Jan. 31, 1956 A. HAKANSON 2,732,726

GEARING

Filed July 23, 1951

FIG. 1.

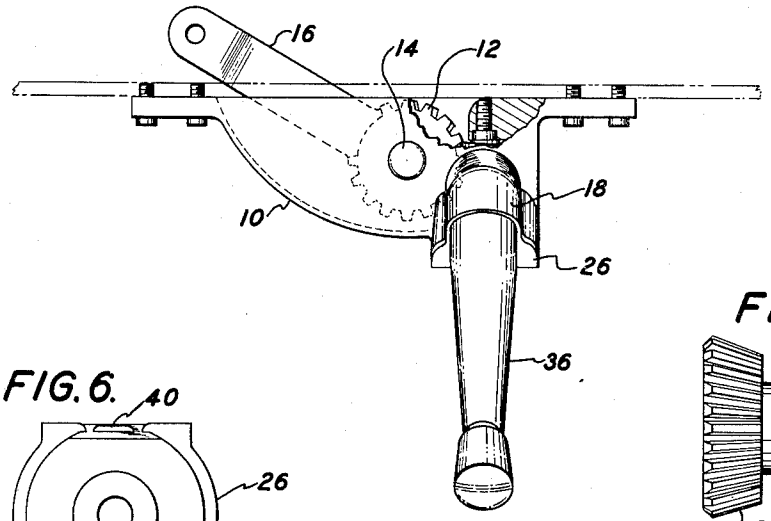


FIG. 5.

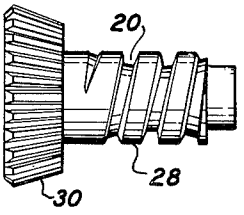


FIG. 6.

FIG. 2.

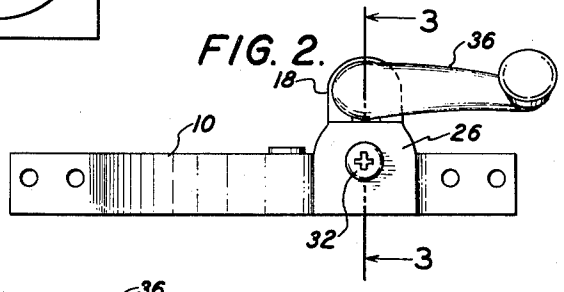


FIG. 3.

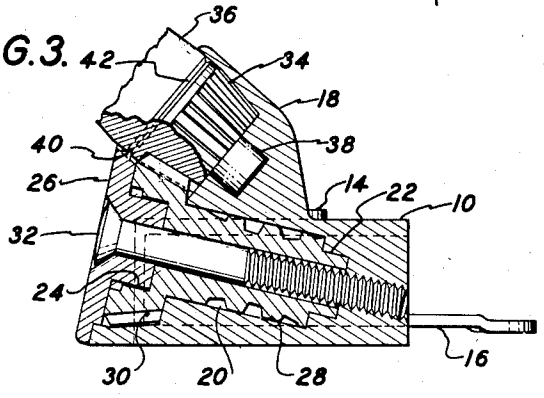
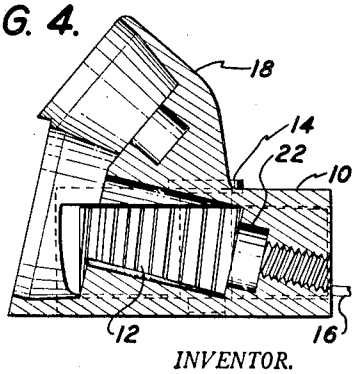


FIG. 4.



INVENTOR.
ALFRED HAKANSON

BY

ATTORNEY

United States Patent Office

2,732,726

Patented Jan. 31, 1956

2,732,726

GEARING

Alfred Hakanson, San Gabriel, Calif.

Application July 23, 1951, Serial No. 238,172

4 Claims. (Cl. 74—425)

This invention relates to an improved lever-type window opener having a drive shaft which extends at a large angle with respect to the plane of rotation of the lever which actuates the window.

Window openers are ordinarily employed to open and close windows which are supported by means of hinges mounted along one of the vertical sides of the window, and it is usually preferable that such window openers be located at or near the bottom of the window. In a conventional arrangement the drive shaft of the window opener is inclined at a large angle with respect to the plane of rotation of the window-operating lever so that the apparatus may be conveniently operated by a person from a standing position, and so that a short crank employed to actuate the drive shaft will not strike the window sill when it is rotated.

Conventional window openers ordinarily employ a lever carrying a driven worm gear, both the lever and the gear being rotated about a vertical axis. A drive shaft carries a worm which engages the driven worm gear, and a crank is formed on the end of the drive shaft. In order to permit the crank to be operated easily by a person who is standing, the shaft which carries the crank should be inclined at a large angle with respect to the plane of rotation of the driven worm gear and the lever. Such a large angle between the axis of the shaft and the plane in which the driven worm gear is rotated causes large frictional losses. These frictional losses result in excessive wear on the worm gear and make the crank hard to turn. Since extremely large shaft angles are not practical in such an arrangement, the shaft which extends the crank away from the window opener must be long in order to prevent the crank from striking the window sill.

These difficulties are overcome in the present invention by providing a worm gear arrangement wherein the shaft which carries the worm is located substantially in the plane of rotation of the driven worm gear so as to minimize frictional losses, and by providing a pair of bevel gears for actuating the worm, so that the shaft of the crank which is connected to one of the bevel gears, may extend at a large angle with respect to the plane of rotation of the driven worm gear. Preferably, the bevel gears provide a gear reduction so that the crank may be rotated with great ease.

The invention will be more fully understood from the following description and the drawings, wherein:

Fig. 1 is a plan view, partially broken away, of a preferred form of the apparatus of the invention;

Fig. 2 is an elevational view of the apparatus of Fig. 1;

Fig. 3 is a sectional view along the line 3—3 of Fig. 2;

Fig. 4 is the sectional view shown in Fig. 3, with the driving gears removed;

Fig. 5 shows the worm and the bevel gear which is attached thereto; and

Fig. 6 shows the closure cap which is employed to hold the driving gears in place.

Referring to the drawings, a housing **10** is employed

to support the window opening apparatus. A driven worm gear **12** is rotatable about a pin **14** which extends at right angles to and between two parallel walls of the housing **10**. A window actuating lever **16** is rigidly connected to the driven worm gear **12**, and the lever **16** is preferably an integral part thereof.

The driving gears for the window opener are mounted in a protrusion **18** in the housing **10**. A shaft **20** is located in an opening in the protrusion **18**, and the shaft **20** is rotatably supported by means of a bearing **22** in the housing **10** and a bearing **24** in a closure plate **26**. The shaft **20** has a worm **28** thereon which engages and serves to drive the worm gear **12**. The shaft **20** also has a bevel gear **30** thereon which tapers toward the worm **28**.

A screw **32** serves to secure the closure plate **26** to the protrusion **18** in the housing **10**.

A bevel gear **34** is located in another opening in the protrusion **18**, and it serves as a driving means for the bevel gear **30**. A crank **36** is connected to the bevel gear **34**, and the crank **36** serves to operate the window opener. The bevel gear **34** and the shaft of the crank **36** which is connected to the bevel gear **34** are rotatably secured in the opening in the protrusion **18** of the housing by means of a bearing **38** located in the protrusion **18**, and a protrusion **40** on the closure plate **26** which engages an annular groove **42** located around the shaft of the crank **36**.

Since the bevel gears **30** and **34** taper toward the shaft **20**, the shaft **20** may be located in the plane of rotation of the worm gear **12** and still permit the end of the shaft of the crank **36** which is connected to the bevel gear **34**, to be inclined at a large angle with respect to the plane of rotation of the worm gear **12**. However, it is preferable that the shaft **20** be inclined at a small angle with respect to the plane of rotation of the worm gear **12** in order to minimize the size of the housing **10**.

The sectional view shown in Fig. 3 illustrates a preferred embodiment of the invention wherein the shaft **20** is disposed substantially in the plane of rotation of the worm gear **12**. With such an arrangement, the frictional losses are slight and the teeth of the worm gears do not become excessively worn after they have been used extensively. Since the frictional losses are minimized, the window opener may be operated with great ease. Also, the bevel gear **30** is preferably larger than the bevel gear **34** so as to provide a gear reduction and thereby permit the crank **36** to be rotated with greater ease.

I claim:

1. In combination, a housing having a pair of spaced parallel walls and a protrusion thereon having first and second openings therein, a pin connected to said walls and extending at right angles therebetween, a worm gear rotatable around said pin, a shaft having a worm thereon which engages said worm gear, the axis of said shaft being disposed substantially in the plane of rotation of said worm gear, a first bevel gear rigidly connected to said shaft and tapering toward the worm thereon, said shaft and said first bevel gear being located within the first of said openings, a second bevel gear located within the second of said openings and engaging said first bevel gear and tapering toward said worm, a drive shaft connected to said second bevel gear, the portion of said drive shaft adjacent said second bevel gear having an annular groove therein, and a closure plate for said first opening having a portion thereof which engages the annular groove in said drive shaft.

2. A window opener comprising a housing having a pair of spaced parallel walls and a protrusion thereon having first and second openings therein, a pin connected to said walls and extending at right angles therebetween, a worm gear rotatable around said pin, a lever rigidly connected to said worm gear, a shaft having a worm

thereon which engages said worm gear, the axis of said shaft being disposed substantially in the plane of rotation of said worm gear, a first bevel gear rigidly connected to said shaft and tapering toward the worm thereon, said shaft and said first bevel gear being located within the first of said openings, a second bevel gear being located within the second of said openings and engaging said first bevel gear and tapering toward said worm, a crank rigidly connected to said second bevel gear, the portion of said crank adjacent said second bevel gear having an annular groove therein, a removable closure plate for said first opening having a portion thereof which engages the annular groove in said crank, and a bolt extending through the closure plate and through an axial bore in the shaft which carries the worm, the bolt and closure plate serving to secure said shaft and said crank to the housing.

3. A window opener comprising a housing having a pair of spaced parallel walls and a protrusion thereon having first and second openings therein, said openings communicating with one another and said first opening communicating with the space between said parallel walls, a pin connected to said walls and extending at right angles therebetween, a driven worm gear rotatable around said pin, a lever rigidly connected to said driven worm gear, a shaft having a worm thereon which engages said driven worm gear, the axis of said shaft being disposed substantially in the plane of rotation of said driven worm gear, a first bevel gear rigidly connected to said shaft and tapering toward the worm thereon, said shaft and said first bevel gear being located within the first of said openings, a second bevel gear located within the second of said openings and engaging said first bevel gear and tapering toward said worm, the axes of said first and second bevel gears being located in a plane which is at right angles to the plane of rotation of said driven worm gear, a crank rigidly connected to said second bevel gear, the portion of said crank adjacent said second bevel gear having an annular groove therein, and a removable closure plate for said first opening having a portion thereof which engages the annular groove in said crank.

4. In combination, a housing having a pair of spaced parallel walls and a protrusion thereon having first and second openings therein, a pin connected to said walls and extending at right angles therebetween, a worm gear rotatable around said pin, a shaft having a worm thereon which engages said worm gear, the axis of said shaft being disposed substantially in the plane of rotation of said worm gear, a first bevel gear rigidly connected to said shaft and tapering toward the worm thereon, said shaft and said first bevel gear being located within the first of said openings, a second bevel gear located within the second of said openings and engaging said first bevel gear and tapering toward said worm, a drive shaft connected to said second bevel gear, and a closure plate for said first opening.

References Cited in the file of this patent

UNITED STATES PATENTS

1,323,848	Esa	Dec. 2, 1919
1,328,670	Head	Jan. 20, 1920
1,473,691	Young	Nov. 13, 1923
2,220,537	Murrin	Nov. 5, 1940
2,373,197	Ostrander	Apr. 10, 1945

FOREIGN PATENTS

438,315	Great Britain	Nov. 14, 1935