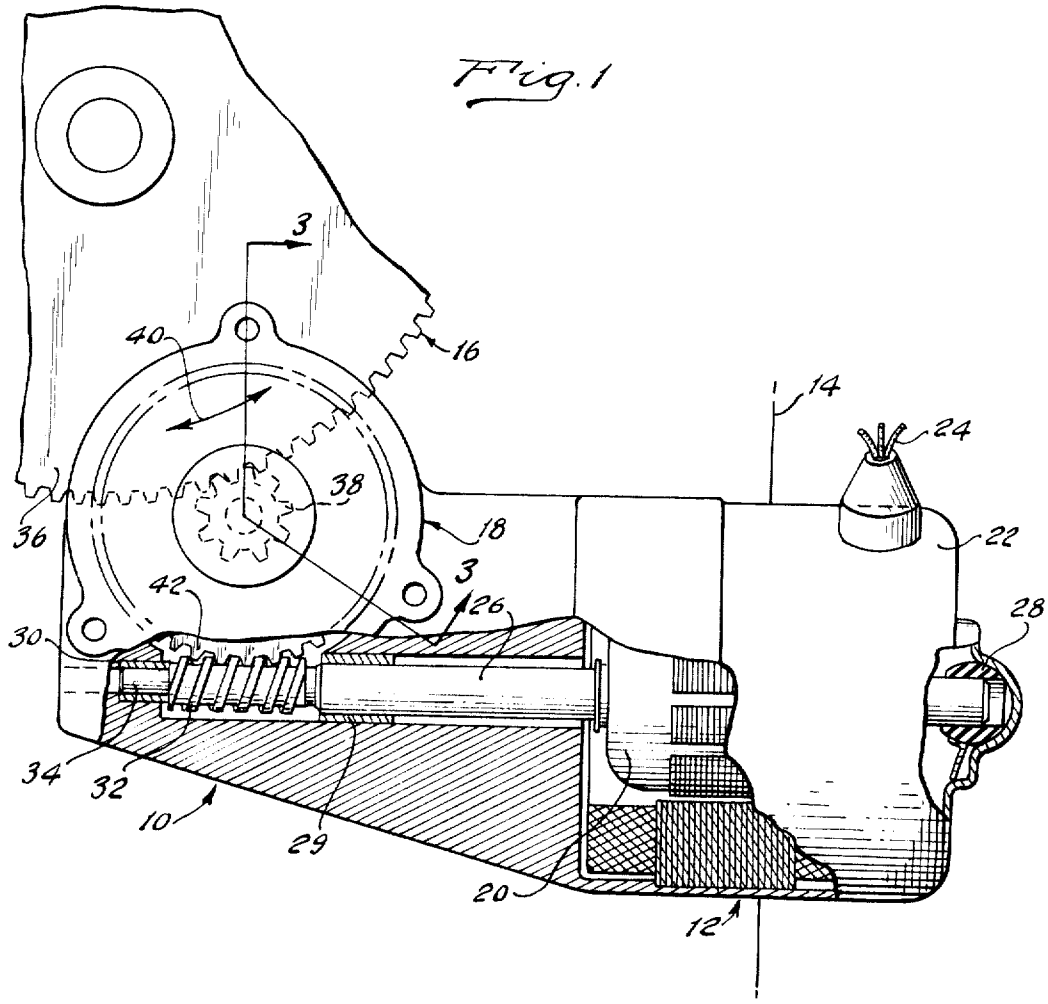
March 5, 1968 J. PICKLES Re. 26,356

WINDOW LIFT GEAR

Original Filed Nov. 27, 1962 2 Sheets-Sheet 1

Fig. 1



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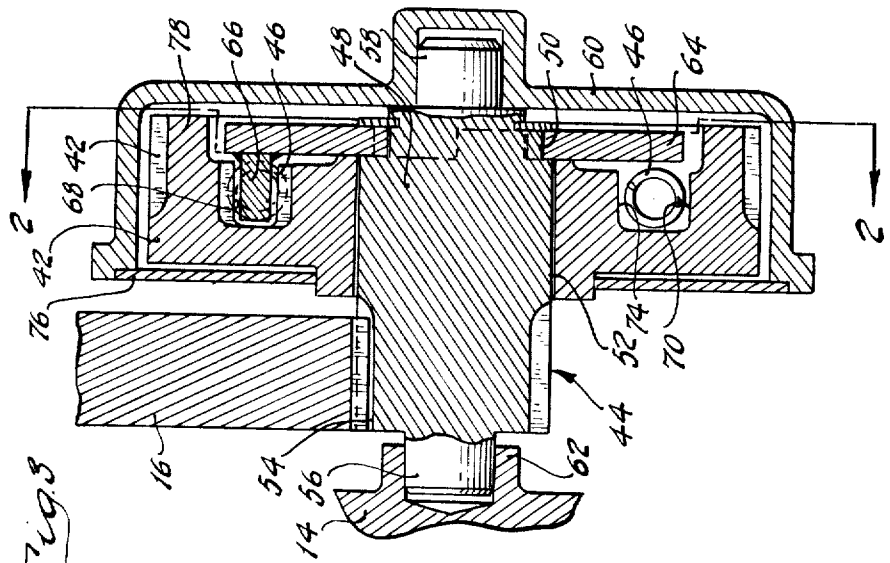

Fig. 3

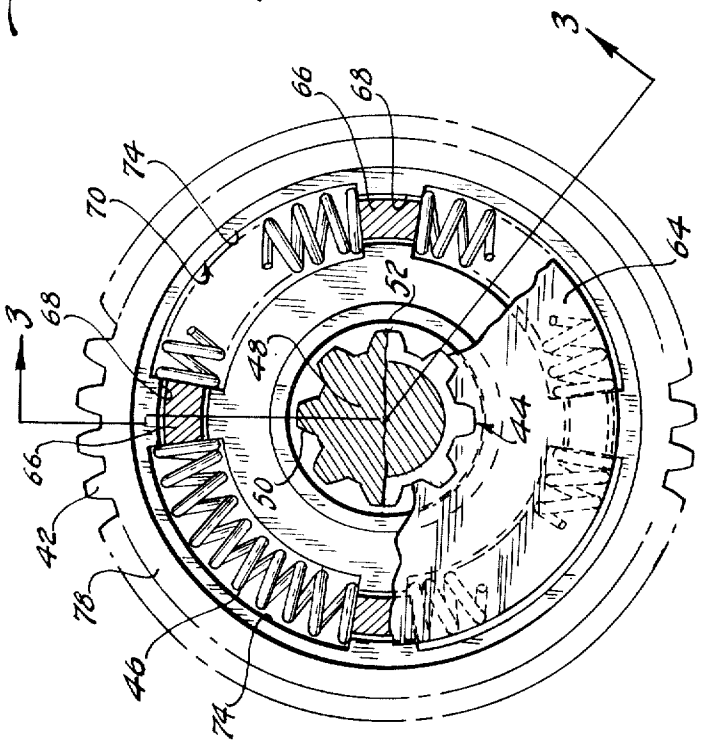

Fig. 2

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WINDOW LIFT GEAR

Joseph Pickles, Bloomfield Hills, Mich., assignor to Ferro Stamping Company, Detroit, Mich., a corporation of Michigan

Original No. 3,208,298, dated Sept. 28, 1965, Ser. No. 240,275, Nov. 27, 1962. Application for reissue July 12, 1967, Ser. No. 661,144

9 Claims. (Cl. 74—411)

Matter enclosed in heavy brackets [ ] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue.

The invention relates to yieldable couplings and refers more specifically to a gear coupling between window drive means and window moving linkage which is yieldable only after a predetermined torque is applied thereto whereby substantially uniform window motion may be effected on actuation of the window drive means while yielding of the gear coupling is permitted at the limits of window travel to prevent jamming thereof.

In the past yieldable couplings have been known for use in conjunction with power operated automobile windows or similar structure wherein yielding of the coupling between the linkages providing window movement and the window drive means is necessary to prevent jamming of the structure at the ends of the travel thereof due to inertia of the drive means. Prior known yieldable couplings have consisted of elastic material such as rubber so arranged in a coupling that on any variation in the force applied to the coupling, compression of the elastic material has taken place.

Thus with the prior yieldable couplings the yielding of the coupling has been proportional to the resistance offered to movement of the driven object. A jerky or non-uniform movement of the driven object may therefore result due to use of the prior known yieldable couplings. For example, during opening and closing of automobile windows driven through prior known flexible couplings, each time the pressure on the window resisting opening or closing thereof is varied the speed of movement of the window in an open or closed direction will increase or decrease depending on the direction of change of resistance to movement thereof.

It is therefore one of the objects of the present invention to provide an improved yieldable coupling for use in conjunction with power operated vehicle windows and the like.

Another object is to provide a yieldable coupling which is yieldable only after a predetermined torque has been applied thereto.

Another object is to provide power operating mechanism for vehicle windows or the like including a yieldable coupling positioned between window drive means and window moving linkage for uniformly driving the window moving linkage at torques below a predetermined torque to produce uniform window movement and yieldable at torques above the predetermined torque whereby jamming of the window is prevented at the limits of the travel thereof.

Another object is to provide structure as set forth above wherein the yieldable coupling comprises a driven gear having an annular recess in one side thereof, prestressed resilient means within said annular recess and a driving pinion including portions exteding into said anular recess and engaged with said resilient means therein whereby the prestressed resilient means urges said pinion into a predetermined position with respect to said gear.

Another object is to provide an improved yieldable coupling which is simple in construction, economical to manufacture and efficient in use.

Other objects and features of the invention will become apparent as the description proceeds, especially when taken in conjunction with the accompanying drawings, illustrating a preferred embodiment of the invention, wherein:

FIGURE 1 is a partly broken away elevation view of a portion of vehicle window power lift structure including a yieldable coupling constructed in accordance with the invention.

FIGURE 2 is an enlarged elevation view of the yieldable coupling portion of the window lift structure illustrated in FIGURE 1 disengaged from the driving pinion and removed from the housing therefor.

FIGURE 3 is an enlarged partial section view of the flexible coupling portion of the window lift structure illustrated in FIGURE 1 taken substantially on the line 3—3 in FIGURE 1.

With particular reference to the figures of the drawing one embodiment of the present invention will now be considered in detail.

The vehicle window lift structure **10** shown in FIGURE 1 comprises the automatic window drive means **12** secured to a vehicle door panel **14** by convenient means (not shown), the window moving linkage **16** for moving the vehicle door window (not shown) to produce movement thereof up and down in accordance with the direction of operation of the drive means **12** and the yieldable coupling **18** positioned between the window drive means **12** and linkage **16**.

In operation the drive means **12** is actuated in opposite directions to drive the window moving linkage **16** at a substantially uniform speed through the yieldable coupling **18** until a predetermined torque is applied to the coupling. After a predetermined torque is applied to the yieldable coupling **18** it yields to prevent jamming of the vehicle window lift structure.

More specifically drive means **12** comprises the reversible electric motor **20** mounted on door panel **14** in housing **22**. Electric motor **20** is operable on being energized by electrical energy over conductors **24** from a source of electrical energy (not shown) to produce rotation of motor shaft **26** mounted in bearings **28**, **29** and **30** in housing **22**. Rotation of motor shaft **26** thus produces rotation of worm **32** secured to the end **34** of motor drive shaft **26** for rotation therewith.

Window linkage **16** is indicated graphically by the sector **36** shown engaged with the driving pinion **38** of the yieldable coupling **18**. It will be understood that the linkage **16** includes a plurality of pivots and levers such as are usual in vehicle window lift structures connected to the sector to produce up or down movement of a window associated therewith on movement of the sector **36** in the direction of arrows **40** on rotation of driving pinion **38**. Such window linkages are known and will not therefore be considered in detail herein.

The yieldable coupling **18** of the invention includes the worm gear **42** rotatably mounted on the pinion mechanism **44**, pinion mechanism **44** and the springs **46** operable between the worm gear **42** and pinion mechanism **44**, as best shown in FIGURES 2 and 3.

The pinion mechanism **44** comprises a shaft **48** having different diameter spline, bearing and pinion portions **50**, **52** and **54** positioned between the ends **56** and **58** thereof, as best shown in FIGURE 3. The opposite ends **56** and **58** of the shaft **48** are journaled for rotation in the housing cover **60** and bearing **62**. Bearing **62** may for example be secured to the door panel **14**.

The plate **64** is splined to the spline portion **50** of the shaft **48** for rotation with the shaft **48** and is provided with a plurality of torque transferring tabs **66** extending substantially perpendicularly thereto and into the por-

tions **68** of the annular recess **70** in the worm gear **42**, as shown in FIGURE 3. The tabs **66** are of relatively short circumferential extent, as indicated in FIGURE 2 and extend between the ends of the resilient means **46** positioned in the portions **74** of the annular recess **70** in the worm gear **42**.

Worm gear **42** is rotatably received on the bearing portion **52** of the shaft **48** of the pinion mechanism **44** while the sector **36** is engaged with the driving pinion portion **54** of the shaft **48** of the pinion mechanism **44**.

The worm gear **42** which, as indicated above, is rotatably supported on the bearing portion **52** of the shaft **48** in turn supports the housing portion **76** engageable with the housing cover **60** to substantially enclose the worm gear **42** and is in driven engagement with the worm **32** as best shown in FIGURE 1. Worm gear **42**, as previously indicated, includes the annular recess **70** in the side **78** thereof having the larger portions **74** and the smaller portions **68**.

The coil springs **46** are positioned within the larger portions **74** of the recess **70** as previously indicated. As installed the springs **46** abut the ends of the portions **74** of the recess **70** and are prestressed whereby on rotation of the worm gear **42** torque is transferred directly to the plate **64** through the engagement of tabs **66** thereon with the ends of the springs **46** at torque forces insufficient to overcome the prestressing of the springs **46**. Yielding between the plate **64** and therefore the pinion portion **54** of the shaft **48** of pinion mechanism **44** and the worm gear **42** will occur when the torque applied therebetween exceeds the prestressing of the springs **46**.

The materials of which the flexible coupling **18** is constructed may vary. In one particular instance the pinion mechanism **44** has been constructed entirely of metal while the worm gear **42** has been plastic, such as Delrin or nylon.

In operation, assuming it is desired to rotate the sector **36** in a clockwise direction to raise a vehicle window connected thereto, the electric motor **20** is energized through appropriate switches (not shown) to rotate the worm **32** in a direction to cause the desired clockwise motion of the sector **36**. Worm gear **42** is thus caused to rotate and to transfer torque from the motor drive shaft **26** to the pinion portion of the shaft **48** of the pinion mechanism **44** through the prestressed springs **46** abutting against the ends of the portions **74** of the annular recess **70**, the tabs **66** on the plate **64** abutting the ends of spring **46** and the plate **64** splined to the portion **50** of the shaft **48**.

Uniform upward movement of a window associated with the sector **36** will then occur until an obstruction is encountered thereby which is sufficient to overcome the prestressing of the springs **46**. When such obstruction is encountered by the window associated with the sector **36** the worm gear **42** will be rotated relative to the plate **64** to compress the springs **46** in the portions **74** of the recess **70**.

Thus it will be seen that with proper prestressing of the springs **46** that the usual variations of stresses encountered in raising and lowering vehicle windows will produce no relative rotation between the plate **64** and worm gear **42** so that uniform movement of the window up or down may be accomplished. The relatively greater torque applied between the plate **64** and worm gear **42** due to inertia of the motor **20** and sudden limiting of the movement of the window due to full opening or full closing thereof will produce relative rotation between the plate **64** and worm gear **42** to relieve stresses in the coupling which might otherwise produce jamming of the window structure.

While one embodiment of the present invention has been considered in detail it will be understood that other embodiments and modifications thereof are contemplated. It is therefore the intention to include within the scope

of the invention all embodiments and modifications thereof defined by the appended claims.

What I claim as my invention is:

1. A yieldable coupling for use in conjunction with a window lift gear or the like operable to automatically raise and lower a window in response to operation of a reversible electric motor comprising a shaft having a bearing stub at each end thereof and including a pinion portion adjacent one end, a centrally located bearing portion and a reduced diameter splined other end portion, said pinion portion of said shaft being adapted to mesh with the window lift gear, a worm gear rotatably mounted on the central portion of said shaft adapted to be driven in opposite directions by the reversible electric motor including a first recess in one side thereof having a bottom formed by a portion of said worm gear and an annular recess in the portion of the gear forming the bottom of said first recess including alternate angularly spaced apart large and small portions, an annular plate including internal splines sleeved over and splined to the other end of said shaft is positioned within said first recess and includes tabs extending from one side thereof into the small portions of said annular recess and coil springs positioned within the large portions of the annular recess abutted against the opposite ends of said large portions for producing rotation of said plate and shaft on rotation of said worm gear, and means for rotatably supporting the bearing stubs at the opposite ends of said shaft.

2. A yieldable coupling for use in conjunction with a window lift gear or the like operable to automatically raise and lower a window in response to operation of a reversible electric motor comprising a shaft having a bearing stub at each end thereof and including a pinion portion adjacent one end, a centrally located bearing portion and a reduced diameter splined other end portion, said pinion portion of said shaft being adapted to mesh with the window lift gear, a worm gear rotatably mounted on the central portion of said shaft adapted to be driven in opposite directions by the reversible electric motor including an annular recess in one side thereof having alternate angularly spaced apart large and small portions, an annular plate including internal splines sleeved over and splined to the other end of said shaft and including tabs extending from one side thereof into the small portions of said annular recess and coil springs positioned within the large portions of the annular recess abutted against the opposite ends of said large portions for producing rotation of said plate and shaft on rotation of said worm gear, and means for rotatably supporting the bearing stubs at the opposite ends of said shaft.

3. A yieldable coupling comprising a rotatably mounted shaft including a pinion portion adjacent one end, a centrally located bearing portion and a reduced diameter splined other end portion, a worm gear rotatably mounted on the central portion of said shaft adapted to be driven in opposite directions including an annular recess in one side thereof having alternate angularly spaced apart large and small portions, an annular plate including internal splines sleeved over and splined to the other end of said shaft and having tabs extending from one side thereof into the small portions of said annular recess and coil springs positioned within the large portions of the annular recess abutted against the opposite ends of said large portions for producing rotation of said plate and shaft on rotation of said worm gear.

4. A yieldable coupling comprising a shaft having a central bearing portion between a splined end portion and a pinion end portion, a worm gear rotatably mounted on the bearing portion of said shaft having a recess in one side thereof, an annular plate having internal splines thereon sleeved over the shaft with the internal splines engaged with the external splines on the splined portion of said shaft and positioned within said recess in said worm gear, and resilient means within said recess and operable

between the annular plate and worm gear for transmitting torque therebetween.

5. Structure as set forth in claim 4 wherein the resilient means is a prestressed spring.

6. A yieldable coupling comprising a shaft having a pinion portion, a bearing portion and a splined portion, a worm gear rotatably mounted on the bearing portion of said shaft and having an annular recess therein having angularly spaced apart alternate large and small portions, an annular plate having internal splines thereon sleeved over the shaft with the internal splines engaged with the external splines on splined portion of said shaft and including a plurality of tabs extending therefrom into the small portions of the recess in the worm gear and individual coil springs positioned within the large portions of said recess in abutment with the ends of said large portions for transmitting torque between the worm gear and plate.

7. A yieldable coupling comprising a worm gear having a recess in one side thereof, a pinion member positioned within and extending out of the worm gear, and resilient means within said recess operable between the worm gear and pinion member for transmitting torque therebetween.

8. A yieldable coupling comprising a shaft having a bearing portion, a splined end portion and a pinion end portion, a worm gear rotatably mounted on the bearing portion of said shaft having a recess in one side thereof, and resilient means positioned entirely within said recess and operable between the shaft and worm gear for transmitting torque therebetween.

9. A yieldable coupling comprising a worm gear having a recess in one side thereof, a pinion positioned immediately adjacent the worm gear, pinion supporting means positioned within said worm gear fixed to the pinion for rotation with the pinion and rotatably supporting the pinion relative to the worm gear, and resilient means entirely within said recess operable between the worm gear and pinion supporting means for transmitting torque therebetween.

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LEONARD H. GERIN, *Examiner.*

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Reissue No. 26,356 March 5, 1968

Joseph Pickles

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

In the grant, line 2, for "assignor to Ferro Stamping Company, of Detroit, Michigan," read -- assignor to Ferro Manufacturing Corporation, --; line 15, for "Ferro Stamping Company, its succssors" read -- Ferro Manufacturing Corporation, its successors --; in the heading to the printed specification, lines 3 and 4, for "assignor to Ferro Stamping Company, Detroit, Mich." read -- assignor to Ferro Manufacturing Corporation --.

Signed and sealed this 6th day of May 1969.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

Commissioner of Patents