United States Patent [19]

Gallanis et al.

[11] **3,794,050**

[45] **Feb. 26, 1974**

[54] **POWER DRIVEN HAIR COMBING APPLIANCE**

[75] Inventors: **George P. Gallanis**, Westchester; **Ikuo I. Komatsu**, Glen Ellyn, both of Ill.

[73] Assignee: **Sunbeam Corporation**, Chicago, Ill.

[22] Filed: **May 8, 1972**

[21] Appl. No.: **251,748**

[52] **U.S. Cl.** ..... **132/11 A**

[51] **Int. Cl.** **A45d 24/00**

[58] **Field of Search** ... 132/11 A, 9, 139, 142, 34 R, 132/11 R; 310/15; 128/32; 74/574

[56] **References Cited**

UNITED STATES PATENTS

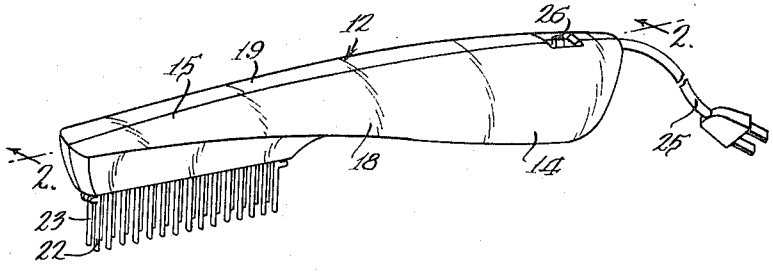
3,272,023	9/1966	Ferguson et al.	74/55
1,357,031	10/1920	Daugherty	132/11 A
3,204,469	9/1965	Spillers	132/11 R
1,523,461	1/1925	Swan	132/11 A

Primary Examiner—Louis G. Mancene
Assistant Examiner—Gregory E. McNeill
Attorney, Agent, or Firm—George R. Clark; Neil M. Rose; John S. Pacocha

[57] **ABSTRACT**

Apparatus for untangling hair including a pair of closely spaced comb members which are reciprocated in an out of phase relationship to create wave motion in hair for the purpose of untangling it. The combs are detachably mounted with respect to the reciprocating mechanism and are simple, molded plastic elements having guiding and supporting portions which detachably secure to the reciprocating mechanism. The teeth of the combs being thickened to prevent oscillation or vibration and to permit the delivery of substantial amounts of power in moving or flexing the locks of hair by the reciprocating mechanism.

18 Claims, 24 Drawing Figures



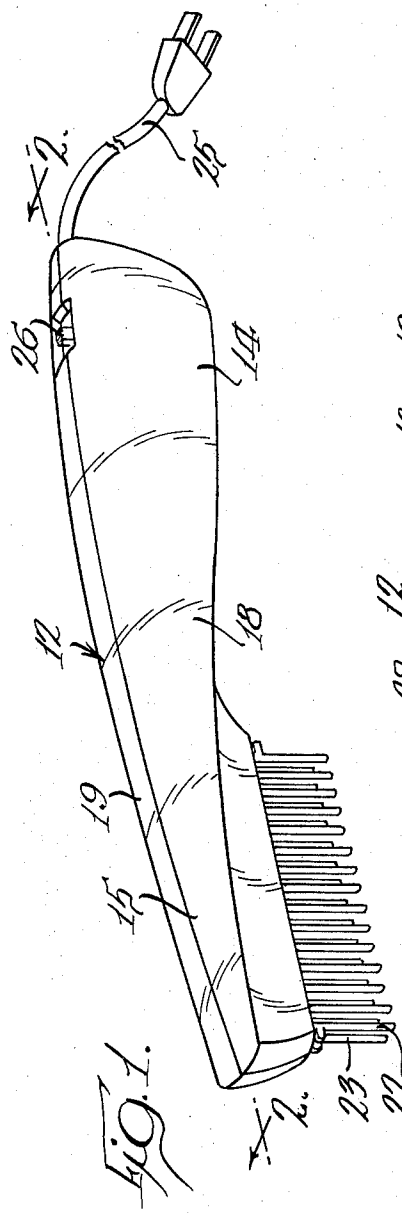


FIG. 1.

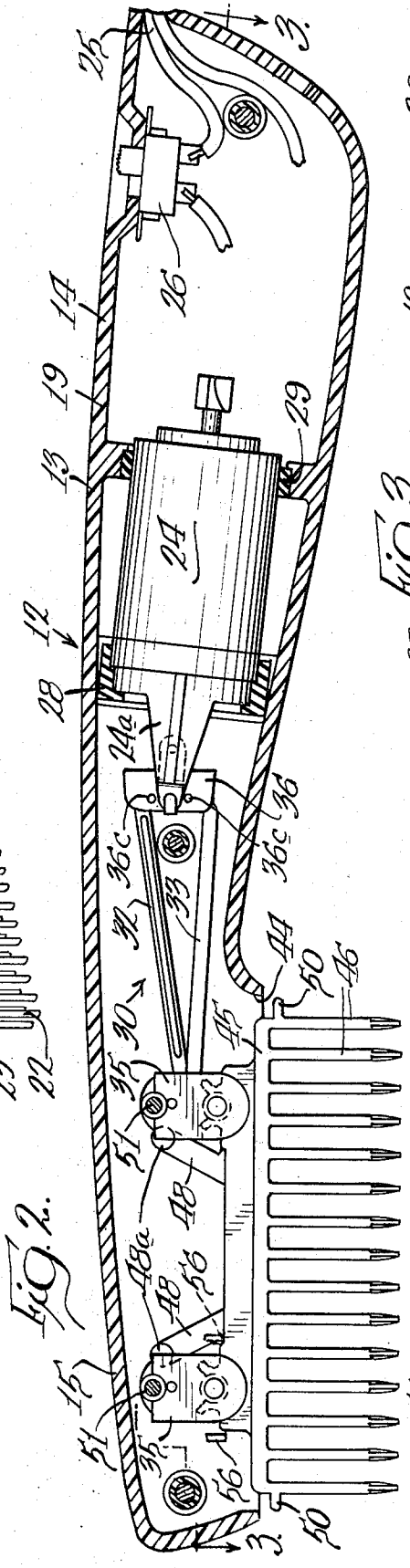


FIG. 2.

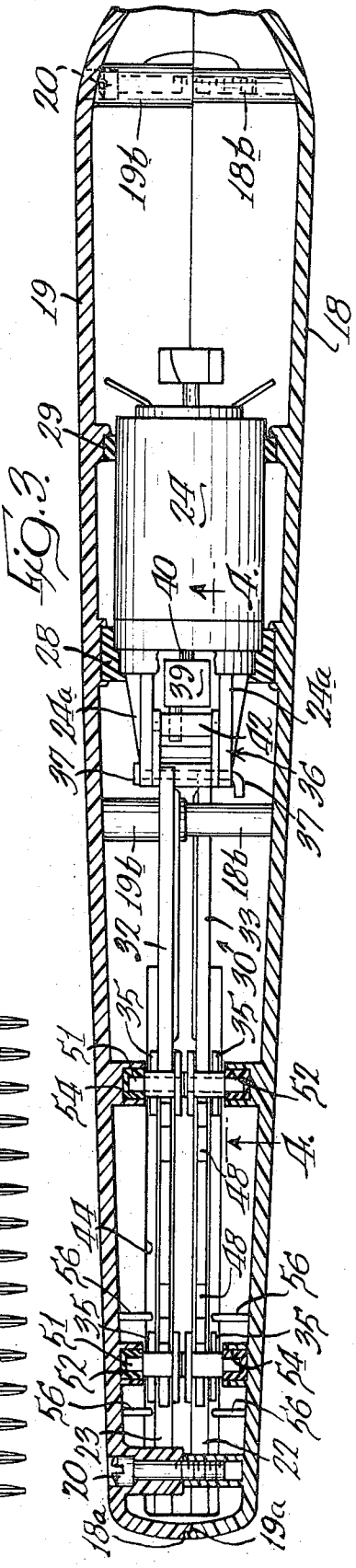


FIG. 3.

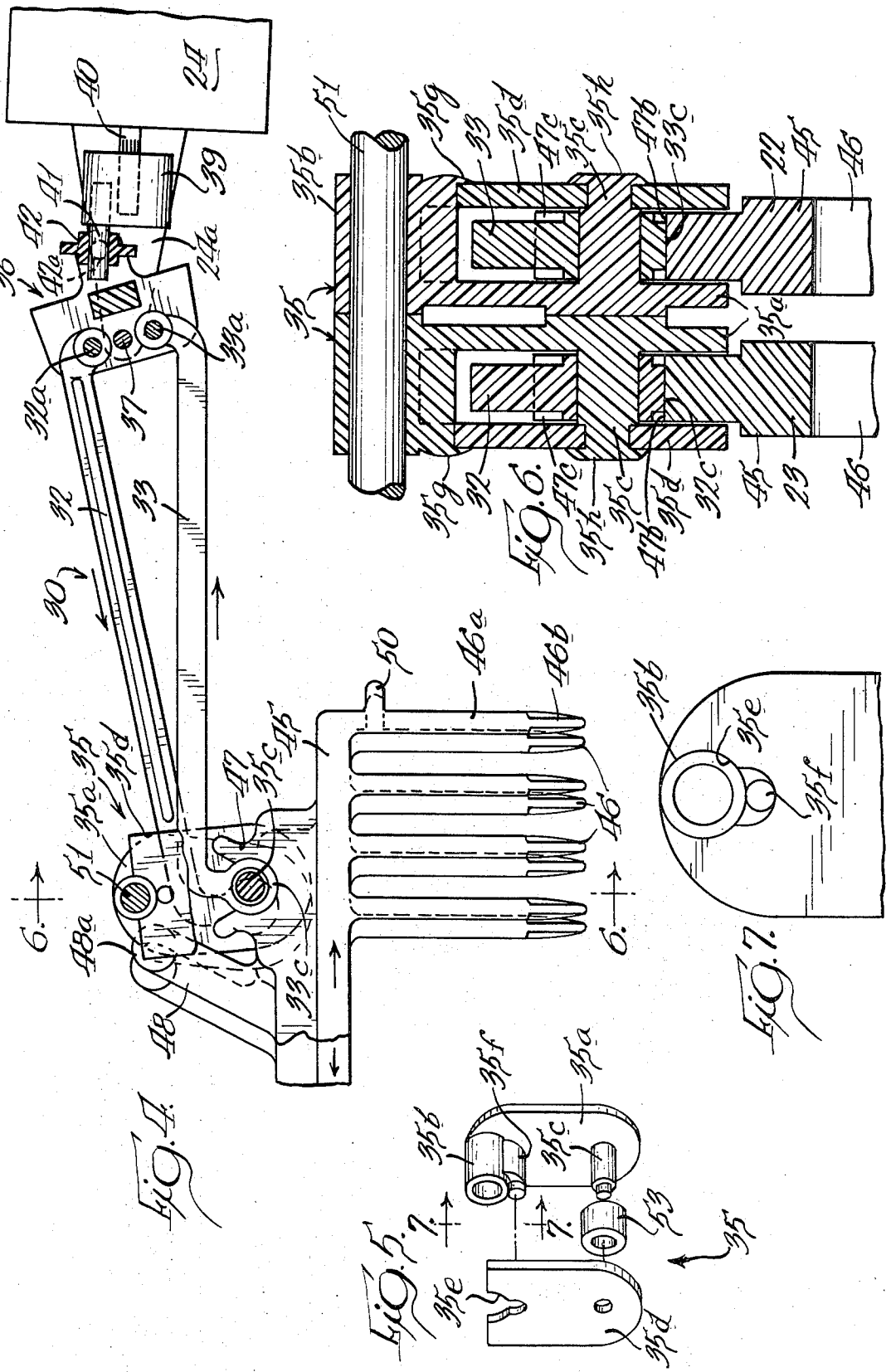


Fig. 4.

Fig. 6.

Fig. 7.

Fig. 5.

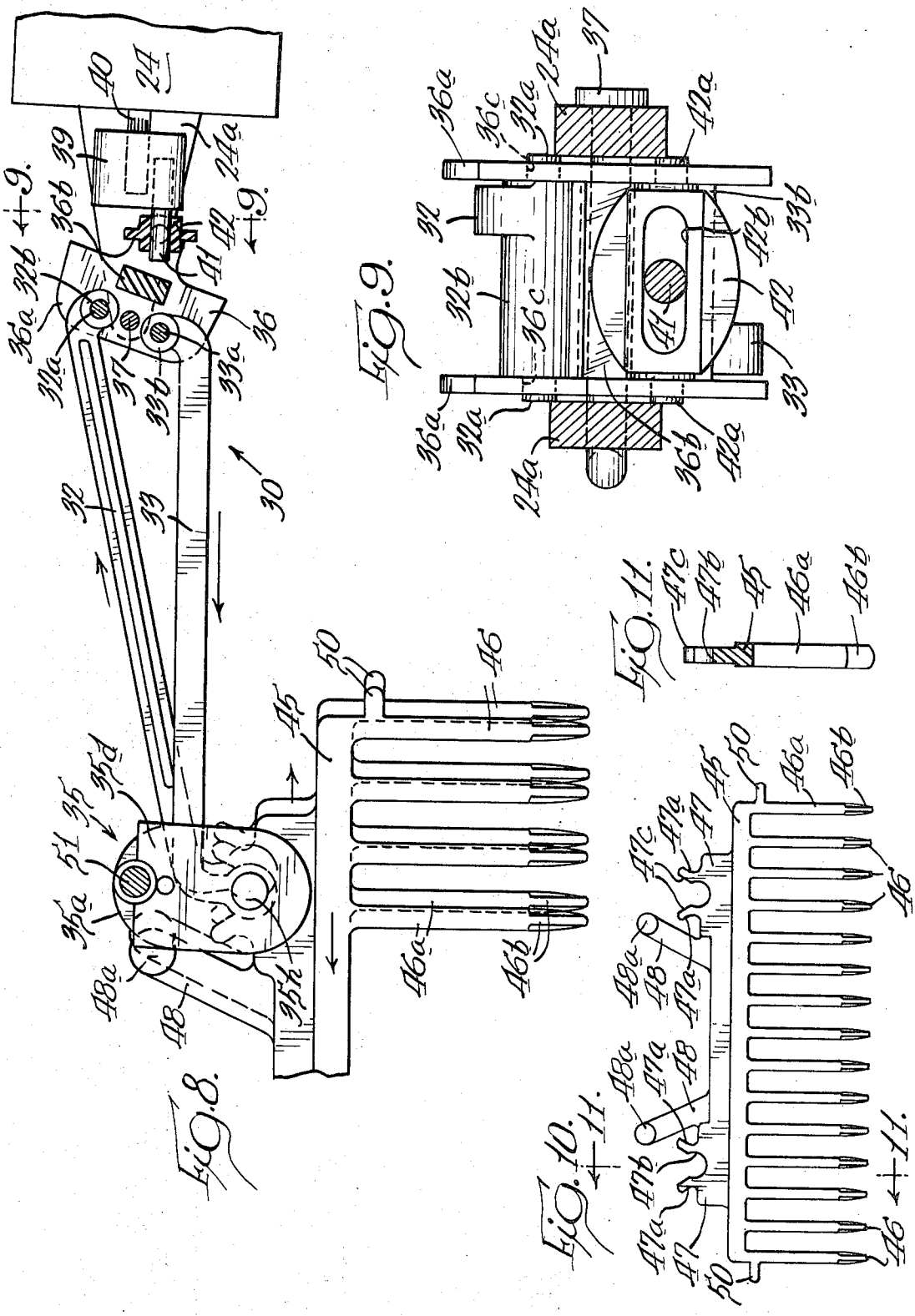

40
24
24a
39
36b
9
32b
42
41
36a
36
32a
37
33b
33a
30
32
33
35d
35
51
35a
48a
48
35b
45
50
46
46a
46b
FIG. 8.
36a
36c
32a
24a
37
42a
32
32b
36c
41b
33b
41
33
36a
32a
24a
36b
42a
FIG. 9.
47c
47b
45
46a
46b
FIG. 11.
48a
47a
48
47b
47
11
50
46
FIG. 10.

Fig. 12a.

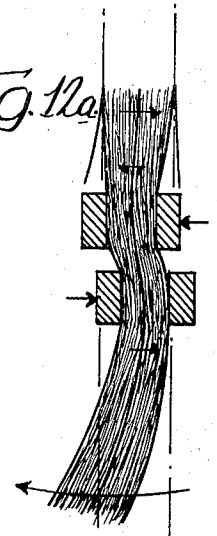


Fig. 12b.

Fig. 12c.

Fig. 13.

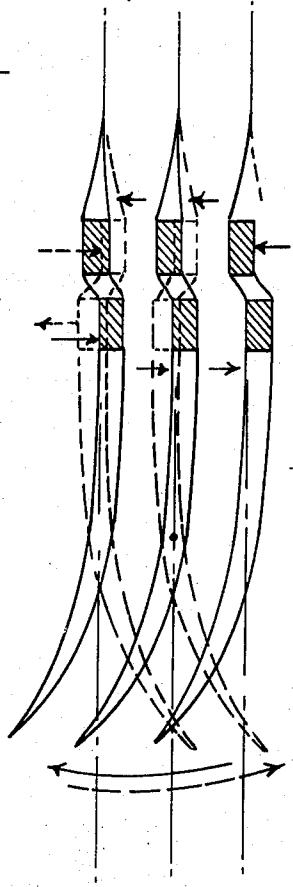


Fig. 14a.

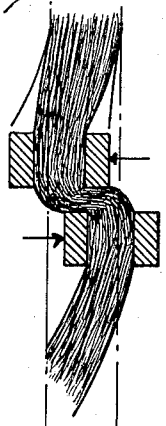


Fig. 14b.

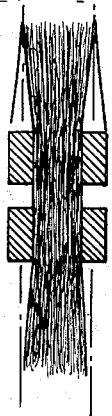


Fig. 14c.

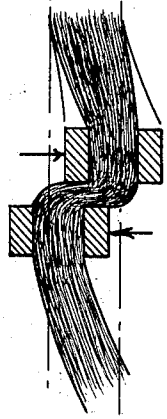


Fig. 15a.

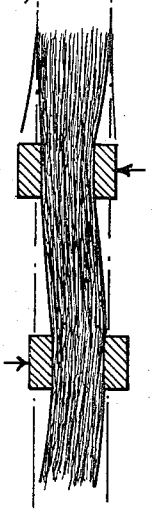


Fig. 15b.

Fig. 15c.

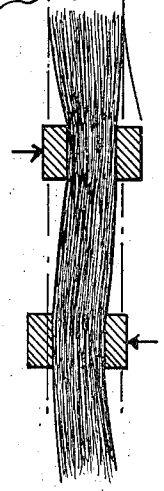


Fig. 16a.

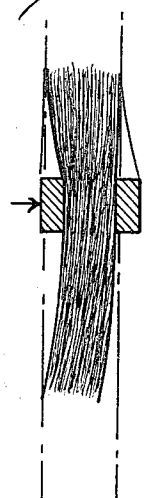


Fig. 16b.

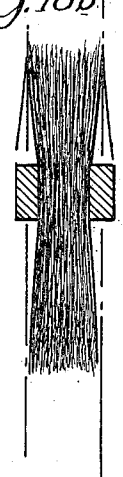
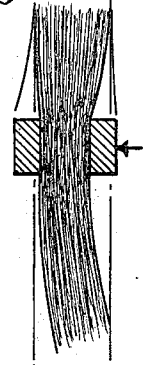


Fig. 16c.



POWER DRIVEN HAIR COMBING APPLIANCE

BACKGROUND OF THE INVENTION

There are many problems encountered in the care of ladies' hair which have not been satisfactorily solved by any of the devices and appliances currently known in the art. At least a portion of the female population has always utilized hair styles which involve letting their hair grow to substantial lengths, often in excess of 18 to 24 inches. In order to make hair look well groomed and properly styled, it is necessary that it be brushed and combed frequently. Under normal circumstances, there may be no difficulty in passing a comb through the hair when it has been only recently combed and brushed and nothing significant has caused the hair to become tangled.

Whenever a woman's long hair is washed, however, there is a tendency for the hair to become quite tangled. A similar situation can also occur when the hair has been wind blown or subjected to some other tangling condition. Under such circumstances, it is time consuming, difficult and even painful for a woman to comb out the tangles in her hair. It is not unusual for combing of tangled hair to take 10 to 15 minutes or more. It would be desirable, therefore, if a device or appliance could be provided which would facilitate the combing out of tangled hair so that the combing could be performed more quickly with less pain, pulling and breaking of the hair.

Another problem associated with the care of women's hair involves maintaining the appearance of a highly styled condition. Thus, after the woman or a beauty parlor has set the hair to produce a plurality of curls arranged in an attractive fashion, it is sometimes difficult to maintain this styled condition for any reasonable length of time such as a week or 10 days. A woman will tend to get the hair style in disarray or at least slightly tangled while sleeping or involved in any other normal activities. It has been found that any attempt to comb the hair under such conditions will tend to straighten the hair or remove the curl which has been set into it. This leaves the woman with a rather unsatisfactory alternative of merely brushing the hair lightly to give it a more orderly appearance but at the same time leaving the curls in a more or less undamaged condition. It would be helpful, therefore, to provide a means for combing out tangles in set hair which means would leave undisturbed the set which had been given to the hair.

Although there is no teaching in the prior art of an appliance which would solve the problems discussed above, the United States patent to Ferguson et al U.S. Pat. No. 3,272,023 discloses apparatus having oppositely reciprocating spaced comb members for the purpose of treating the hair and scalp. While the invention herein disclosed utilizes spaced comb members, there are significant differences in the arrangement of the combs, the manner of reciprocation and the design of the combs which give rise to an entirely different mode of operation than would have been present in apparatus made in accordance with the teachings of the Ferguson patent.

SUMMARY OF THE INVENTION

In accordance with the invention, a pair of closely spaced reciprocating combs are provided to accomplish the untangling and combing of hair which has been tangled by washing, teasing or otherwise tangled. The combs are positioned in close proximity so that the hair extending between the teeth of the combs will be turned or flexed thereby creating wave like motion in the strands of hair. This wave length motion tends to untangle the hair in much the same way as one might untangle string by shaking the strands of string at a point spaced away from where the strands enter the tangled area. It is also apparent that to perform the untangling function satisfactorily, it is desirable to have the comb provide a gentle tensioning of the hair toward the comb.

Applicants' tangle removing comb includes a slim housing which may be easily grasped in the hand and which encloses a motor and means driven by the motor for reciprocating the two combs in an out of phase relationship. The combs themselves are molded plastic members provided with guiding and support means and which also include integrally molded resilient means detachably connecting the combs to the reciprocating drive means. While it is, of course, important that the combs be firmly supported during the reciprocating thereof, it is also important that the combs be readily detachable from the reciprocating drive mechanism so that they may be washed and maintained in a sanitary condition. As will be explained in greater detail, the rate of reciprocating of the comb as well as the spacing of the teeth in each individual comb and the spacing between the teeth in adjacent combs is important to achieve the optimum results as far as the untangling of the hair is concerned.

Accordingly, it is an object of the present invention to provide a power driven combing appliance having improved characteristics with respect to removing tangles from the hair.

It is another object of the present invention to provide an improved hair grooming appliance which permits the combing of styled hair without eliminating the curl or set of the hair.

It is a further object of the present invention to provide an improved power driven comb having closely spaced counter reciprocating combs which reciprocate in an out of phase relationship to remove tangles from the hair.

It is a further object of the present invention to provide an improved combing appliance which includes two closely spaced oppositely reciprocated combs arranged to create a wave-like action in the hair to remove tangles.

Another object of the present invention is to provide an improved hair combing appliance having a pair of readily removable combs which are supported for reciprocation in an out of phase relationship.

Still another object of the present invention is to provide an improved reciprocating comb which includes integrally formed guide and support means and resilient means for detachably securing the comb to a power drive means.

Further objects and advantages of the invention will become apparent as the following description proceeds and the features of novelty which characterize the invention will be pointed out with particularity in the claims annexed to and forming a part of this specification.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a power driven combing appliance embodying our invention;

FIG. 2 is an enlarged sectional view taken substantially on line 2—2 of FIG. 1;

FIG. 3 is a sectional view taken substantially on line 3—3 of FIG. 2;

FIG. 4 is an enlarged fragmentary sectional view taken substantially on line 4—4 of FIG. 3;

FIG. 5 is an exploded perspective view of one of the oscillating links which supports the combs of the appliance;

FIG. 6 is an enlarged fragmentary sectional view taken substantially on line 6—6 of FIG. 4;

FIG. 7 is an enlarged fragmentary view taken substantially on line 7—7 of FIG. 5;

FIG. 8 is an enlarged fragmentary sectional view similar to FIG. 4 but showing the comb reciprocating parts in an alternative position;

FIG. 9 is an enlarged fragmentary sectional view taken on line 9—9 of FIG. 8;

FIG. 10 is a side view of one of the combs shown detached from the drive mechanism;

FIG. 11 is a sectional view taken on line 11—11 of FIG. 10;

FIGS. 12*a*, 12*b* and 12*c* are sketches showing the interrelationship between two sets of comb teeth and the hair positioned between them;

FIG. 13 is a sketch illustrating the wave action which is set up in the hair by oscillating comb teeth;

FIGS. 14*a*, 14*b* and 14*c* are sketches similar to FIG. 12 but illustrating the undesirable effects of excessive oscillation of the combs relative to each other;

FIGS. 15*a*, 15*b* and 15*c* are sketches illustrating the action of widely spaced comb teeth on the hair between the teeth; and

FIGS. 16*a*, 16*b* and 16*c* are sketches illustrating the action of a single reciprocating comb.

Referring now to the drawings, there is shown in FIG. 1 a portable power driven combing appliance designated generally by reference numeral 12. The appliance 12 is of such a size and weight that it may be readily grasped and manipulated by one hand of the user. For this purpose the appliance 12 is formed with a housing 13 one end of which provides a gripping portion 14 as best shown in FIG. 1. The half of the housing opposite from the gripping portion 18 provides a comb supporting portion 15. The housing itself is formed by a pair of generally channel shaped housing halves 18 and 19.

The housing halves 18 and 19 are formed along their abutting edges with steps or shoulders 18*a* and 19*a* as shown in FIG. 3 to provide a smooth and even juncture along the abutting edges. The housing halves 18 and 19 are also provided with inwardly extending bosses 18*b* and 19*b* respectively which receive assembly screws 20 for the purpose of retaining the housing halves 18 and 19 in assembled relationship. As was mentioned above, the gripping portion 14 of the housing 13 is sufficiently small so that it may be conveniently grasped in the hand of the user.

Supported on the portion 15 of the housing 13 are a pair of closely spaced combs 22 and 23. For the purpose of driving the combs 22 and 23 in a reciprocating motion, there is provided a motor 24 mounted within the housing 13. While the motor 24 may be of any suitable type in the preferred embodiment, a 120 volt DC permanent magnet motor was used which had a nominal speed in the order of 8,500 r. p. m. The motor 24 is connected to a suitable source of power by a cord 25 which also has an on-off switch 26 connected in series with one of the cord conductors and one of the motor terminals.

The motor 24 is supported within the housing 13 by means of molded rubber rings or grommets 28 and 29 as is best shown in FIGS. 2 and 3. The motor 24 is drivingly connected to the combs 22 and 23 by a transmission mechanism 30 which imparts a reciprocating motion to the combs 22 and 23 and which is enclosed in the comb supporting portion 15 of the housing 13. This drive mechanism 30 includes a pair of connecting rods 32 and 33 each of which is connected at the end most remote from motor 24 to a pivotally supported oscillating link 35. The other end of each of the connecting rods 32 and 33 is secured to a rocker member 36. The rocker member 36 is pivotally supported by a pair of die cast arms 24*a* which extend outwardly from the end of motor 24. The motor 24 includes an armature shaft 40 the exposed end of which extends outwardly between the arms 24*a* and which supports a drive block 39. The drive block 39 as is best shown in FIGS. 4 and 8 includes an eccentric or crank pin 41 which extends outwardly in parallel space relation to the motor shaft 40. In order to couple the crank pin 41 to the rocker member 36, there is provided a yoke 42 which is pivotally supported in the rocker member 36.

As is best illustrated by FIGS. 8 and 9, the rocker member 36 includes a pair of spaced parallel plate portions 36*a* which are somewhat T-shaped as seen in FIG. 8. The plate portions 36*a* which are connected by transversely extending body portion 36*b* are formed with holes 36*c* as shown in FIG. 2 which holes are adapted to receive integrally molded projections 32*a* and 33*a* formed on the ends of connecting rods 32 and 33 respectively (FIGS. 8 and 9). The projections 32*a* and 33*a* extend outwardly from hub portions 32*b* and 33*b* which extend between the plate portions 36*a* as illustrated in FIGS. 8 and 9. Similarly, the yoke 42 as shown in FIG. 9 is formed with integrally molded projections 42*a* which extend through corresponding openings in the plate portions 36*a* to pivotally support the yoke 42 with respect to the rocker member 36. Thus prior to assembling the rocker member 36 to the die cast arms 24*a*, the plate portions 36*a* are sprung apart to insert the hub portions 32*b* and 33*b* of the connecting rods 32 and 33 and to insert the yoke 42 into pivotal connection with the rocker member 36. Thereafter, the rocker member 36 is inserted between the arms 24*a* and an axle member 37 is inserted through the aligned openings in the plate portions 36*a* and in the ends of arms 24*a*. As so assembled, the rotation of the motor shaft 40 causes the drive block 39 to move the crank pin 41 in a circular path while in engagement with a slot 42*b* formed in the yoke 42. Engagement of the pin 41 with the yoke 42 during its rotation by the shaft 40 causes the member 36 to rock about its axle 37. As a consequence of this rocking movement, the connecting rods 32 and 33 move in opposite directions and oscillate the adjacent links 35 in opposite directions.

The housing 13 is formed in the area of the supporting portion 15 with an elongated slot 44 within which the combs 22 and 23 are mounted for reciprocating

movement. Each of the combs includes a shank portion 45, teeth 46, integrally formed mounting sockets 47 and guide legs 48. The teeth 46 in the preferred embodiment are about .080 inch thick and about .187 inches wide. The teeth are made substantially wider than they are thick in order that they may be strong enough to resist vibration and to transmit sufficient power while still being thin enough to pass through the hair easily. In the same connection the teeth are provided with heavy body portions 46*a* which are in cross section almost rectangular while the ends of the teeth are formed with rounded portions 46*b* which are tapered at the edges and the ends to facilitate the entry of the teeth into and through the hair. Near the root of the end teeth on both combs there are provided projections 50 which are for the purpose of facilitating insertion and removal of the combs from their position mounted within the opening 44.

The links 35 are connected to the housing 13 at their upper ends by means of pins 51 which are received within rubber bushings 52 (FIG. 3) which are received in recesses 54 formed integrally with the housing halves 18 and 19. The links which are best shown in FIGS. 5, 6 and 7 resemble the links used in a bicycle chain each comprising an inner plate 35*a* having an outwardly extending boss 35b formed with an opening to receive the pivot pin 51. Also extending from the inner plate 35*a* is a projection 35*c* which provides a bearing for the connecting rods 32 and 33 as far as the link members closest to the motor 24 are concerned. If one considers the sectional view of FIG. 2 and FIG. 3, it will be noted that there are two pairs of oscillating links 35. The oscillating links positioned nearest to the motor 24 support the driving ends of the connecting rods 32 and 33 as is best shown in FIGS. 4 and 6. As may be seen in FIG. 4 the ends of the connecting rods 32 and 33 which engage the link projections 35*c* are somewhat L-shaped having generally cylindrical portions 32*c* and 33*c* which have bearing holes to receive the link projections 35*c*. The connecting rod portions 32*c* and 33*c* are positioned between inner plates 35*a* and outer plates 35*d* which are received over the reduced diameter portions on the outer ends of the projections 35*c* as shown in FIG. 6. The upper ends of the outer plates 35*d* are notched at 35*e* (FIG. 5) to engage the bosses 35*b* which have adjacent shouldered projections 35*f*. Each of the projections 35*f* supports the outer plate 35*d* in spaced parallel relation to the inner plate 35*a* and the outer ends of projections 35*f* are heat staked over as shown at 35*g* in FIG. 6 to retain the upper edges of the outer plate 35*d* assembled to the remaining portions of the link 35. The reduced diameter ends of each of the projections 35*c* which extend through outer plate 35*d* is heat staked at 35*h* (FIG. 6) to retain the inner and outer plates together.

The mounting sockets 47 are formed at either end of each of the combs 22 and 23. These sockets are upwardly facing channel-like recesses which are defined in part by flexible leg portions 47*a*. The recess provided by each socket 47 defines a generally cylindrical portion 47*b* which extends more than 180° around its axis so as to form a pocket within which a bearing 53 of the oscillating link 35 may snap into and be retained. It should be understood that the two links 35 positioned most remote from the motor 24 include the bearings 53 which are received on projections 35*c* as shown in FIG. 5 and which snap into locking engagement with the sockets 47 on the combs 22 and 23. The sockets 47 at the other end of the combs 22 and 23 snap into engagement with the cylindrical portions 32*c* and 33*c* formed on the connecting rods 32 and 33 respectively. The cylindrical portions 32*c* and 33*c* are of the same outside diameter as the cylindrical portions 47*b* in the sockets 47. To permit the bearings 53 and the cylindrical portions 32*a* and 33*a* of the connecting rods to snap into the sockets 47, the legs 47*a* are provided with outwardly angled ends 47*c* as is best shown in FIG. 10 to deflect the legs 47*a* outwardly as the bearings 53 or cylindrical portions 32*c* and 33*c* are snapped into engagement with the sockets 47. The resilience of the plastic used in molding the combs 22 and 23 is such that the legs 47*a* may be deflected for easy assembly and disassembly of the combs from the drive mechanism 30 while at the same time holding the combs firmly during operation of the combing appliance 12.

The projections 50 located at both ends of each of the combs 22 and 23 facilitate removal of the combs from their assembled position with respect to drive mechanism 30. In addition, the projections 50 tend to block entry of foreign matter and debris through the clearance openings between the combs 22 and 23 and the housing portions defining the opening 44. When it is desired to remove one of the combs, a finger may be inserted beneath one of the projections 50 and a light prying force exerted outwardly of the housing 13. This causes one end of the comb to be detached from its oscillating link 35; continued rotation of the comb about the other oscillating link 35 causes the attached end of the comb to engage the housing 13 at the other projection 50 and further rotation causes the comb to separate itself completely from the drive mechanism 30 and its oscillating links 35.

Although the links 35 connected to connecting rods 32 and 33 are maintained in a proper position for reassembly to combs 22 and 23, the outer most links 35 are in no way connected to the transmission 30 after the combs 22 and 23 are removed. To maintain these outer links properly positioned for assembly to the comb sockets 47, there are provided locating projections 56 positioned on both sides of the lower ends of the outer links 35 as is best shown in FIGS. 2 and 3. The projections 56 are spaced sufficiently to permit oscillation of links 35 but sufficiently close together to locate links 35 for assembly to combs 22 and 23.

From the above description it can be readily appreciated that as the motor 24 rotates shaft 40 the connecting rods 32 and 33 cause the adjacent driven links 35 to oscillate about their pivot pins 51. This motion of the inner oscillating links 35 causes the combs 22 and 23 to reciprocate as they are supported by the two pairs of oscillating links 35.

Since there is a substantial amount of transverse force exerted against the combs 22 and 23 during the combing of tangled hair, it is important that the combs 22 and 23 be provided with adequate support to resist this action which would in effect pivot the comb about the shank portion 45. In order to counteract this pivoting or twisting motion, the shank portion 45 is supported and guided by the lengthwise extending housing walls which define the edge of opening 44. In addition, the guide legs 48 extend upwardly and outwardly from the shank portion 45 of both of the combs 22 and 23 as shown in FIG. 10. The upper ends of the legs 48 are provided with bearing pads 48a which are received be-

tween the inner plate **35***a* and the outer plate **35**d as best shown in FIGS. **2, 3** and **4.** As the combs **22** and **23** reciprocate through their full travel as illustrated by comparing FIGS. **4** and **7,** the bearing pads **48***a* continue to be sandwiched between the inner and outer plates **35***a* and **35***d* respectively of the oscillating links **35.** By providing two guide legs on each of the combs, adequate support of the combs against any twisting about the shank portion is assured. The sockets **47** and the guide legs **48** provide a simple but effective means for detachably connecting the combs **22** and **23** with respect to the drive mechanism **30** and housing **13.**

Because of the substantial vibration forces associated with the appliance **12,** it is desirable to use foam rubber padding in the housing portion **15** between the motor mounting ring **28** and the outer end of the housing **13.** This rubber padding lessens the noise which would otherwise be generated by the parts vibrating within the housing **13.**

While there has been described above the structural details of the preferred embodiment of the appliance **12,** there has been no discussion of the considerations involved in dimensioning the parts so as to achieve the desired effect on the hair. The various parameters such as the spacing apart of the combs, the stroke length delivered by the drive mechanism **30** and the spacing of the teeth **46** are all details which have a significant effect on achieving the objecting of moving the hair in such a way that tangles are eliminated as expeditiously as possible. The patent to Ferguson U.S. Pat. No. 3,272,023 discloses an appliance having counter reciprocating combs which obviously operate in a considerably different manner than that contemplated by the instant invention. Although there is no discussion in the Ferguson et al patent of the dimensions of the comb, the spacing of the comb or the speed of oscillation, there are some aspects which can be readily observed. First, the combs of the Ferguson et al patent appear to be spaced a substantial distance apart. This wide spacing of the combs is undesirable since it eliminates the co-action obtained by the two combs reciprocating in opposite directions to create a type of wave motion in the hair. The action of widely spaced combs is much like that of a single comb as shown in FIG. **16** wherein the comb teeth merely move the central portions back and forth. As illustrated by the sketches of FIG. **15,** the wide spacing of the teeth as compared to the spacing shown in FIGS. **12** or **13** results in mere displacement of central portions of the hair without producing the whip-like action which produces the wave effect illustrated in FIG. **13.** Secondly, the Ferguson et al patent contemplates a substantial amount of oscillation or length of stroke which would appear to be on the order of twice the spacing of the comb teeth. As will be explained in greater detail, the reciprocation of the combs in such a way that the teeth bypass the teeth on the adjacent comb tends to cause the pair of combs to produce a combined action in which the hair is fed through the comb excessively producing a teasing type of action. This type of action interferes with and hampers the proper creation of the wave effect which tends to loosen the tangled hair. It is desirable to have the combs designed and positioned so that a slight pulling effect or action is achieved.

Referring to FIG. **12,** there is shown a sequence of three sketches which illustrate the relative positions of two pairs of comb teeth and the hair which is acted upon by these two pairs of teeth. The overall center-to-center spacing of the teeth in the preferred embodiment is .25 inches while the spacing between the adjacent combs is on the order of .065 inches. The strands of hair are shown in FIG. **12** extending between the teeth **46.** When the teeth of the adjacent combs are in aligned relationship as in **12***b*, they are in the center of their strokes. In **12***a* the comb teeth are shown in their position of maximum displacement in one direction while in **12***c* the comb teeth are shown in their position of maximum displacement in the other direction. The result of this cyclic action is to mildly but repeatedly turn or twist a section of the hair thus causing waves to be generated which pass down the hair toward the tangled portions and tend to eliminate the tangles. FIG. **13** illustrates the whip-like or wave action which is produced in the strands of hair between a series of teeth on adjacent combs. This action results in the substantial movement of the hair well in advance of the comb to produce the untangling before the teeth arrive at a tangled area. This produces a quicker, less painful combing of the hair. The overall action may be compared to the manner in which one shakes a tangled piece of string to untangle it.

In order to achieve the best results, it has been found that the rate of reciprocation should be at least on the order of 4,000 cycles per minute. Increasing the speed of reciprocation to as high as 10,000 cycles per minute produces acceptable results. A good compromise speed which is obtainable at reasonable cost of components with acceptance levels of vibration and noise is on the order of 6,000 to 9,000 cycles per minute.

There are various aspects of the design of the combs **22** and **23** which should also be noted at this time. The combs are preferably made of a tough plastic material such as nylon which may be integrally molded in one piece. Because of the substantial vibrations to which the comb is subjected as a consequence of the reciprocating action, the comb teeth **46** are designed to be considerably more rigid than are normal comb teeth. The upper portions of the teeth **46***a* are in the preferred embodiment about .080 inches in thickness and about .187 inches in width as viewed lengthwise of the comb. The teeth are almost rectangular in cross section being rounded slightly at the corners. It has been found that nylon combs made of these dimensions provide sufficient rigidity and strength to perform the untangling functions. In order to facilitate the entry of the fairly bulky teeth into the hair, the ends are tapered and rounded as shown at **46***b*.

Tests have been run on combs having greater spacing of the teeth than the .250 inch center-to-center distance described above and at the same time using a greater stroke than the .060 stroke described above. These tests indicated that increasing the stroke length and teeth spacing did not detract from the untangling action as long as the combination of tooth spacing and stroke length was not used which would result in the teeth passing by each other substantially. In this connection reference should be made to the series of sketches FIG. **14***a*, FIG. **14***b* and FIG. **14***c* which illustrate the manner in which the hair is affected when the closely spaced reciprocating teeth pass by each other to any significant extent. Sketch **14***a* shows the teeth in their aligned positions as a lock of hair is received between a set of four teeth. As the combs are reciprocated to the positions shown first in **14***b* and then in

14c, the strands of hair have a tendency to be pulled lengthwise a substantial extent into the gap between the combs. This action might also be accompanied by some stretching of the hair. In any event, any substantial lengthwise movement and stretching of the hair tends to curl the hair creating a teasing type action. In addition, loops of hair are produced which further tangle the hair. This action hampers considerably the attempts at untangling and actually tends to create more tangles under certain circumstances. With the design parameters described above, the combs produce only a slight pulling on the hair which aids in the untangling.

In considering the situations in which the passing of the teeth may form loops which in turn result in tangling of the hair rather than untangling, it is desirable to consider the angle of the intermediate portion of the lock with the teeth in the position as in FIG. 4c. In such a situation, if the central portion extends parallel to the direction of travel of the combs, there is invariably a tangling condition produced. In addition even when the intermediate portion approaches this parallel situation, looping and tangling may be produced depending on the type of hair and its condition.

It has also been discovered that a single reciprocating comb as shown in FIG. 16 or one which is shown in the Ferguson patent with the adjacent combs spaced substantially apart are substantially less effective in untangling the hair than are the combs contemplated by the instant invention. Such arrangements are ineffective in creating the wave conditions illustrated in FIG. 13. As is illustrated by the sketches of FIG. 15, it appears that widely spaced combs merely oscillate sections of hair and do not turn the sections as shown in FIG. 12 to create the action which is further illustrated in FIG. 13.

Because of the problems of consistently tangling hair in the same manner, it is difficult to run tests which are repeatable and which clearly establish the optimum design. However, on the basis of the tests which have been run, it appears that the desired untangling action can be achieved best when operating in a stroke range of from 4,000 to 10,000 strokes per minute and using stroke lengths of between .030 and .130 inches. In some conditions it may be possible to allow the teeth to bypass each other to a slight extent and still have little lengthwise movement of the hair into the comb and still have the wave action required for the untangling of the hair. While the combs should be spaced fairly close together, it appears that a spacing up to .25 inches would be acceptable.

While there has been shown and described a particular embodiment of the present invention, it will be apparent to those skilled in the art that various changes and modifications may be made without departing from the invention in its broader aspects, and it is, therefore, contemplated in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of the present invention.

What is claimed as new and desired to be secured by Letters Patent of the United States is:

1. A power driven comb comprising an elongated housing which encloses a motor and transmission means connected to reciprocate a pair of comb support means, said housing being formed with a slot in one wall thereof adjacent said comb support means, a pair of comb members detachably secured to said support means and positioned in closely spaced parallel relation to said slot, each said comb member having widely spaced teeth to permit tangled hair to enter the space between the teeth, each tooth throughout a substantial portion of its length being of constant thickness in the direction lengthwise of said comb member, said members being reciprocated by said transmission means in an out of phase relation, the teeth in each comb having edge portions lying along the space between the combs which edge portions define longitudinal planes spaced apart no more than .25 inches, said members being reciprocated at a rate of more than 4,000 cycles per minute to produce wave motion in said hair to untangle said hair and reciprocated a distance no greater than the space between said teeth.

2. A power driven comb comprising an elongated housing which encloses a motor and transmission means connected to reciprocate a pair of comb support means, said housing being formed with a slot in one wall thereof adjacent said comb support means, a pair of comb members detachably secured to said support means and positioned in closely spaced parallel relation in said slot, said members veing reciprocated by said transmission means in an out of phase relation, said members being reciprocated at a rate of more than 4,000 cycles per minute to produce wave motion in said hair to untangle said hair, each said comb member each includes a shank portion which supports teeth extending outwardly therefrom, mounting sockets on said shank portions which releasably secure said comb members to said transmission means, bearing and guide means which are formed on said comb members and extend from said shank portion in the opposite direction from said teeth to guide said comb members in reciprocating movement and to support said comb members against twisting about said shank portion, said bearing and guide means being positioned within said housing and having end portions in sliding engagement with spaced bearing surfaces.

3. A power driven comb which includes a pair of counter reciprocating combs adapted to untangle hair and to comb hair with a minimum adverse effect to the curled or styled condition of the hair comprising an elongated housing enclosing a motor and transmission means, a pair of elongated comb members supported in closely spaced relation in a slot formed in said housing, each said comb member having widely spaced teeth to permit tangled hair to enter the space between the teeth, said comb members having teeth extending outwardly of said slot and mounting portions within said housing extending in a direction opposite from said teeth, the teeth in each comb having edge portions lying along the space between the combs which edge portions define longitudinal planes spaced apart no more than .25 inches, said transmission means being connected to said combs to reciprocate them at a rate of in excess of 4,000 cycles per minute with the stroke length of each comb member being equal to or less than the space between the teeth whereby said comb members produce a wave motion in said hair which untangles the hair.

4. The power driven comb of claim 3 wherein said comb members are reciprocated at a rate of between 6,000 and 9,000 cycles per second, said stroke length being between .03 and .130 inches, whereby said comb members produce a wave like action in the hair to untangle it.

5. The power driven comb of claim 3 wherein said slot extends lengthwise of said housing and said comb

teeth extend laterally of said housing, said comb having a shank portion from which said teeth extend, said mounting portions being formed on the side of the shank portion opposite to the side from which said teeth extend, each of said comb members being supported by a pair of oscillating links pivoted to said housing adjacent said slot, said transmission means being connected to one link of each said pair of oscillating links to drive said comb members.

6. The power driven comb of claim **5** wherein said comb members are detachably connected to said oscillating links, said transmission means including a connecting rod pivotally connected to one of said one link of each said pair and locating protuberances on said housing on both sides of the oscillating links which are not connected to said transmission means to position said last mentioned links for assembly of said comb members thereto.

7. The power driven comb of claim **3** wherein said motor includes an output shaft extending lengthwise of said housing and supporting on its outer end an eccentric which drives a rocker member, said rocker member being pivoted about an axis perpendicular to said shaft and oscillated about said axis by said eccentric, a pair of connecting rods each pivotally connected to said rocker member along axis spaced above and below said rocker member axis whereby rotation of said motor shaft reciprocates said connecting rods in an out of phase relation, said connecting rods having their ends remote from said rocker member connected to said comb members.

8. The power driven comb of claim **3** wherein said comb members are supported by oscillating links which are pivotally connected to said housing, said links having cylindrical bearings at their free ends which are detachably received in bearing recesses in said comb members.

9. The combing appliance of claim **8** wherein said housing comprises a pair of channel shaped halves which abut along a central plane through the axis of said housing, said motor is supported by rubber rings which extend around the ends of said motor and are clamped between the housing and the motor, axles for pivotally supporting the links with respect to said housing, the ends of said axles being received in spaced recesses in said housing halves.

10. The combing appliance of claim **9** wherein said comb members are formed with guide legs which extend outwardly from said comb members adjacent said sockets and engage said links adjacent to their pivotal connection to said housing, said links having spaced bearing surfaces between which the outer ends of said guide legs are received and supported.

11. A power driven comb which includes a pair of counter reciprocating combs adapted to untangle hair and to comb hair with a minimum adverse effect to the curled or styled condition of the hair comprising an elongated housing enclosing a motor and transmission means, a pair of elongated comb members supported in closely spaced relation in a slot formed in said housing, said comb members having teeth extending outwardly of said slot and mounting portions within said housing extending in a direction opposite from said teeth, said transmission means being connected to said combs to reciprocate them at a rate of in excess of 4,000 cycles per minute with the stroke length of each comb member being equal to or less than the space between the teeth, said comb members being supported by oscillating links which are pivotally connected to said housing, said links having cylindrical bearings at their free ends which are detachably received in bearing recesses in said comb members, said comb members include shank portions having spaced sockets, said sockets comprise bearing recesses formed by outwardly extending flexible legs, said links having cylindrical bearings at the ends spaced from the pivotal connection to the housing, said bearing being received in said sockets with said legs extending around said bearings to retain said comb members assembled to said links.

12. In a power driven combing appliance of the type having a pair of parallel spaced counter reciprocating comb members, the improvement comprising a frame having means for pivotally supporting two pair of oscillating links on two spaced parallel axes, each link having a pair of spaced parallel plates joined by bearing means at either end, the bearing means at one end pivotally supports each said link with respect to said housing, the bearing means at the other end of each said link pivotally supports said comb members with respect to said links, bearing means on said comb members detachably engaging said bearing means on the other end of said links, said comb members including guide legs adjacent the bearing means on said comb members extending outwardly therefrom into bearing engagement with said links between said plates.

13. The combination of claim **12** including a motor and transmission supported on said frame and drivingly interconnected to said comb members to reciprocate said comb members in an out of phase relation, said transmission including a pair of connecting rods having their driven ends connected to be reciprocated by said motor, the driving ends of said connecting rods being connected to engage the bearing means on said other ends of the links in one pair of said links and said connecting rods driving in oscillating motion said one pair of links.

14. The combination of claim **13** wherein said comb members have shank portions formed with outwardly opening sockets which detachably receive said bearing means on the other ends of said links, said links in said one pair having the driving ends of said connecting rods interposed between the link bearing means on the said other ends and said sockets.

15. A comb member comprising an elongated shank portion having spaced parallel teeth extending outwardly perpendicular to said shank portion, said teeth being as wide as said shank portion throughout the major portion of their length to provide strength and rigidity and being tapered and rounded at the ends to facilitate entry of the teeth into the hair, the side of said shank portion opposite from said teeth having drive sockets at both ends thereof to detachably engage a reciprocating drive mechanism, a pair of guide arms extending from said shank portion in the direction opposite from said teeth and each guide arms being positioned adjacent one of said sockets, said guide arms having bearing pads at their upper ends to slidably engage a bearing means during reciprocation of said comb member and resist turning of said member about said shank portion.

16. The comb member of claim **15** wherein sockets provide outwardly facing recesses defined in part by resilient arms which flex to permit a cylindrical bearing

member to be forced into assembled relation to said socket.

17. The comb member of claim 15 wherein said guide arms are of lesser thickness than the socket defining portions of said comb member except for said bearing pads which are the said width as said socket defining portions.

18. A power driven comb comprising a housing having an opening in one wall thereof, an electric motor mounted in said housing, a pair of comb support means mounted in said housing adjacent said opening, means for drivingly relating said motor and said comb support means whereby energization of said motor causes counter-reciprocation of said pair of comb support means at a rate of at least 4,000 cycles per minute, a pair of combs each having a plurality of teeth arranged in spaced parallel relationship with the teeth projecting outwardly from said opening, and means connecting each of said pair of combs to a different one of said support means whereby said combs reciprocate with said comb support means, the spacing of said comb teeth being greater than the spacing between longitudinal planes defined by the portions of the teeth of each comb which lie along the space between said combs when connected to said comb support means, said means for drivingly relating said motor and said comb support means producing a reciprocating stroke of said combs no greater than said tooth spacing.

* * * * *

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,794,050 Dated February 26, 1974

Inventor(s) George P. Gallanis and Ikuo I. Komatsu

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 10, line 62 - "per second" should be

--per minute--

Signed and sealed this 8th day of October 1974.

(SEAL)
Attest:

McCOY M. GIBSON JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

USCOMM-DC 60376-P69
* U.S. GOVERNMENT PRINTING OFFICE : 1969 O—366-334

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,794,050 Dated February 26, 1974

Inventor(s) George P. Gallanis, et al.

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

On the cover sheet, Item (22), the filing date should read -- May 9, 1972 --.

Signed and sealed this 30th day of July 1974.

(SEAL)
Attest:

McCOY M. GIBSON, JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

USCOMM-DC 60376-P69
* U.S. GOVERNMENT PRINTING OFFICE : 1969 O—356-334.