Nov. 28, 1950 P. HEFTLER 2,531,430

CARPET SWEEPER BRUSH AND WHEEL PRESSURE ADJUSTING MECHANISM

Original Filed April 1, 1942 3 Sheets-Sheet 1

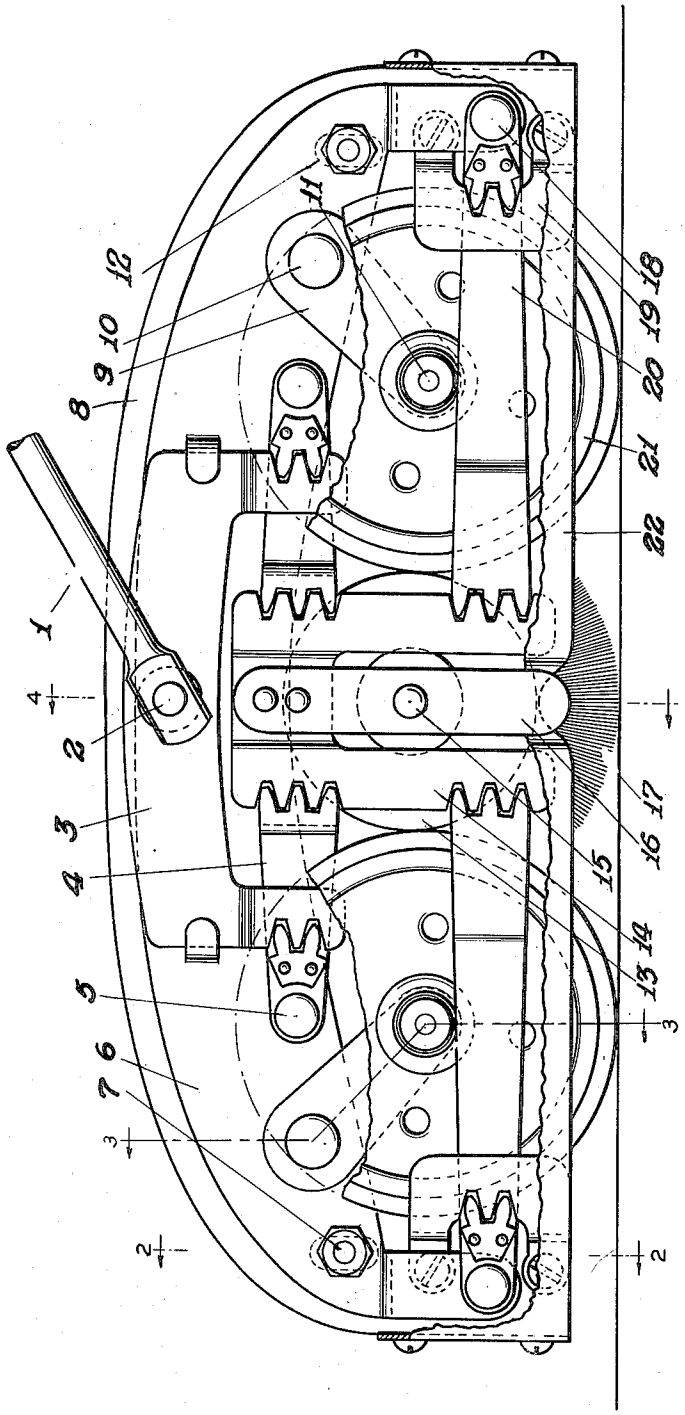


FIG. 1

Paul Heftler

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Original Filed April 1, 1942 3 Sheets-Sheet 2

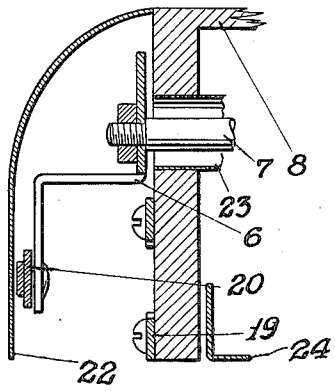


FIG. 2

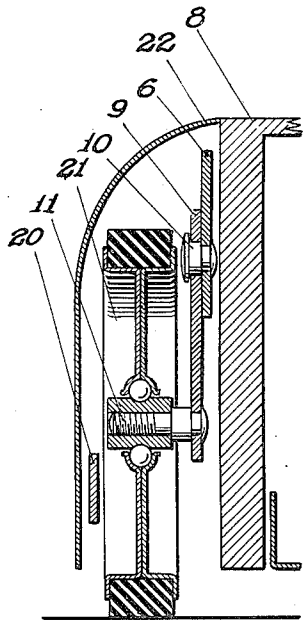


FIG. 3

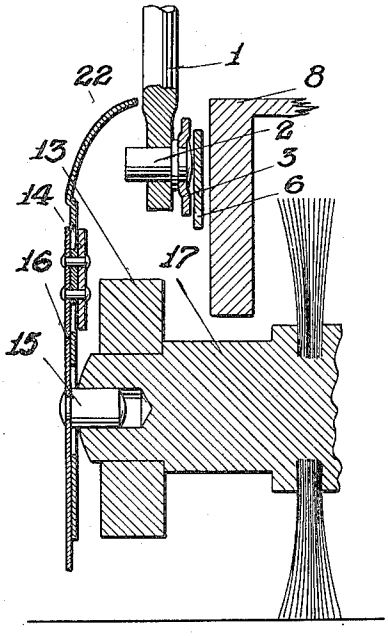


FIG. 4

Paul Heftler

Nov. 28, 1950 P. HEFTLER 2,531,430
CARPET SWEEPER BRUSH AND WHEEL PRESSURE ADJUSTING MECHANISM
Original Filed April 1, 1942 3 Sheets-Sheet 3

FIG. 5

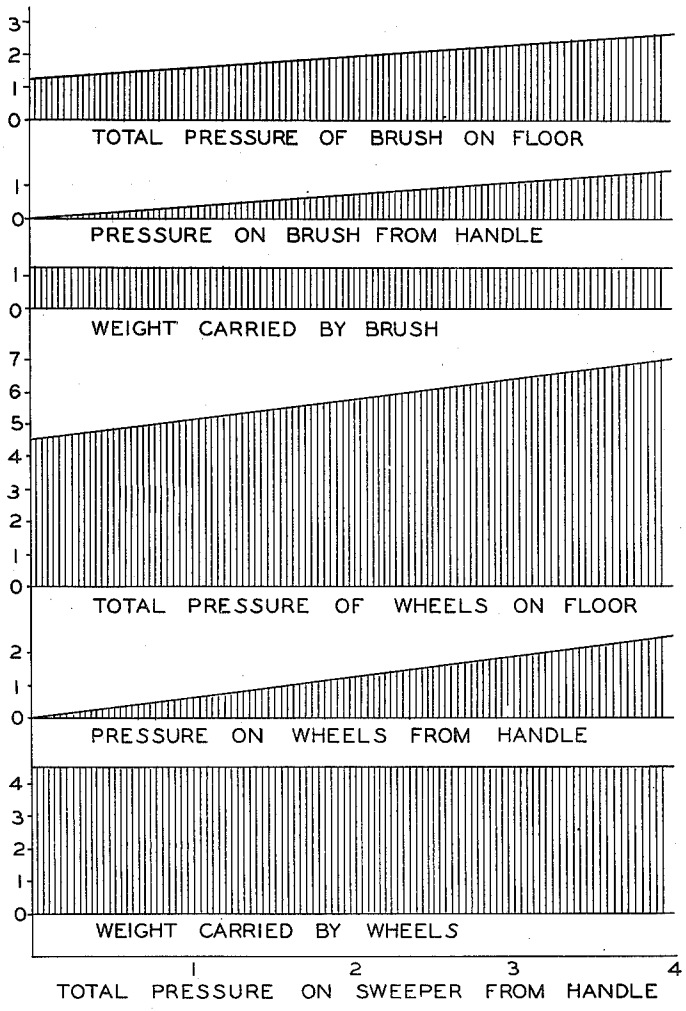
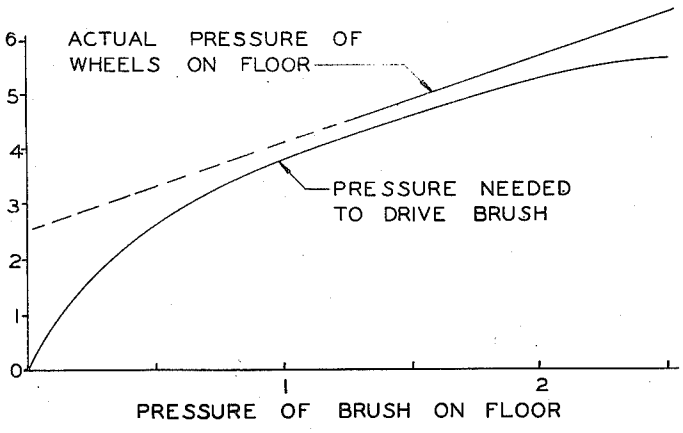


FIG. 6



Paul Heftler

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2,531,430

CARPET SWEEPER BRUSH AND WHEEL PRESSURE ADJUSTING MECHANISM

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Continuation of application Serial No. 437,269, April 1, 1942. This application September 10, 1943, Serial No. 501,780. In Great Britain October 20, 1938

10 Claims. (Cl. 15—41)

1

The main invention described in this specification and shown in the accompanying drawing is a floor and carpet sweeper that automatically adjusts itself to the softness of the carpet or rug or other floor surface which it is sweeping and in which both the weight of the sweeper and any pressure which may be applied to the sweeper through its handle are always divided between the wheels and the brush in such proportions that the most powerful sweeping action possible with that total force is always secured. No matter how hard or soft the carpet or rug may be and no matter how much or how little pressure may be applied through the handle only enough of this pressure is applied to the wheels to keep them from slipping, and all the rest is applied to the brush so that, to secure any desired sweeping power, the least possible pressure need be applied to the sweeper through its handle.

This new and desirable result is obtained by (1) connecting the wheels to the brush in such a way that they can rise and fall freely with respect to the brush, (2) providing a mechanism which divides the weight of the sweeper between the wheels and the brush in one ratio, and (3) providing a mechanism which divides any handle pressure between the wheels and the brush in another ratio. These mechanisms are so made that each of these ratios remains practically constant no matter how the position of the brush changes, as long as the brush remains within its normal range of movement. These two ratios are different so that the ratio in which the total pressure of the sweeper on the rug is divided between the wheels and the brush changes as that pressure is increased by pressing down on the handle. Thus, for every different pressure on the handle, the total pressure is divided in the way that gives the most sweeping power; this is done by applying a greater proportion of that pressure to the brush as the pressure is increased.

Other inventions disclosed here are a new way of connecting a brush adjusting mechanism to a wheel so that any pressure on the wheel from the brush adjusting mechanism helps to press the wheel against the brush pulley which it drives, and a new way of connecting the arms or levers of a brush adjusting mechanism to a brush carrier so that they will both move and guide the brush carrier.

In order that the invention may be easily understood, a specific form of it is shown and explained in the drawings and the following paragraphs. This, however, is only one particular construction that illustrates the invention particularly well, and the invention may be carried out in other ways. In the drawings,

2

Figure 1 is an end view of the sweeper with most of the end cover 22 broken away to show the adjusting mechanism;

Figures 2, 3 and 4 are sections on the lines 2—2, 3—3 and 4—4 of Figure 1;

Figure 5 is a diagram showing how the weight of the sweeper and the pressure applied to the sweeper through its handle are divided between the wheels and the brush as this pressure is increased; and

Figure 6 is a graph showing how closely the actual pressure of the wheels on the floor follows that which is needed to drive the brush as the pressure of the brush on the floor increases.

General construction

In this sweeper, the case 8 does not form the frame, but it floats or can move up and down relative to a separate frame upon which the wheels 21 are mounted. The frame is formed of two end plates or wheel carriers 6 joined together by two cross bars 7, which extend through the case. In order to allow the case to float, there is a slight clearance (shown in Figures 2 to 4) between the frame side plates 6 and the ends of the case, and the frame cross bars 7 extend through vertical slots 12 in the ends of the case and are enclosed in tubes or tunnels 23 which extend through the case and keep dust and lint flying about inside of the sweeper from settling in the slots 12 and interfering with the movement of the bars 7.

The wheels 21 are mounted on stub axles 11 fixed to the ends of wheel support arms 9 pivoted to the frame end plates 6 by shoulder rivets 10. The wheel support arms extend down and towards each other at angles of about forty-five degrees to the horizontal so that the wheels will be pressed against the brush pulley 13 hard enough to prevent slippage.

The case 8 is of wood, and it encloses conventional dust pans 24 on each side of the brush 17. The end cover 22 of the case has a central portion in the form of a shallow vertical offset or channel, which forms a guide for the brush pivot carrier assembly. This assembly is made up of the brush pivot carrier 14 (whose legs fit on either side of the back of the offset just mentioned), the brush pivot spring 16 (which fits in the front of the offset), the brush pivot 15 (which passes in through a slot in the offset), and a small spacer and some rivets (which pass through another slot in the offset). The slots

are long enough to permit the brush pivot carrier assembly to move up and down freely.

The weight of the case and other parts, such as the dust pans, carried by the case is transmitted to weight dividing gears **20** by case supporting brackets **19** and is divided between the wheels and the brush by the gears. The portion of the weight applied to the wheels is transmitted to the frame end plates through the shoulder rivets **18** which form the pivots of the gears, and the portion of the weight applied to the brush is transmitted to the brush pivot carrier **14** through the racks or gear teeth on its edges.

The handle **1** is carried by a pivot on a handle pivot carrier **3**, which can slide up and down on the frame end plate **6** and is guided by a pair of lugs on the frame end plate. The pressure applied to the sweeper through the handle by the person using the sweeper is divided between the wheels and the brush by the pressure dividing gears **4**. The portion of this pressure applied to the wheels is transmitted to the frame end plates by the shoulder rivets **5** which form the pivots of the gears, and the portion of the pressure applied to the brush is transmitted to the brush pivot carrier **14** through the racks or gear teeth on its edges.

Details

The brush pivot carriers **14**, the frame end plates **6**, the wheel support arms **9**, the case support brackets **19**, and the parts of the gears **4** and **20** are all made of metal one sixteenth of an inch in thickness, and the end covers **22** and the brush pivot springs **16** are half of this thickness. The ends of the gears engaged with the rack teeth on the edges of the brush pivot carrier **14** may be kept in mesh by a thin plate secured to the back of the carrier by the same rivets that hold the brush pivot spring and by additional rivets, and the other gear teeth may be kept in mesh by thin plates secured to the outside of the small parts of the gears. These small parts of the gears, which are riveted to the main parts, may be slightly thicker than one sixteenth of an inch in order to provide working clearance.

The weights of the various parts of the sweeper may be as follows:

Brush, brush carrier assembly, and the brush ends of the gears	.75 lb.
Frame, wheels, wheel support arms, and the frame ends of the gears	2.00 lb.
Case, end covers, dust pans and other parts moving up and down with the case	3.00 lb.
Handle and handle pivot carrier	.50 lb.

The effective lengths or pitch radii of the parts of the weight dividing gears **20** that engage the case support bracket and the brush pivot carrier may be $\frac{5}{8}$ inch and $3\frac{3}{4}$ inches respectively, so that the weight of the case and the parts that move with it is divided between the brush and the wheels in the ratio of 5 to 25. The effective lengths or pitch radii of the parts of the handle pressure dividing gears **4** that engage the handle pivot carrier and the brush pivot carrier may be $\frac{5}{8}$ inch and $1\frac{11}{16}$ inches respectively, so that any pressure applied to the sweeper by the handle is divided between the brush and the wheels in the ratio of 10 to 17.

Operation

When no pressure is being applied to the sweeper through its handle, the only forces which press the wheels and the brush against the floor

are the weights listed above, and not even all of those, for much of the weight of the handle is carried by the person using the sweeper. These weights are divided as follows:

	Total weight	Weight carried by:		
		Brush	Wheels	Person
	Pounds			
Brush, etc.	.75	.75		
Frame, etc.	2.00		2.00	
Case, etc.	3.00	.50	2.50	
Handle, etc.	.50	.10	.17	.23
		1.35	4.67	.23

The total weight thus resting on the floor is divided between the brush and the wheels in the ratio of 1.35 to 4.67, or 1 to 3.46, and this ratio remains the same even when the wheels sink into a soft rug or when the brush bristles bend down under heavy pressure.

The pressures of the brush and the wheels on the floor caused by pressure applied to the sweeper through the handle are both zero when the applied pressure is zero, and they increase uniformly as the applied pressure is increased from zero to a few pounds. Whatever this pressure is, it is divided in the ratio of 10 to 17 between the brush and the wheels, this division being done by the handle pressure dividing gears **4**. Thus, when an additional pressure of 3.65 lb. for example is applied to the sweeper through the handle, 1.35 lb. of this is applied to the brush and 2.30 lb. to the wheels; the total pressure of the brush on the carpet is increased from 1.35 lb. to 2.70 lb., and the total pressure of the wheels on the carpet is increased from 4.67 lb. to 6.97 lb. The brush pressure is increased by 100% while the wheel pressure is increased by a little less than 50%.

The way in which the wheel and brush pressures increase as pressure is applied through the handle of the sweeper is shown graphically in Figure 5. The two important things to note from this figure are the fact that there is a substantial brush pressure even when the handle pressure is zero and the fact that the percentage increase in the brush pressure is much greater than the percentage increase in the wheel pressure. These are the reasons why the sweeper sweeps any thickness of rug well without any pressure being applied to the handle and why a small amount of pressure on the handle increases the sweeping power more than the same pressure would increase the sweeping power of any other known sweeper.

In fact, this sweeper has nearly the greatest sweeping power theoretically possible in a carpet sweeper of its size and weight. In any carpet sweeper, in which the brush is driven by friction from the wheels, it is necessary that the wheels press against the carpet hard enough to make them turn instead of slip. How hard the wheels must press on the carpet is determined by how hard the brush presses on the carpet, for more force is needed to drive the brush when it presses down hard than when it presses down lightly. The driving force which the wheels can apply to the brush without slipping too much on the carpet is approximately proportional to the force with which they press down on the carpet, but the force needed to drive the brush does not vary in such a simple way with its pressure on the carpet.

By actually measuring, with special apparatus, the force required to drive a standard carpet

sweeper brush on different types of rugs with different pressures of the brush on the rugs, it has been found that the thickness or softness of the rug makes practically no difference in the force required and that this force increases rapidly at first when the pressure of the brush is increased, then increases less rapidly, and finally drops off when the pressure is so great that the bristles are bent so much that their smooth sides instead of their ends are rubbing on the carpet. The result of this peculiar and hitherto unknown relation between the brush pressure and the force required to drive the brush is that the pressure on the wheels needed to drive the brush varies with the pressure on the brush as shown by the curve in Figure 6.

The straight line in Figure 6 shows how the actual pressure of the wheels on the floor varies in this sweeper with the pressure of the brush on the floor, and it can be seen how closely it parallels the pressure needed. The close parallel shows how efficiently the sweeper uses its own weight and the pressure applied to it. The dotted part of the straight line diverges from the lower end of the curve, but this is not important because this part of the line represents brush pressures that would occur only if the operator lifted up on the handle. The pressures that occur in normal operation are those represented by the solid portion of the line, and, in this range, the parallel is very close.

Other inventions in the sweeper shown

Besides the main invention discussed above, the sweeper shown in the drawings contains some other inventions, which may be used in other sweepers without the main invention. One of these is the combination of a brush adjusting mechanism and oblique arms connecting the wheels to the mechanism so that the wheels always press against the brush as hard as they press against the floor, and another is the use of gear teeth to interconnect the brush, the wheels, the case, and the handle.

Other forms of the inventions

While only one form of the inventions has been shown and described in detail, the inventions illustrated by this specific form can be carried out in many other ways. Some of these other ways will be obvious from this specification, but others will require further invention. Some of these are disclosed in other pending applications, Serial Nos. 664,390 and 30,447, filed on April 23, 1946, and June 1, 1948. The patent which will include this specification will cover not only those various sweepers but also any sweeper that comes within any of the following definitions or "claims". The present application is a continuation of my application Serial No. 437,269, filed April 1, 1942, now abandoned.

I claim:

1. A floor and carpet sweeper having a case, a handle, a pair of floor wheels at each end of the case, a rotary brush extending lengthwise in the case, a friction pulley on each end of said brush and engaging the floor wheels for driving the brush as the sweeper is pushed along a floor or carpet, means for supporting the brush and the friction pulleys for free vertical movement through a definite range of movement relative to the wheels, means for dividing the weight of the sweeper between said wheels and said brush resting on the floor or carpet in one ratio throughout their range of movement whereby both the wheels and the brush can rest freely on the floor or carpet without any pressure being applied to the handle no matter whether the floor is hard and supports the wheels without yielding or whether the carpet is thick and soft enough to let the wheels sink down in below the level of the brush, and means for dividing any pressure applied to the sweeper by the handle between wheels and the brush in another ratio, the weight dividing means and the pressure dividing means being proportioned so that the percentage of the handle pressure applied to the brush is greater than the percentage of the sweeper weight carried by the brush.

2. In a carpet sweeper having a frame and a brush movable vertically with respect to the frame, a brush pivot carrier having gear teeth facing in opposite directions, and horizontally extending arms having gear teeth near their ends, the arms being pivoted to the frame of the sweeper on opposite sides of the brush pivot carrier and their gear teeth engaging the gear teeth on the brush pivot carrier for pushing the brush down.

3. In a carpet sweeper having a frame, wheels, and a brush movable vertically with respect to the frame and the wheels, a brush pivot carrier having gear teeth formed in its side edges, and a pair of horizontally extending arms having gear teeth formed in their ends, the gear teeth on the arms engaging the gear teeth on the brush pivot carrier and serving both to transmit forces from the arms to the brush pivot carrier and to guide the brush pivot carrier in a vertical path.

4. In the brush adjusting mechanism of a carpet sweeper having an end cover, a brush pivot carrier assembly including an upright brush pivot carrier formed of metal plate and having gear teeth on its side edges, an upright brush pivot spring formed of a strip of thin spring metal, and a brush pivot fixed to the spring, the carrier lying on the inside of the cover and the spring lying on the outside of the cover, the spring being fixed to the carrier through a slot in the cover, and the brush pivot extending from the spring through a slot in the cover.

5. In a carpet sweeper having a frame and a brush movable vertically with respect to the frame, an upright brush pivot carrier having gear teeth near one end and facing in opposite directions, means for guiding the other end of the carrier along an approximately vertical path, and horizontally extending arms having gear teeth near their ends, the arms being pivoted to the frame of the sweeper on opposite sides of the carrier and their gear teeth engaging the gear teeth on the carrier for moving the brush and guiding that end of the carrier.

6. In a carpet sweeper having a case with a sheet metal end cover formed to provide a channel extending up and down on the outside, a brush pivot blade spring lying in the channel, and a brush pivot fixed only to the blade spring, an inverted U-shaped sheet metal brush pivot carrier on the inside of the end cover with its center fastened to the upper end of the blade spring through a slot in the end cover and its two arms extending down along the inside of the end cover at the sides of the back of the channel, at least a portion of each of the two arms being offset towards the end cover so as to slide on the back of the end cover at the side of the back of the channel, and brush adjusting mechanism connected to the lower ends of the arms.

7. In a carpet sweeper, a case, a pair of wheels, a brush having a pulley located between and driven by the wheels, a wheel carrier freely movable down with respect to the case and connected to the wheels to move them down with it relative to the case, means for guiding the wheel carrier relative to the case and for preventing rocking of the case relative to the wheel carrier and the wheels, and means for pressing the wheel carrier down.

8. In a carpet sweeper having a frame, floor wheels carried by the frame, a rotary brush movable up and down with respect to the frame and driven by the wheels, and a handle pivot movable up and down with respect to the frame, a lever connected to the frame at one point and to the brush at another point and to the handle pivot at a third point between the first two points.

9. In a carpet sweeper that has a frame, four floor wheels carried by the frame, a rotary brush that can move practically straight up and down with respect to the frame and that is driven by the wheels, and a handle pivot that can move practically straight up and down with respect to the frame, a mechanism that connects the handle pivot to the frame and to the brush and that is made to make the brush move in the same direction relative to the frame as the handle pivot and to move further than the handle pivot.

10. In a carpet sweeper having wheels and a brush and a handle pivot, mechanism connected to the wheels and the brush and the handle pivot for moving the brush down relative to the handle pivot when the handle pivot is moved down relative to the wheels, the part of that mechanism connected most directly to one of the wheels being a swinging arm and a stub axle fixed to the arm, and the swinging arm and stub axle being a means for guiding that wheel relative to the rest of the mechanism in an oblique path extending up and towards the axis of the brush at an angle of approximately forty-five degrees to the horizontal.

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REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
383,806	Gore et al.	May 29, 1888
388,376	Ruton	Aug. 21, 1888
391,129	Drew	Oct. 16, 1888
397,102	Wiedersum	Jan. 29, 1889
539,445	Raymond	May 21, 1895
555,052	Raymond	Feb. 18, 1896
564,647	Raymond	July 28, 1896
580,190	Mayo	Apr. 6, 1897
600,413	Drew	Mar. 8, 1898
642,172	Sweitzer	Jan. 30, 1900
743,838	Duffy	Nov. 10, 1903
878,432	Totten	Feb. 4, 1908
914,438	Mason	Mar. 9, 1909
1,079,694	Deacon	Nov. 25, 1913
1,813,325	Smith	July 7, 1931
1,879,752	Kenyon	Sept. 27, 1932
1,925,354	White	Sept. 5, 1933
2,034,025	Cummins	Mar. 17, 1936
2,171,633	Pullen	Sept. 5, 1939
2,178,917	Pullen	Nov. 7, 1939
2,278,736	Poggensee	Apr. 7, 1942

FOREIGN PATENTS

Number	Country	Date
341,466	Germany	1921
441,175	Great Britain	1936