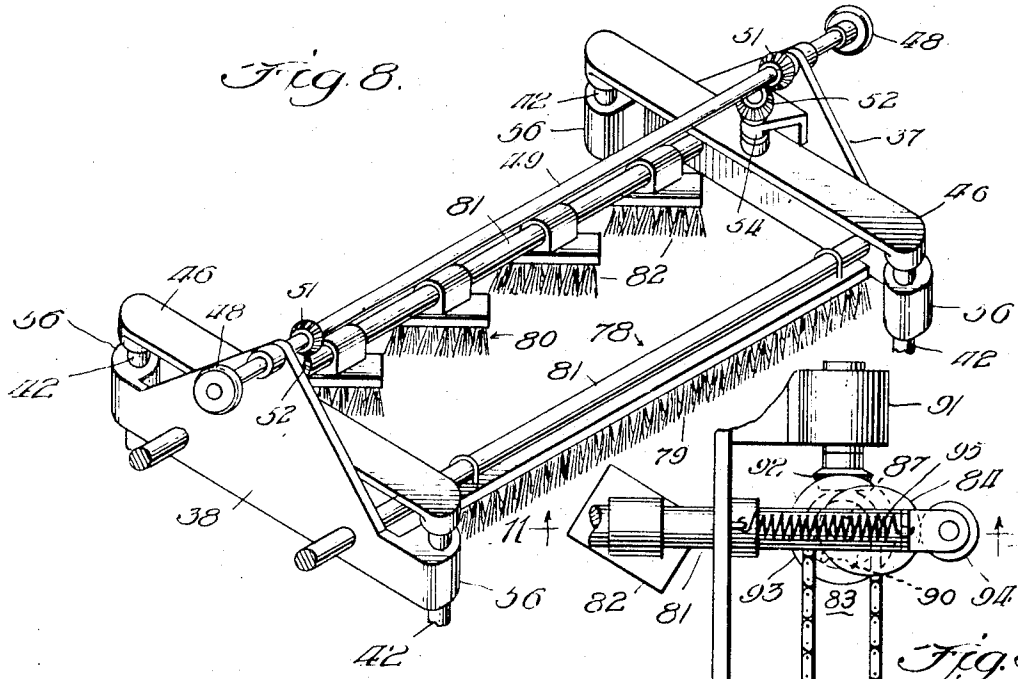
by Edwin A. Hampson, Atty.

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Fig. 8.



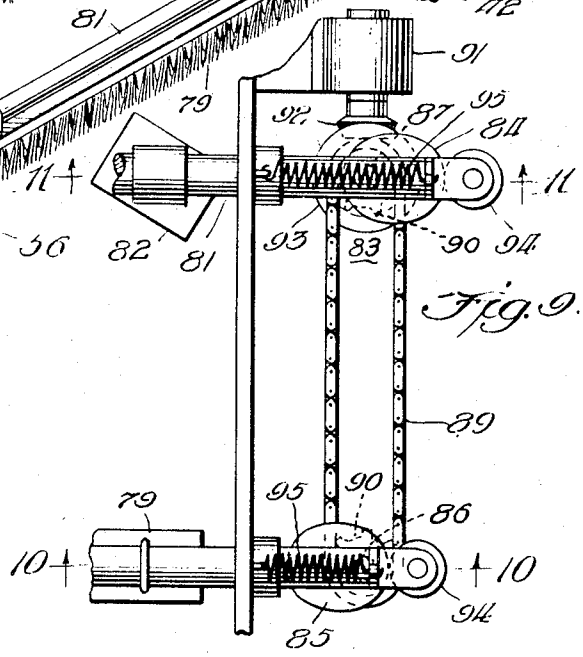


Fig. 9.

Fig. 10.

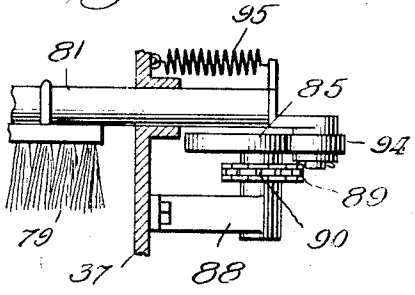
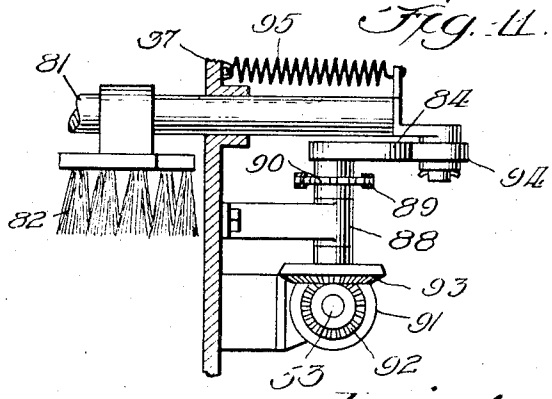


Fig. 11.



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Patented May 16, 1944 2,348,817

UNITED STATES PATENT OFFICE

2,348,817

BOARD FINISH APPARATUS

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Application February 5, 1941, Serial No. 377,412

2 Claims. (Cl. 91—25)

This invention relates to an apparatus for applying to a surface of sheet form material a uniform unstreaked surface coating, and more particularly relates to the application of a surface coating to felted fibrous structural material in board form.

It is well known that various types of apparatus have been used in the past for applying a surface coating to sheet form material, namely, apparatus such as: doctoring rolls, coating rolls, and various forms of spraying equipment, but it has been found that with such forms of coating apparatus and particularly spraying apparatus, the maximum speed of coating to obtain a smooth unstreaked coating is substantially thirty-five feet per minute.

It is, therefore, a principal object of this invention to disclose not only a novel method of obtaining a smooth unstreaked coating at high rates of surface coating but also apparatus for coating sheet form material, particularly structural sheet form material of the type known as insulation board, at a rate substantially in excess of thirty-five feet per minute and up to and even in excess of sixty-five feet per minute.

Another object of the invention is to provide a novel brushing apparatus in combination with the usual types of automatic reciprocating spray machines and also the ordinary swinging arm type of automatic spray machines to increase the rate of coating of these machines. Coating as used here and throughout the specification and claims defines a smooth unstreaked surface coating applied at a high lineal speed.

Another object of the invention is to provide a unitary type of brushing apparatus which may be readily applied to existing coating apparatus in production lines, and particularly to enable the coating apparatus to be speeded up.

Another object of the invention is to provide a brushing apparatus with a reciprocatory type of brushing motion simulating hand brushing.

Another object of the invention is to provide a brushing apparatus having a brushing motion which is a combination of reciprocatory and rotary motion.

Still another object of the invention is to provide a brushing apparatus with a brushing motion wherein there are a plurality of brushes having reciprocatory or to and fro motion in opposite directions with respect to each other.

Still a further object of the invention is to provide a novel brushing apparatus which has a brushing motion provided by a plurality of rotary brushes with some of the brushes rotating in opposite directions with respect to each other.

Still another object of the invention is to provide a brushing apparatus wherein the brushes may be adjusted vertically with respect to the surface which is to be finished and also to compensate for the wear of the brushes.

Among other objects, the invention provides a satisfactory means for manufacturing coated sheet material either continuously with the formation of the sheet material or as a separate step in its manufacture; to secure production of a uniform product; and to effect definite savings in the manufacture of coated board on an extensive commercial scale.

The foregoing objects which will be evident to those skilled in the art are obtained by the structure hereinafter described and claimed and illustrated in the accompanying drawings, wherein:

Figure 1 is a view in elevation of a preferred form of brushing apparatus applied to a conveyor type of automatic reciprocating spray machine;

Figure 2 is a plan view of the apparatus illustrated in Figure 1;

Figure 3 is a perspective view of the brushing apparatus illustrated in conjunction with the swinging arm type of automatic spraying machine;

Figure 4 is a vertical view, partly in section, along the line 4—4 of Figure 3, illustrating the cam for reciprocating a rotary brush of the brushing apparatus;

Figure 5 is a vertical view, partly in section, along the line 5—5 of Figure 3, illustrating the driving mechanism of the brushing apparatus;

Figure 6 is a vertical view, partly in section, along the line 6—6 of Figure 3, illustrating the sliding connection between a brushing roll and the driving mechanism of the brushing apparatus;

Figure 7 is a view in elevation, partly in section, along the line 7—7 of Figure 3, illustrating the adjusting mechanism for the brushes;

Figure 8 is a modification of the novel brushing apparatus which uses only a to and fro or reciprocatory brushing motion;

Figure 9 is a plan view illustrating the mechanism for actuating the reciprocatory brushes of the apparatus illustrated in Figure 8;

Figure 10 is a vertical view, partly in section, illustrating the actuating mechanism for the reciprocatory brushes, along the line 10—10, looking in the direction of the arrow of Figure 9; and,

Figure 11 is a vertical view, partly in section,

illustrating the actuating mechanism for the reciprocatory brushes, taken along the line 11—11 of Figure 9, and looking in the direction of the arrow.

The invention is illustrated in connection with a conveyor type of automatic reciprocating spray machine and also with the swinging arm type of automatic spraying machine, although it is evident that the novel form of brushing apparatus may be used in conjunction with an equivalent type of coating apparatus such as coating rolls, doctoring rolls, and the like.

Referring to Figures 1 and 2, a brushing apparatus 15 is mounted transversely with respect to the direction of travel of a continuous conveyor 16. The type of conveyor illustrated is a cable type having cables 17 driven from sheaves 18 and passing over tightening sheaves 19. The tightening sheaves 19 are adjusted by suitable take-up mechanism 20.

Although this invention is being described in connection with a cable type of conveyor, it is obvious that any other suitable form of conveyor may be used in conjunction with the spraying apparatus 15 without departing from the scope of our invention. The conveyor 16 may be suitably driven from a motor 21 by variable speed reduction apparatus 22 and driving mechanism 23 comprising suitable gearing or equivalent driving mechanism.

A preferred type of spraying apparatus used in combination with the novel brushing apparatus is an automatic reciprocating spray machine 24. The spray machine 24 is of a well known commercial type comprising a plurality of spray guns 25 which are carried back and forth across the material to be sprayed by a suitable driving mechanism 26 comprising a motor 27 and suitable chain driving mechanism 28. The mechanism of the apparatus is such that the spray guns turn on and off automatically, only spraying when they are directly over the material being sprayed. It is obvious that the spray guns may be vertically adjusted with respect to the material being sprayed.

The spraying apparatus illustrated is designed for spray coating sheet material up to and including widths of five feet as it is continuously conveyed underneath the spray guns as they are reciprocated across the surface of the sheet material. It has been found that a suitable coating may be applied with this type of spraying apparatus when the material is fed through at a rate up to and including about thirty-five feet per minute, but as production is increased and the conveyor speed up, the surface finish is unsatisfactory with streaks being left on the surface of the material from the spray guns. It is therefore, a principal object of the invention to overcome this surface streaking as the speed of the conveyor is increased, and this has been satisfactorily accomplished with the novel form of brushing apparatus 15 with the result that the conveyor may be operated up to and in excess of sixty-five feet per minute with the streak marks of the spray guns being eliminated and a smooth uniform coating applied to the surface of the large flat objects or sheets continuously conveyed underneath the brushing apparatus.

Referring to Figures 1 to 7, inclusive, the novel form of brushing apparatus 15 will be described in detail together with the method of operation thereof. The preferred form of brushing apparatus 15 preferably comprises a plurality of rotary brushes 29 of suitable material to smoothly brush out the coating which is applied to the surface of the sheet form material. It is preferred that the diameter of the roll shall be such that the bristles are sufficiently flexible and sufficiently long that the wear of the brushes may be taken up through the adjusting mechanism of the brushing apparatus without necessitating many changes of the brushing roll due to wear. The brushing rolls 29 may be made up on a suitable mandrel 30 and preferably are formed by affixing on the mandrel a plurality of brushes annularly formed. The length of the rotary brushes 29 shall be such as to be equivalent to the width of the largest sheet of material to be brushed and still to allow for reciprocatory motion of the brush transverse with respect to the direction of travel of the sheet material to simulate a natural brushing movement as the brushes are rotated. Although three rotary brushes have been illustrated, a satisfactory brushing action may be accomplished by the use of two brushing rolls or even one in some instances without departing from the scope of the invention as disclosed and claimed.

It is preferred that the rotary brushes 29 may be readily detached with their supporting mandrel 30 from their rotary and reciprocating drive shafts 31, 32, and 33 in order that the brushes may be readily replaced as they are worn without necessitating the tearing down of the entire brushing apparatus. The rotary and reciprocating drive shafts 31, 32, and 33 preferably comprise at one end cam shafts 34 and at the opposite ends, respectively, spline shafts 35 and 36. The cam shafts 34 and the two spline shafts 35 and the spline shaft 36 are suitably journaled in the end frames 37 and 38. Suitable bearing supports 39 and 40 are mounted on the end frames 38 to journal the spline shafts 35 and 36 and the stub shaft 41. The end frames 37 and 38 are slidably mounted on vertical supports 42 and the vertical supports 42 are suitably affixed and rigidly supported by base members 43. The frame for the brushing apparatus is simply formed by the vertical supports 42 and the base members 43 in connection with the end frames 37 and 38, and these end frames may be suitably spaced apart by transverse braces 44 and 45, the transverse brace 44 being affixed to the vertical supports 42 and the transverse brace 45 being affixed to the end frames 37 and 38. The vertical supports 42 for each of the end frames are longitudinally spaced by the bottom base members 43 and top cross members 46.

Vertical adjustment of the brushing rolls 29 to provide for variation in thickness of the material being brushed, as well as to provide for adjustment necessary because of the wear of the brushes, is accomplished by a novel adjusting mechanism. With the adjusting mechanism 47, the brushing rolls may be simultaneously vertically adjusted from either side of the apparatus by hand wheels 48 secured to a transverse adjusting shaft 49 journaled in the end frames 37 and 38. The adjusting shaft 49 actuates bevelled gearing 50 mounted on the end frames 37 and 38. The bevelled gearing comprises bevel gears 51 and 52 which are respectively affixed to the adjusting shaft 49 and adjusting screws 53. The adjusting screws 53 are suitably journaled as at 54 by bearings affixed to the end frames and adjustably attached to the top cross members 46 by a suitably threaded nut 55 affixed thereto to provide for vertical adjustment of the end frames 37 and 38, supporting the

rotary brushes 29, with respect to the vertical supports 42 of the brushing apparatus. It is obvious that as the hand wheels are rotated clockwise or counter-clockwise, the brushes 29 are raised or lowered with respect to the surface of the conveyor to compensate for wear of the brushes and the thickness of the material being conveyed and coated.

It is, therefore, obvious that a simple form of adjusting mechanism 47 has been provided as the end frames are slidably mounted on the vertical supports 42 by the housings 56, and the latter are sufficiently long that the vertical adjustment of the brushes is the same in the direction of travel of the conveyed material as well as transverse with respect thereto so that the brushes, as they rotate and reciprocate, uniformly brush the surface of the sheet material, leaving the surface unstreaked.

In order to support the cables of the conveyor and to provide a level surface underneath the brushes, grooved rollers 57 are suitably mounted on transverse supporting rods 58 which are supported by longitudinal supporting members 59 adjustably affixed to the vertical supports 42. It is obvious that this supporting frame 60 may be raised or lowered to level the surface of the conveyor with respect to the brushing rollers, and although a supporting frame has been described having grooved rollers which rotate as the cables are actuated, it is obvious that any suitable type of supporting frame may be used to support the sheet form material in a level position, and that the type of supporting frame merely depends on the type of conveyor used.

A novel brushing motion is provided by combining a rotary and reciprocating motion of each of the brushes, and in addition to the rotary and reciprocating motion of the brushes, the reciprocatory motion of the brushes is such that each of the brushes reciprocates in opposite directions with respect to each other, thus simulating the effect of hand brushing such as would be accomplished manually by the use of many hands as the sheet material is conveyed underneath the brushing rollers. The speed of rotation of the brushes and rate of reciprocation thereof shall be such that a uniform unstreaked surface coating is formed as the material is conveyed and the coating applied. The brushing apparatus may be either individually driven by a motor 61, as illustrated in Figure 3, or driven from the same motor 21 which drives the conveyor, as illustrated in Figure 2. The mechanism has been illustrated using driving chains 62 or 63 driving a sprocket 64. It may be desired to use either a variable speed motor 21 or 61 depending upon whether or not it is necessary to vary the speed of the brushes or to reciprocate them at a constant rate.

Referring to Figures 3 and 6, the driving sprocket 64 is slidably affixed to the spline shaft 36 to provide for a reciprocatory motion of the shaft 36 as the brush 29 which is connected thereto reciprocates transversely with respect to the material as it is conveyed. The other rolls 29 are driven from the shaft 36 by a similar sprocket 65 suitably splined to allow for the reciprocation of the shaft 36, and the sprocket 65 is connected to the stub drive shaft 41 by a chain 66 and sprocket 67. It is obvious that by the use of different sized sprockets the relative speeds of the rotary brushes may be changed or with suitably selected sprockets, the brushes may be driven at the same rate depending upon the particular type of surface finish desired. The stub drive shaft 41, being affixed to the intermediate gear 68, suitably actuates spur gears 69 and 70 to drive the remaining rolls 29 of the brushing machine. It is obvious that other suitable driving mechanism may be used for actuating the rolls 29 to rotate them without departing from the scope of the invention, and for the purpose of illustration, the simplest form of driving mechanism has been illustrated and described. It is also obvious that other suitable modifications may be made in the driving mechanism to rotate the rotary brushes in the same directions either counter to the motion of the material being conveyed or in the same direction thereof, or suitable mechanism may be provided to rotate the brushes in the direction illustrated or in other suitable directions without departing from the scope of the invention.

In order to provide the necessary reciprocatory motion to the brushes as they are rotated, a novel mechanism is provided comprising the cam shafts 34 and the cams 71 and 72. To provide the reciprocatory motion as illustrated in Figure 2, the cylinder cams 71 are cut in the same direction, while the cam 72 is cut in an opposite direction. To transform the rotary motion of the brushes into a combined rotary and reciprocatory motion, the rotary cams 71 and 72 are actuated by the stationary rollers 73 suitably mounted on a fixed bracket 74 affixed to the end frame 37. It is, therefore, obvious that as the brushes are rotated, a reciprocatory motion is imparted to the brushes through the co-action of the cams 71 and 72 and the fixed position of the rollers 73. The direction of reciprocation of the rotary brushes 29, as illustrated in Figure 2, is preferred although it is obvious that different motions may be imparted to the brushes by changing the cams; and by disconnecting the cams, the brushes, if necessary, may rotate without reciprocation.

The novel brushing apparatus 15 which has just been described was primarily described with reference to an automatic reciprocating spray machine, but it is to be understood that it is equally as suitable for use with a swinging arm type of automatic spraying machine as spraying machine 75, illustrated in Figure 3, wherein only the lower portion of the pendulum arm 76 of the apparatus has been illustrated. The pendulum or swinging arm 76 supports spray nozzles 77 for spraying the surface of the conveyed sheet material. The novel brushing apparatus is perhaps better suited for providing a smooth unstreaked surface coating with this type of apparatus because with this type of apparatus the spray guns move over the object which is being sprayed with a variable speed thus leaving the spray marks more readily discernible than with the automatic reciprocating type of spray machine. However, by using the novel form of brushing apparatus disclosed above in combination with either of the above types of spraying apparatus or with coating rolls, or other coating apparatus, a more satisfactory and better surface finish is applied to a surface of an object being sprayed or otherwise coated, particularly large flat objects which are being sprayed or surface coated on a conveyor.

A suitable but yet more simple form of brushing apparatus is illustrated in Figure 8 of the drawings, and the illustration particularly disclosing a brushing apparatus comprising a plurality of reciprocating rods carrying brushes moving transversely with respect to the direction of the conveyed material being surface coated. This modification will only be described with reference to the mechanism for reciprocating the

reciprocatory brushes as the details of the construction of the framework for the brushing apparatus are substantially the same as those disclosed with reference to the preferred embodiment illustrated in Figure 3; and therefore, like reference characters will denote similar parts. The modified brushing apparatus 78 preferably comprises a plurality of reciprocating brushes 79 and 80 supported by the reciprocating bars or rods 81. The reciprocating brush 79 has been illustrated as a single transverse brush while the reciprocating brush 80 has been illustrated as being formed by a plurality of individual brushes 82 mounted at an angle to the direction of travel of the conveyed material being coated and brushed. Although for the purpose of illustration the reciprocating brushes 79 and 80 have been illustrated as being formed differently, it is obvious that both reciprocating brushes may be formed as the brush 79 or as the brush 80 without departing from the scope of the invention. It is believed, however, that the arrangement, as illustrated in Figure 8, provides a more satisfactory mechanism for smoothing out a coating applied to a surface of sheet material to leave the surface of the material in a smooth and unstreaked condition. The brushes 79 and 80 may be individually adjusted vertically to compensate for the wear thereof.

It is preferred that the overall length of the brushes 79 and 80 shall be such that they extend entirely across the width of the material being coated and that the distance between the end frames shall be such, however, that reciprocatory motion of the brushes may be had with the brushes reciprocating in opposite directions with respect to each other. It is also preferred that the brush 80 shall have the individual brushes 82 mounted in an overlapping condition so that each brush overlaps the other so that if the first brush is not being operated, the surface of the material may be brushed across the width thereof without reciprocating the brush 80.

It is obvious that the mechanism necessary for providing the brushes 79 and 80 with the reciprocatory motion should be simpler than the apparatus necessary to provide the combined reciprocatory and rotary motion of the brushing apparatus disclosed and illustrated with respect to Figure 3. The reciprocating bars or rods 81 supporting the brushes 79 and 80 are suitably journaled in the end frames 37 and 38 in order that the bars may be reciprocated by the actuating mechanism 83.

Referring to Figures 9, 10, and 11, the preferred actuating mechanism comprises cams 84 and 85 similarly formed but timed preferably 180° out of phase so that as one brush is moving in one direction the other brush is moving in an opposite direction. The cams 84 and 85 are affixed to shafts 86 and 87 journaled in supporting bearings 88 mounted on the end frame 37. The cam shafts 86 and 87 are suitably connected together by a drive chain 89 and sprockets 90. It is to be understood that if it is desired to reciprocate one brush relatively faster than the other this may be suitably accomplished by changing the size of sprockets driving the cam shafts. It is preferred that the rate of reciprocation of the brushes shall be such that a uniform unstreaked surface coating is formed as the material is conveyed and the coating applied.

The combined cam shaft and drive shaft 87 may be driven by the bevelled gears 92 and 93 from a variable speed motor 91, suitably mounted on the end frame 37, the bevel gear 93 being suitably affixed to the combined drive and cam shaft 87. The variable speed motor 91 or a constant speed motor may be used depending upon whether or not it is necessary to vary the speed of the brushes or to reciprocate them at a constant rate. It is evident that, as the cam shafts 86 and 87 are rotated, the cams 84 and 85 in turn reciprocate the reciprocating bars 81 supporting the brushes 79 and 80 by means of the cam shaft rollers 94 affixed to the rods 89 and held in contact with the cams 84 and 85 by the springs 95 affixed to the reciprocating bars 81 and to the end frame 37. It is also obvious that, as these cams are rotated, the reciprocating bars 81 are simultaneously reciprocated in opposite directions with respect to each other, thus imparting a suitable brushing action to the brushes 79 and 80 to smooth out any streaks which might be formed by the overlapping of the spray marks left by the automatic reciprocating type of spray machine or the swinging arm type of spray machine, and this form of brushing apparatus is equally as satisfactory for providing a smooth and unstreaked surface coating when used in combination with various coating apparatus such as coating rolls, doctoring rolls, doctoring blades, or other suitable form of apparatus for spraying or showering or otherwise applying a coating on a surface of material as it is conveyed underneath a suitable coating apparatus.

Although these novel forms of brushing apparatus have been primarily developed for brushing a coating applied to felted fiber insulation boards in sheet form, and preferably sheets up to and including widths of 5' and lengths up to 12', it is evident that these brushing apparatus may be used for brushing continuous sheets of material in thin or thick sheet form and the brushing apparatus may be provided in suitable widths as may be required.

Although it is preferred to use these forms of brushing apparatus in connection with coatings comprising a pigment and an adhesive vehicle for the pigment, it is evident that this apparatus is suitable for any type of coating which may be showered on the surface of the sheet form material or sprayed thereon or roller coated thereon and these types of coatings may be of the class of coatings comprising casein types of paint, oil base paints, lacquers, varnishes and the like without departing from the scope of the invention as disclosed and claimed.

It is evident that there has been disclosed a simple form of brushing apparatus and a modification thereof to be used in combination with coating apparatus of any particular type but preferably spraying apparatus of the types known as automatic reciprocating spraying machines and automatic swinging arm type of spraying machines wherein the rate of coating may be increased from about 35' per minute up to and in excess of about 65' per minute without detracting from the appearance of the finished surface coating and providing an improved unstreaked surface finish obliterating the streaks ordinarily occurring in coating at high speed with ordinary apparatus or left by the overlapping spray marks of the usual spraying apparatus without the novel forms of brushing apparatus disclosed. It is also obvious that this novel form of brushing apparatus is suitable for brushing an applied coating on either single

sheets or continuous sheets of material of different thickness, and they may vary in thickness from material the thickness of paper to structural board like material in thicknesses up to and in excess of 1", or other forms of large flat objects to which it is desired to apply a smooth and uniform unstreaked surface coating. It is also apparent that apparatus has been disclosed which may be fabricated as a single apparatus or used in conjunction with a continuous type of conveyor which preferably has a translational movement or with any suitable conveyor apparatus which carries material being coated without departing from the scope of the invention as disclosed and claimed.

Suitable modifications have also been disclosed providing novel apparatus for providing not only a reciprocatory motion to the brushes, but also for providing a combined rotary and reciprocatory motion, as may be more suitable for use with the particular coating material being used. There has also been disclosed preferred mechanism for actuating the brushes to provide the reciprocatory or the combined reciprocatory and rotary motion and there has also been disclosed a simple form of mechanism for vertically adjusting the brushing apparatus with respect to the material and the conveyor to provide for changes in thickness of the material and to also provide for adjustment of the wear of the brushes.

The preferred embodiments of the invention described are also capable of certain other modifications without departure from the scope of the invention to be defined in the following claims.

What is claimed is:

1. In an apparatus for applying a surfacing coating to fiber insulation board and the like, the combination of a longitudinally extending framework, a conveyor for conveying sheet form material along the framework, a spraying device mounted over the framework and conveyor thereon and serving to apply a substantially uniform paint-like coating to the surface of a fiber insulation board carried by the conveyor and a coating distributing and smoothing device mounted over the conveyor but longitudinally spaced from the spraying device and having a plurality of distributing and smoothing members carried thereby, the such members extending across the width of a sheet, mechanism connected to the members for imparting limited reciprocation thereto and the reciprocation, imparted to a such member, out of step with the reciprocation of another of such members.

2. In an apparatus for applying a surfacing coating to fiber insulation board and the like, the combination of a longitudinally extending framework, a conveyor for conveying sheet form material along the framework, a spraying device mounted over the framework and conveyor thereon, means traversing the spraying device transversely of the direction of travel of the conveyor and serving to apply a substantially uniform paint-like coating to the surface of a fiber insulation board carried by the conveyor and a coating distributing and smoothing device mounted over the conveyor but longitudinally spaced from the spraying device and having a plurality of distributing and smoothing members carried thereby, the such members extending across the width of a sheet carried by the conveyor, the distributing and smoothing members mounted for rotation and limited transitional motion in the axial direction thereof, mechanism connected to the rotating and reciprocating members and rotating the such members and imparting thereto limited transitional movement in the direction of the axis of such members, the transitional movement imparted to a such member opposed in phase to that of another of such member.

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