The present invention relates generally to knife sharpening devices and more particularly to a knife sharpening attachment for a cordless electric mixer.

In recent years, a large demand has developed for knife sharpening appliances. As a result of this demand, there are a number of small power driven knife sharpeners available on the market which are designed specifically for sharpening kitchen knives. These sharpeners are powered by small electric motors.

While they are effective in operation, the necessity for an electric motor, a switch and reduction gearing requires that the devices sell for a substantial amount of money.

In an effort to make available a low cost knife sharpener, many appliance manufacturers have introduced knife sharpening attachments which may be used in conjunction with household food mixers. Through the use of the food mixer as a power unit, it is possible to simplify the sharpener design considerably since it no longer need include the switch, the electric motor and the reduction gearing associated therewith. The unit need only contain the rotatable grinding wheel or wheels and a suitable housing to enclose them and support the power take-off shaft which is adapted to engage the spindle of the electric mixer. An example of this type of attachment is disclosed in the U.S. patent to Lindsay et al. No. 2,694,275.

Most of the attachments of this type hitherto known in the art have included only a single grinding wheel. In simplifying the attachment type sharpener as much as possible, designers have generally avoided the use of a second grinding wheel. When using a sharpener having a single grinding wheel, it is, of course, necessary to sharpen the two sides of a knife blade successively rather than sharpening both sides simultaneously. It would be desirable, therefore, to have a knife sharpening attachment in which grinding wheels are provided to sharpen both sides of the knife blade simultaneously.

Another well-known type of knife sharpener attachment is one which uses a stationary grinding wheel, one of which is driven and the other of which is spring biased against the first mentioned wheel to provide its rotation. Since the two wheels are in face-to-face contact, their abutting faces must be beveled to permit entry of the knife edge therebetween. Such an arrangement has many obvious limitations. The size and angle of the opening between the wheels will be determined largely by the wear which takes place at the face of the wheels. When a wide knife blade is inserted or a blade is pressed too far down into the opening between the wheels, the grinding wheel which is not positively connected to the drive means will cease to rotate and be ineffective in sharpening the knife.

In sharpening a knife, it is desirable to shape the cutting edge so that it has a narrow angle defined by the intersecting surfaces of the blade. Regardless of how the surfaces of two axially spaced grinding discs are shaped, it is difficult to obtain a well defined angle on the cutting edge which terminates at a sharp, even apex. To obtain this desired angle at the cutting edge, it is necessary to have the grinding surfaces overlapping so they define a sharp angle.

It has also been found that a grinding wheel in a knife sharpener should rotate in a particular direction with respect to the cutting edge of the knife. If the grinding wheel engages the blade back from the cutting edge and rotates toward the cutting edge, it will tend to produce a feather edge on the blade. Such an edge is very weak, dulls easily and is considered undesirable. It is, therefore, preferable to have the grinding wheels or discs moving in a direction from the cutting edge toward the back of the knife in the area of engagement.

It is, therefore, an object of the present invention to provide a simple, effective and compact knife sharpening attachment for use with a cordless electric mixer.

Another object of the invention is to provide a compact knife sharpening attachment having a pair of grinding wheels disposed to engage the cutting edge of a knife simultaneously.

A further object of the invention is to provide a knife sharpening attachment for a household mixer having a pair of grinding wheels which are inclined relative to each other so that they engage the cutting edge of a knife at a selected angle.

Yet another object of the invention is to provide an improved knife sharpening attachment having a pair of grinding wheels mounted on a housing with a flexible drive means interconnecting the wheels.

A further object of the invention is to provide an improved knife sharpening attachment having a pair of grinding wheels mounted for rotation with their axes inclined to one another and with one of the grinding wheels nested within the other and a flexible drive means interconnecting the two grinding wheels.

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.

For a better understanding of the present invention, reference may be had to the accompanying drawings in which:

FIG. 1 is a perspective view of the knife sharpening attachment in assembled relation to a household electric mixer;
FIG. 2 is a sectional view of the knife sharpening attachment taken along line 2—2 of FIG. 1;
FIG. 3 is an elevational view of the knife sharpening attachment taken along line 3—3 of FIG. 1;
FIG. 4 is a sectional view of the knife sharpening attachment taken along line 4—4 of FIG. 2; and
FIG. 5 is a sectional view of the knife sharpening attachment taken along line 5—5 of FIG. 4.

The present invention provides a knife sharpening attachment for a household electric mixer in which a pair of overlapping cup-shaped grinding wheels are mounted for rotation with their axes at an angle to one another. The angular disposition of the wheel axes results in the faces of the grinding wheels being inclined at a predetermined angle for engagement with the cutting edge of a knife. The grinding wheels are mounted with a flexible spring drivingly interconnecting them with one of the wheels being provided with a drive shaft which may be received in the spindle of an electric mixer. The general design of the cup-shaped grinding wheels is disclosed and claimed in copending Jeppson application Serial No. 755,624, filed August 18, 1958, now Patent No. 2,958,987, and assigned to the same assignee as the instant application.

There is shown in the drawings a knife sharpening attachment, generally designated by reference numeral 12, which is adapted to be assembled to and driven by a household electric mixer 13 as shown in FIG. 1. The knife sharpening attachment 12 includes a housing 14 which is made up of two cup-shaped plastic housing members 16 and 18. The two housing members 16 and 18...
form a somewhat spherical enclosure within which the sharpening mechanism is received. To secure the housing members 16 and 18 in abutting relationship, a pair of tangs 20 and 22 are utilized. The housing member 18 is provided with a pair of integrally formed locating projections 21 which extend into close fitting recesses in the housing member 16 to locate accurately the two housing portions relative to each other.

The plastic housing member 18 has several large projections that extend outwardly from the housing member 18 for engagement with the electric mixer 13. As can be seen in FIG. 2, the post 24 has a notch 24a formed thereon which seats against the side-wall of the electric mixer 13. It should be understood, however, that the projection 24 may engage any other suitable portion of the mixer to limit the relative rotation between the knife sharpening attachment 12 and the mixer 13. Nested within the annular grinding wheel 38 is a second grinding wheel 40 which is disposed at an angle to the grinding wheel 38. To relate drivingly the grinding wheel 40 and the drive shaft 30, a resilient helical spring member 42 is utilized as a flexible shaft connection. The helical spring 42 is formed of closely wound muslin wire so that it will form a strong, flexible connection. The inner end of drive shaft 30 has a threaded portion 30d formed thereon to engage threadedly one end of the spring 42. It should be understood that the threads 30d are in such a direction that the shaft 30 will tend to thread further the spring 42 hereafter. In one constructed embodiment, the drive shaft 30 was adapted to be rotated counterclockwise as viewed in FIG. 3 and the threads 30d were left-hand to assure the tightening of the threaded connection between the spring 42 and the drive shaft 30.

To support rotatably the grinding wheel 40 within the housing 14, a second bearing 44 is pressed into an inwardly extending plastic boss 16a which is molded integrally with the housing member 16 and has a bore or socket therein for receiving the bearing 44. Rotatably received within the journal bearing 44 is a stub shaft or hub member 46. The hub member 46 is a somewhat cylindrical member having a tapered hole 46d extending inwardly from one end. The tapered hole 46d is in communication with a cylindrical recess 46b. The tapered hole 46d and the recess 46b are necessary to provide clearance for the connecting spring 42 which extends into driving relation with the hub 46.

To effect the driving connection between the spring 42 and the hub 46, a splined screw member 48 is employed. The outer end of the screw member is formed with threads 48a onto which the spring 42 is threaded. The inner end of the screw connector 48 is formed with a splined or knurled portion 48b which is press fitted into a hole 46c in the hub 46.

To insure a smooth driving connection from the drive shaft 30 to the hub 46, the spring 42 is provided with a number of supporting balls 50 which are received within the turns of the spring 42 to prevent its collapse or misaligned deflection. The spring 42 with balls 50 positioned therein forms a suitable universal driving connection between the angularly disposed shafts 30 and 46.

The portion of the hub 46 which receives the grinding wheel 40 has formed thereon a cylindrical flange 46d and a cylindrical shoulder 46c. The cylindrical flange 46d abuts the rear face of the grinding wheel 40 while the cylindrical shoulder 46c is received in a hole 40b formed coaxially in the grinding wheel 40. A suitable cement is provided on a beater pin 48d to obtain a snug fit with the hub 46. In operation, the grinding wheels are urged outwardly as work is inserted between the wheels. Thrust washers 31 and 45 are positioned against the inner ends of bearings 34 and 44 to provide bearing surfaces for the cone-shaped member 36 and the hub 46 respectively to rotate against.

As can best be seen in FIG. 4, the axes of the grinding wheels 38 and 40 are inclined slightly to the horizontal, and faces 35b and 40b, respectively, of the grinding wheels are at a slight angle to each other. This angle will be the angle at which the cutting edge of the knife will be sharpened. As is explained in detail in the Jepson application No. 755,624, (now Patent No. 2,958,987) referred to above, it is desirable that in sharpening a knife the grinding wheel should move from the cutting edge toward the back of the knife. This prevents the building up of a feather edge along the cutting edge of the blade and is considered the most desirable way of sharpening a knife. The blade is desirably engaged to the strict engagement between the knife being sharpened and the grinding wheels so that the grinding wheels engage the blade only where the most desirable relative rotation between the blade and the grinding wheels is obtained.

The lip of the cup-shaped housing member 16 is notched out so that, upon assembly of the cup-shaped housing 3,088,268
member 18 thereto, a knife receiving slot 52 extends across most of the upper half of the housing 14. As can best be seen in FIGS. 2 and 4, the blade slot 52 is in alignment with the intersecting planes of the faces 38a and 40a of the grinding wheels 38 and 40. If the depth of the slot 52 were not limited to some extent, it can be appreciated that the knife blade could be made to engage the grinding wheels in such a way that the wheel would be, moving across, the blade would slide from the back of the blade toward the edge rather than in the opposite and more preferable direction. For this reason, the slot 52 has been formed so that its limits the engagement of the knife to the areas of the grinding wheels which produce the optimum sharpening results.

Turning to FIG. 5, we may note a line A—A, which represents the intersection of the plane of the faces 38a and 40a of the grinding wheels. The lines B—B and C—C represent the limiting positions of the knife or tool being sharpened. These positions are determined by the location of shoulders or stops 52a and 52b which define the end of the knife receiving slot 52. Along the line B—B the knife is in the position defined by the shoulder 52b and upwardly turning portions of the grinding wheels 38 and 40. By placing the stop 52a above the line of intersection A—A, the blade being sharpened may not be made to engage the grinding wheels where they are moving downwardly as viewed in FIG. 5. Similarly, when the knife is in the position defined by line C—C, it is in engagement with the shoulder 52a and the upwardly turning portions of the grinding wheels 38 and 40. Thus, the location of the shoulder 52b prevents the knife from engaging the grinding wheels 38 and 40 along the right-hand edge as shown in FIG. 5 where the direction of grinding engagement would be undesirable. The stop 52a merely prevents rotation of the blade downwardly to such an extent that it would not engage the smaller wheel 40 of the two grinding wheels.

The knife sharpening attachment 12 is particularly adapted for use with the portable type electric mixer or, alternatively, any electric mixer which is designed to be rested upon a table or countertop. Many of the current models of electric mixers have supporting portions provided at the rear end of the motor housing so that the housing may be rested upon an upended position on a flat surface. This permits easy insertion and removal of the beater elements as well as providing a convenient position for electrical connections and various other operations. Normally, when the mixer is in this upended position, the axes of the beater spindles are inclined slightly to the horizontal plane.

To permit knives to be sharpened in a vertical position, the drive shaft 30 has been angled downwardly with respect to the plane of the knife receiving slot 52 so that the motor housing 14 can best be seen in FIG. 4. Thus, when the drive shaft 30 is inserted into the spindle of an upended mixer, the knife receiving slot 52 will lie in a vertical plane which has been found to be most convenient for the average user.

While there has been shown and described one particular embodiment of the present invention, it will be apparent to those skilled in the art that various modifications may be made without departing from the invention in its broader aspects, and it is, therefore, aimed 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 is new and desired to be secured by Letters Patent of the United States is:

1. A knife sharpener comprising a drive shaft having a threaded end portion, a first annular grinding wheel, a cone shaped member supporting said first grinding wheel and secured to said drive shaft adjacent said threaded end portion, a second shaft spaced from one end of said drive shaft and having an axial bore with a threaded connector at the bottom of said bore, said second shaft extending angularly relative to said drive shaft, a second annular grinding wheel secured to said second shaft and positioned partially within said first annular grinding wheel, a flexible shaft extending from said thread end portion and said threaded connector to drivingly interconnect said drive shaft and said second shaft.

2. A knife sharpener comprising a split housing of molded plastic material having an external boss having a bore therethrough, said housing also having an internal boss disposed at an angle relative to said external boss and having a bore therein, a drive shaft journaled in said external boss, a driven shaft journaled in said internal boss and having an outer flange and an inner socket, an inner annular grinding wheel secured on and secured to said flange, a cup-shaped member secured to said drive shaft in said housing, an outer annular grinding wheel secured on and secured to said member in a position overlapping a portion of said inner grinding wheel, and a coiled flexible shaft seated at one end in said socket and secured thereto and extending over the adjacent end of said drive shaft and secured thereto.

3. A knife sharpener comprising a housing having a knife molded plastic material having an external boss having a bore therethrough, said housing also having a keying peg parallel with said boss, a web connecting said peg and said boss, said housing also having an internal boss disposed at an angle relative to said external boss and having a bore therein, a drive shaft journaled in said external boss, a driven shaft journaled in said internal boss, said driven shaft having an axially extending socket formed therein, an inner annular grinding wheel seated on and secured to said driven shaft, a cup-shaped member secured to said drive shaft in said housing, an outer annular grinding wheel seated on and secured to said member in a position overlapping a portion of said inner grinding wheel, and a coiled flexible shaft seated at one end in said socket and secured thereto and extending over the adjacent end of said drive shaft and secured thereto.

4. A knife sharpening attachment for use with a housing having a knife receiving slot between said members, means for forming a split boss in said housing and a knife receiving slot between said members, a bearing boss molded integrally with each of said members, each boss having a bore extending therethrough, bearings mounted in said bores, a drive shaft journaled in said bearings and extending through the wall of said housing, a driven shaft journaled in said bearings and extending in a direction substantially parallel with said housing, a coiled spring secured to the inwardly directed ends of said shafts to drivingly interconnect said shafts, a first annular grinding wheel secured to said driven shaft, a second annular grinding wheel secured to said drive shaft by a cone-shaped supporting member, the outside diameter of said first wheel being less than the inside diameter of said second wheel, said first wheel being partially received within said second wheel whereby the faces of said wheels define an acute angle for receiving a knife to be sharpened.

6. A knife sharpening attachment for use with an
electric mixer comprising a pair of cup-shaped members secured together to form a spherical housing with a knife receiving slot therein, journal bearings secured to each cup-shaped housing member, a drive shaft mounted for rotation in one of said bearings with one end extending outside of said housing, a cone-shaped grinding wheel support secured to the inner end of said drive shaft and extending coaxially therefrom, a first annular grinding wheel secured to said cone-shaped support and rotatable in a plane intersecting the plane of said slot, a stub shaft journaled for rotation in the other of said bearings, a second annular grinding wheel secured to said stub shaft coaxially therewith, said second grinding wheel being nested within said first grinding wheel, the line of intersection of the planes of the grinding faces of said wheels lying in the same plane and intersecting with a line connecting the bottom ends of said slot, and flexible drive means interconnecting said drive shaft and said stub shaft.

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