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MANUFACTURE OF REFINED PARAFFIN WAX

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This invention relates to the manufacture of refined paraffin wax, and more particularly to the manufacture of refined paraffin wax from de-oiled slack wax by distillation.

In the present practice of manufacture of various grades of paraffin wax from de-oiled slack wax, the low-melting grades obtained contain large amounts of valuable high-melting components, and conversely, much low-melting wax is lost, not to be recovered in the manufacture of the high-melting grades. Ideally, distillation would be effective in preparing different melting-point grades, if the consequent harmful reduction of tensile strength and poor anti-scuff characteristics and gloss could be avoided, but as is well known, close-cut distillate waxes are poor in these properties. Consequently, distillation has not hitherto been commonly used commercially for preparing different melting-point grades of paraffin wax.

It is an object of this invention to produce a greater quantity of marketable wax from de-oiled wax than can be obtained by present methods.

A further object of this invention is the use of a distillation process for separating wax into different melting-point grades.

These and other objects are accomplished by the present invention wherein we provide a paraffin wax composition comprising the combined distillates from de-oiled wax, said distillates being combined in such manner that at least two are separated in order of volatility by at least one not included in the combined distillates. By distilling a de-oiled slack wax into at least three fractions, and combining at least two of the fractions so that they are separated in order of volatility by at least one fraction not included in the combination, we obtain paraffin waxes of different melting-point grades, while still obtaining products of markedly improved tensile strength and other desirable properties. Or, we may combine these fractions in such manner that each combination in turn is characterized by the omission of at least one fraction intermediate to that combination. Stated in another way, our invention comprises the non-consecutive blending of distillate fractions of a paraffin wax to obtain markedly improved paraffin wax compositions.

Our invention does not apply to waxes in general, such as carnauba wax or beeswax, but only to paraffin wax, and primarily to de-oiled wax, such as de-oiled slack wax.

A requirement of the initial wax is that it

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should consist of components of rather wide melting-point range. A suitable wax may be prepared in the refinery by the usual operations of filter pressing the wax distillate and sweating the slack wax obtained, or by any other process known in the art. It is necessary to have a thoroughly de-oiled starting material since the oil in the charge has the same boiling range as the wax, and if not removed will distribute itself throughout the wax fractions and blends. Then, each fraction or blend would require a separate de-oiling. It is preferred that the wax charge have an oil content of less than approximately 1 per cent.

As referred to above, our invention comprises distillation of a de-oiled wax into at least three fractions, and the combination of at least two of these fractions in such a manner that at least two of the fractions are separated in the order of volatility, by at least one fraction not included in the combination. Take for example a starting material which is distilled into ten fractions. Then if fractions 1, 2, 3, 4 and 6 are combined, omitting fraction 5, a high tensile strength, low melting point wax will result. The combining of cuts 5, 7, 8, 9 and 10, which are also non-consecutive, omitting cut 6, will result in a product with considerably improved tensile strength. But the straight, consecutive blending of these cuts, such as the combining of cuts 1, 2, 3, 4 and 5 results in a markedly inferior product.

Thus, a 122°–125° F. A. M. P. refined wax, which was prepared in the refinery by filter-pressing wax distillate and sweating the slack wax obtained, was distilled into ten equal fractions and several blends were made. The results of this distillation, and data on the various products and comparative data on blends are shown in Table 1. The tensile strength data were obtained on samples having a square cross section, ¼ inch per side.

TABLE 1

Data for the blends

Blend No.	Cuts Used	Tensile Strength (Lbs. Pull at 70° F.)	Melting Point, °F.
1	2, 3, 4, 5	9	116.8
2	1, 2, 3, 5, 7	26	117.1
3	2, 3, 5, 7	37	119.7
4	2, 3, 6, 7	42	120.9
5	4, 5, 8, 9, 10	85	131.0
6	4, 6, 8, 9, 10	85	132.6

Data for the individual fractions

Wax Fraction Number	Tensile Strength (Lbs. Pull at 70° F.)	Melting Point, °F.
1	1	102.9
2	8	110.7
3	14	115.0
4	19	118.9
5	21	123.8
6	36	127.8
7	59	131.2
8	42	135.7
9	53	139.6
10	58	142.2
Original Wax	53	124.0

It will be noted that a consecutive blend of four fractions, such as cuts 2, 3, 4 and 5, results in a product with a tensile strength of 9 pounds; whereas if four fractions are combined in a non-consecutive manner, such as cuts 2, 3, 5 and 7, omitting cuts 4 and 6, the resulting product has a tensile strength of 37 pounds.

If fraction 1 is discarded, since it appears to be of little value as a wax, and the remaining fractions comprising 90 per cent of the total are blended, the novel and advantageous features of our invention become readily apparent. Cuts 2, 3, 4 and 5, which, when combined consecutively, have a tensile strength of 9 pounds and a melting point of 116.8° F., would probably be marketable only as a very cheap grade of wax, such as might be used for coating the tips of match sticks. Cuts 6, 7, 8, 9 and 10 if also combined consecutively would have a tensile strength of approximately 40 pounds or less. Thus, only 50 per cent of the wax charge is convertible into a good grade of marketable wax. If, by contrast, we make a product by combining cuts 2, 3, 6 and 7 in accordance with our invention, it has a tensile strength of 42 and a melting point of 120.9° F. and has good marketable value. When the remaining cuts 4, 5, 8, 9 and 10 are also combined the combination has a tensile strength of 85 and a melting point of 131° F. Thus, by non-consecutive blending, 90 per cent of the original wax can be converted into desirable products. This is to be contrasted with the 50 per cent of desirable products obtained by the method of consecutive blending.

Furthermore, it should be noted that when fractions of different tensile strength and melting points are blended non-consecutively in accordance with our invention, the tensile strength of the non-consecutive blend is greater than the arithmetic mean tensile strength calculated from the values of the components; but the melting point of such a blend is close to the arithmetic mean of the components. As the spread in melting point and tensile strength of the individual components of the blend is increased, the amount of increase in tensile strength of the blend over the arithmetic mean calculated tensile strength becomes greater. In other words, in non-consecutive blends prepared from wide-cut fractions, a greater increase in tensile strength is obtained than in non-consecutive blends prepared from close-cut fractions. Furthermore, the tensile strength of a blend prepared in accordance with our invention and having a given melting point, is always greater than the tensile strength of an individual component of the blend or a consecutive blend having the same melting point.

The results of the distillation of a second batch

of 122°–125° F. A. M. P. refined wax are shown below in Table 2.

TABLE 2

Data for the individual fractions

Fraction No.	Tensile Strength (Lbs. Pull at 70° F.)
1	3
2	12
3	17
4	22
5	28
6	33
7	31
8	35
9	60
10	67

Data for the blends

Blend No.	Fractions Used To Make Blend	Tensile Strength (Lbs. Pull at 70° F.)
1	3, 5	23.3
2	3, 4, 5	18.5
3	2, 3, 4, 5	15.2
4	4, 6, 8, 9, 10	81.9

It will be noted in Table 2 that blend No. 1, which has fraction 4 omitted, is considerably increased in tensile strength thereby.

In accordance with our invention, it is practicable to combine non-consecutively products of a single distillation; or to combine non-consecutively fractions from various distillations; or to store various fractions, having them available for use in making products with specific requirements. By these practices, fractions or portions of fractions may be combined non-consecutively at once, or stored until needed. As will be obvious to those skilled in the art, the various fractions can be combined in accordance with our invention to yield products having desired characteristics such as melting point, tensile strength, penetration, and the like.

In commercial practice, it is considered advisable to distill a de-oiled slack wax into fewer fractions than ten, such as four, in which case the first and third fractions are combined to yield one grade of valuable paraffin wax, and the second and fourth fractions combined to yield the other grade. In this way there are produced two non-consecutively blended waxes of marketable specifications.

In some cases, the first portion of the distilled product may have an exceedingly low melting point. Such exceedingly low melting point product is preferably discarded. This is illustrated in the manufacture of two grades of valuable paraffin wax from de-oiled slack wax, whereby the slack wax is distilled into five fractions, the lightest fraction is discarded, and the second and fourth fractions are combined to yield one valuable grade of wax, the third and fifth fractions to yield the other grade.

An outstanding advantage of our invention resides in the fact that it enables the use of a distillation process for the manufacture of excellent grades of paraffin wax. The distillation process is convenient, desirable and economical for separating wax into different melting-point grades. Prior to our invention, the advantages of large-scale distillation of paraffin wax into various melting-point grades was recognized, but could not be practiced due to the large propor-

tion of distillate which was not useful or marketable. Much of the material was unmarketable because it did not have satisfactory tensile strength. Our invention, by its use of blending, advantageously converts these unmarketable products into marketable ones. Thus, if the paraffin wax is distilled, and the products are blended by ordinary methods, only 50% of the products are marketable. On the other hand, by our discovery, the percentage of marketable products is boosted to 90%—almost doubled. By use of our invention, practically all of the products of the distillation are marketable.

The results of our invention are both unobvious and unexpected. When combining wax fractions, the properties of the combinations would be expected to be a composite of those of the individual fractions. It is surprising therefore that when the fractions are combined in accordance with our invention, products are obtained with tensile strengths which are not a composite, and not an arithmetic average, but which are markedly higher. Not only is the increase in tensile strength obtained unobvious and unexpected, but it could also not be predicted that marketability and usefulness of the products would be enhanced.

What we claim is:

1. A paraffin wax composition of improved tensile strength comprising a blend of distillate fractions from de-oiled wax, said blend containing at least two distillate fractions separated in order of volatility by at least one distillate fraction not included in the blend, said blend having a higher tensile strength for its melting point than either an individual fraction of the same melting point or a consecutive blend of the same melting point.

2. A paraffin wax composition of improved tensile strength comprising a blend of distillate fractions from at least three distillate fractions of de-oiled wax, said blend containing at least two distillate fractions separated in order of volatility by at least one distillate fraction not included in the blend, said blend having a higher tensile strength for its melting point than either an individual fraction of the same melting point or a consecutive blend of the same melting point.

3. A paraffin wax composition of improved tensile strength comprising a blend of distillate fractions from four distillate fractions of de-oiled wax, said blend containing at least two distillate fractions separated in order of volatility by at least one distillate fraction not included in the blend, said blend having a higher tensile strength for its melting point than either an individual fraction of the same melting point or a consecutive blend of the same melting point.

4. In the manufacture of refined paraffin wax from de-oiled wax by distillation, the process which comprises distilling a de-oiled slack wax into at least three fractions having different tensile strength characteristics, and combining at least two fractions in such manner that at least two of the combined fractions are separated in the order of volatility by at least one fraction not included in the combined fractions to produce a product having a higher tensile strength for its melting point than either an individual fraction of the same melting point or a consecutive blend of the same melting point.

5. In the manufacture of two grades of valuable paraffin wax from de-oiled wax by distillation, the process which comprises distilling a de-oiled wax into four fractions having different tensile strength characteristics, and combining the first and third to yield one grade, and the second and fourth to yield the other grade, said grades having higher tensile strengths for their melting points than either individual fractions of the same melting points or a consecutive blend of the same melting points.

6. In the manufacture of two grades of valuable paraffin wax from de-oiled slack wax by distillation, the process which comprises distilling a de-oiled slack wax into five fractions having different tensile strength characteristics, discarding the lightest fraction and combining the second and fourth to yield one grade, and the third and fifth to yield the other grade, said grades having higher tensile strengths for their melting points than either individual fractions of the same melting points or a consecutive blend of the same melting points.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,937,518	Henderson et al.	Dec. 5, 1933
2,157,625	Page	May 9, 1939
2,348,689	Abrams et al.	May 9, 1944
2,361,582	Wade et al.	Oct. 31, 1944
2,373,634	Wagner	Apr. 10, 1945
2,399,521	Tyler	Apr. 30, 1946