CLAIMS

What is claimed is:

1. A handle for a small electric hand-held appliance, the handle comprising:

a motor assembly (100) disposed in the handle, the motor assembly (100) comprising:

a generally L-shaped magnetic yoke (102) formed from two substantially perpendicular surfaces, wherein the two substantially perpendicular surfaces define a concave receiving portion; and

an iron core (110) and a coil winding (106) disposed substantially in the concave receiving portion,

wherein the iron core (110) and the coil winding (106) are free from contact with one of the two substantially perpendicular surfaces when the motor assembly (100) is at rest.

2. The handle of claim 1, wherein the motor assembly further comprises at least one magnet disposed substantially in the concave receiving portion.

3. The handle of claim 2 that has one or more of the following features:

(i) wherein the at least one magnet and the iron core are free from contact such that a first gap is formed, the at least one magnet and the generally L-shaped magnetic yoke are free from contact such that a second gap is formed, and the first gap and the second gap are substantially perpendicular to each other;

(ii) wherein the at least one magnet and the iron core are free from contact such that a first gap is formed, the at least one magnet and the generally L-shaped magnetic yoke are free from contact such that a second gap is formed, and the first gap and the second gap form an angle therebetween of about 60 degrees to about 120 degrees.

4. The handle of any of the preceding claims, wherein the motor assembly further comprises a back iron disposed substantially in the concave receiving portion.

5. The handle of claim 4 that has one or more of the following features:

(i) wherein the back iron is free from contact with the iron core;

(ii) wherein the back iron is coupled to and disposed above the at least one magnet;

(iii) wherein the back iron is free from contact with the generally L-shaped magnetic yoke;

(iv) wherein the motor assembly further comprises a mass coupled to the back iron, wherein the mass is a non-magnetic material.

6. The handle of any of the preceding claims, wherein the motor assembly further comprises a leaf spring coupled to the generally L-shaped magnetic yoke, wherein the leaf spring is configured to define a resonant frequency of the motor assembly.

7. The handle of claim 6 that has one or more of the following features:

(i) wherein the leaf spring is generally U-shaped;

(ii) wherein the leaf spring only contacts a portion of the generally L-shaped magnetic yoke such that the leaf spring is free of contact from one of the two substantially perpendicular surfaces of the generally L-shaped magnetic yoke.

8. The handle of any of the preceding claims, wherein the motor assembly is resonant.

9. The handle of any of the preceding claims, wherein the motor assembly further comprises a mass coupled to the back iron, wherein at least one of the mass and the back iron is a soft magnetic material.

10. The handle of claim 9 that has one or more of the following features:

(i) wherein the mass is configured to define a resonant frequency of the motor assembly;

(ii) wherein a resulting force of the motor assembly is substantially linear with a deflection of the mass.

11. The handle of any of the preceding claims that has one or more of the following features:

(i) wherein the motor assembly further comprises a mount coupled to an exterior of one of the two substantially perpendicular surfaces of the generally L-shaped magnetic yoke and to the iron core such that the mount is not disposed within the concave receiving portion;

(ii) wherein the motor assembly is configured to apply a linear vibration along a longitudinal axis of the handle;

(iii) wherein the motor assembly is accommodated in a portion of the handle having a diameter less than about 7 mm;

(iv) wherein a frequency of the motor assembly is about 50 Hz to about 500 Hz.

Claims

1. A small electric hand-held appliance, the small electric hand-held appliance comprising:

a handle having a longitudinal axis

a motor assembly (100) disposed in the handle, the motor assembly (100) comprising:

a generally L-shaped magnetic yoke (102) formed from two substantially perpendicular surfaces, wherein the two substantially perpendicular surfaces define a concave receiving portion; and

an iron core (104) and a coil winding (106) disposed substantially in the concave receiving portion,

a mass disposed above the iron core and the coil winding, the mass being free of contact with the generally L-shaped magnetic yoke,

wherein the iron core (104) and the coil winding (106) are free from contact with one of the two substantially perpendicular surfaces when the motor assembly (100) is at rest, during use the motor assembly applies a linear vibration to the mass along the longitudinal axis of the handle. .

2. The small electric hand-held appliance of claim 1, wherein the motor assembly further comprises at least one magnet disposed substantially in the concave receiving portion.

3. The small electric hand-held appliance of claim 2 that has one or more of the following features:

(i) wherein the at least one magnet and the iron core are free from contact such that a first gap is formed, the at least one magnet and the generally L-shaped magnetic yoke are free from contact such that a second gap is formed, and the first gap and the second gap are substantially perpendicular to each other;

(ii) wherein the at least one magnet and the iron core are free from contact such that a first gap is formed, the at least one magnet and the generally L-shaped magnetic yoke are free from contact such that a second gap is formed, and the first gap and the second gap form an angle therebetween of about 60 degrees to about 120 degrees.

4. The small electric hand-held appliance of any of the preceding claims, wherein the motor assembly further comprises a back iron disposed substantially in the concave receiving portion.

5. The small electric hand-held appliance of claim 4 wherein the back iron is free from contact with the iron core.

6. The small electric hand-held appliance of any of the preceding claims, wherein the motor assembly further comprises a leaf spring coupled to the generally L-shaped magnetic yoke, wherein the leaf spring is configured to define a resonant frequency of the motor assembly.

7. The small electric hand-held appliance of claim 6 wherein the leaf spring is generally U-shaped.

8. The small electric hand-held appliance of any of the preceding claims, wherein the motor assembly is resonant.

9. The small electric hand-held appliance of claim 1 wherein the mass is configured to define a resonant frequency of the motor assembly.

10. The small electric hand-held appliance of any of the preceding claims wherein a frequency of the motor assembly is about 50 Hz to about 500 Hz.