

United States District Court,
N.D. Ohio, Eastern Division.

GMI HOLDINGS, INC., d/b/a The Genie Company,
Plaintiff.

v.

STANLEY DOOR SYSTEMS, INC,
Defendant.

Sept. 27, 1996.

Patentee brought action against competitor, alleging infringement of its patent for a screw drive garage door opener. On competitor's motion for summary judgment, the District Court, O'Malley, J., held that: (1) patent was not literally infringed, and (2) prosecution history estoppel barred patentee from claiming infringement under doctrine of equivalents.

Motion granted.

4,532,585. Not infringed.

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MEMORANDUM & ORDER

O'MALLEY, District Judge.

Plaintiff, GMI Holdings, Inc., d/b/a The Genie Company ("Genie"), alleges that two screw-drive garage door opener devices designed and manufactured by defendant Stanley Door Systems, Inc. ("Stanley") infringe Genie's U.S. Patent Number 4,352,585. Stanley has moved for summary judgment under Rule 56(c) of the Federal Rules of Civil Procedure, claiming it is entitled to a judgment of non-infringement as a matter of law. Specifically, Stanley asserts that the openers do not embody the claims of the Genie patent and that, accordingly, no reasonable trier of fact could conclude that those openers infringe that patent. For the reasons set forth below, Stanley's motion for summary judgment is **GRANTED**.

I. Procedural History

Genie commenced this action in 1992, asserting eight separate claims against Stanley that attack Stanley's marketing practices as violative of various federal and state laws designed to protect against unfair trade practices. Among these claims was a patent claim charging Stanley with infringing the '585 patent by manufacturing and selling a garage door opening device Stanley began marketing in 1983.

In response, Stanley filed an answer and nine-count counterclaim denying that it engaged in any improper conduct or competed unfairly with Genie and claiming that, in fact, Genie had engaged in improper trade practices, including trademark infringement and violation of Section 43(a) of the Lanham Act, 15 U.S.C. s. 1125(a). With respect to Genie's charge of patent infringement, Stanley asserted that the Genie '585 patent is invalid, that, even if valid, Stanley's 1983 model garage door opener does not infringe that patent, that Genie is estopped by its own conduct during the prosecution of the '585 from claiming infringement in this case and that Genie waited far too long to bring suit, despite full awareness of Stanley's marketing efforts. Based on these assertions, Stanley requested among other things, that this Court declare the '585 invalid and not infringed.

Discovery on all issues was completed in September, 1994. In November, 1994, this matter was transferred to the undersigned's docket and a status conference was held shortly thereafter. At that time, the parties indicated their respective intentions to file cross-motions for summary judgment on most of the claims asserted. In the hopes of narrowing the issues presented, or possibly resolving the matter completely, the Court, with agreement of the parties, referred the matter to Magistrate Judge David Perelman for a settlement conference. Shortly before the settlement conference, Genie charged that a second garage door opening device, which Stanley began marketing in the fall of 1994 in lieu of the first-accused 1983 device, also infringed its '585 patent.

At the settlement conference, the parties agreed in principle to resolve all of the non-patent claims involved in the action (including trademark, trade dress, product disparagement and unfair trade practice claims) and agreed upon a mechanism for presentation of the patent claims to the Court. This agreement in principle was finalized and ultimately put in the form of a Stipulation of Partial Dismissal and Judgment Entry, filed on January 10, 1996. By that stipulation, Genie dismissed the first seven of the claims in its complaint and Stanley agreed to dismiss Counts 1 through 7 and paragraphs 157 through 163 and 177 through 181 of Count 9 of the counterclaim. The parties then agreed to present the remaining claims, Genie's claims that the '585 has been infringed and Stanley's counterclaim seeking a judgment that it has not, to the Court in stages. FN1 First, the parties agreed that Genie's patent infringement claim would be construed to include a claim of infringement with respect to Stanley's post-1994 garage door opener (the second-accused device), without a formal amendment of the complaint in this action. Next, the parties agreed that the issue of infringement with respect to both accused devices would be presented to the Court by way of a dispositive motion in which Stanley would seek a judgment of non-infringement as a matter of law. And, finally, the parties agreed to stay discovery with respect to the post-1994 opener, pending the Court's resolution of Stanley's dispositive motion.

FN1. In addition to the infringement issue, Stanley did not relinquish its claim that Genie's entire action is barred by laches. In light of this opinion, this issue is moot.

Because the Court now grants summary judgment in favor of Stanley, no further discovery is needed, and, in light of the parties' earlier stipulation, this matter is dismissed in its entirety.

II. The Nature of the Infringement Claims

A. The '585 Patent

The '585 Patent discloses and claims a complete garage door opener that utilizes a motor-driven rotating screw (screw drive) to raise and lower the door. Specifically, as shown on Figure 1 of the '585 patent (Exhibit A to this opinion), the Genie opener uses a screw (20) that extends within a rigid guide (28), from a motor (17) to an assembly (34, 37, 38, 39) that pulls the door (14) open or pushes the door closed, depending upon whether the motor rotates the screw clockwise or counterclockwise.

The lifting or closing operation is accomplished by the movement of a partial nut (or traveler), to which the door is attached. The partial nut moves along the screw as it rotates, dragging the door with it. Because the average garage door is eight or nine feet high, the partial nut must move that distance to fully open (or, alternatively, close) the door. Because the partial nut is pulled along by rotations of the screw drive, the screw drive must, in turn, be eight or nine feet long.

A screw which is approximately nine feet long is both bulky and awkward, making it difficult to store and handle and expensive to ship. Garage door opener manufacturers, accordingly, have looked for ways to segment the screw and the guide that houses it, while not inhibiting the smooth operation of the screw drive function. The first such effort resulted in the issuance of Patent No. 4,241,540 to Depperman. The Depperman patent disclosed a garage door opener in which the screw and guide are segmented into foldable parts. (Exhibit B to this opinion). While solving some of the handling problems, the Depperman design purportedly had some functional weaknesses, in that it was allegedly "prone to tolerance errors" at the joint where the fold occurs, and still was somewhat bulky because of the way in which the segments would need to be packaged together.

The improvement to the art claimed in the '585 patent is use of a screw which is (1) segmentable into completely disconnectable, rather than foldable, parts for packaging and shipping, and (2) capable of being reconnected readily by the end user in a manner that allows for smooth and dependable operation- *i.e.*, for smooth transition of the partial nut during rotation and for operation with limited tolerance failures at the coupling of the screw segments.

The '585 contains 19 claims, of which only Claims 1 and 15 are independent. Of those, Genie only asserts infringement as to Claim 1. As finally allowed, Claim 1 reads as follows (emphasis added):

1. In a garage door operator having a motor-driven screw at least partially within guide means, a partial nut guided by said guide means and movable longitudinally therealong by engagement with said screw and connectable to open and close the garage door, *the screw being in at least first and second parts, and a coupling adapted to interconnect adjacent ends of the first and second screw parts*, the improvement comprising said coupling being readily connectable and being disconnected at the time of shipment to the customer said coupling in the connected condition being capable of being traversed by the partial nut, *the first screw part having a portion adapted to abut and directly transmit torque both clockwise and counterclockwise to the second screw part.*

The prosecution history which resulted in the specific phrasing of Claim 1 of the '585 is important. In the first application for the '585, Genie claimed an invention broad enough to cover *all* segmented screw-type garage openers. Thus, Claim 1 claimed a garage door opener having a screw in at least first and second parts and a coupling adapted to interconnect the ends of those parts, "the improvement comprising said coupling being readily connectable and being disconnected at the time of shipment to the customer." Spalding Patent Application dated March 6, 1980, at 16. FN2 The patent examiner rejected this claim on the grounds that it was obvious in light of the prior art. Specifically, the patent examiner found that earlier patents separately taught the inventions of (1) a screw-drive operated garage door opener, (2) segmentation of the screw in a screw-drive mechanism and (3) the method for interlocking such a segmented screw. Accordingly, the patent examiner concluded that the combination of these inventions would be obvious to one of ordinary skill in the art, rendering the claim unpatentable under 35 U.S.C. s. 103. USPTO Action dated October 10, 1980, at 2.

FN2. Exhibit K to Stanley's motion for summary judgment and exhibit E to Genie's response brief contains documents relating to the prosecution history of the '585 patent.

Genie then amended Claim 1 to require that the coupling "in the connected condition [be] capable of being traversed by the partial nut." Amendment "A" to Spalding's Patent Application, at 2. The patent examiner again rejected the claims as obvious, this time citing to yet an additional prior art reference "teaching the segmentation of elongated screw threaded shafts while retaining their capability of being traversed by a nut when assembled." USPTO Action dated April 16, 1981, at 2.

Genie once again amended Claim 1, this time requiring that the first screw part have "a portion adapted to directly transmit torque both clockwise and counterclockwise to the second screw part." Amendment to Spalding's Patent Application, dated July 10, 1981, at 2. And, once again, the patent examiner rejected Genie's claims. This time, the claims were rejected under 35 U.S.C. s. 102 as being substantially met by the Depperman foldable screw mechanism mentioned above. The examiner noted that the failure to mention Depperman earlier in the history of his consideration of the '585 application was "regrettable." FN3 USPTO Action, dated October 9, 1981, at 2.

FN3. To the extent Depperman justified rejection of Genie's third iteration of Claim 1, it presumably would have also justified rejection of the first and second.

To overcome this third rejection, Genie further amended Claim 1 to require that the first screw portion be adapted to " *abut and* directly transmit torque both clockwise and counterclockwise to the second screw part." Amendment "C" to Spalding Patent Application, at 3 (emphasis added). In the remarks accompanying this proposed amendment, Genie explained that the invention it sought to claim was superior to Depperman. Genie first pointed out that Depperman's structure suffered from a problem of weakness of the coupling relative to the rest of the screw and from the problem of "possible cumulative error in the tolerance of all the manufactured parts." *Id.* at 2. Genie then described its invention as a "hermaphroditic interfitting coupling" and explained its advantages vis-a-vis Depperman as follows:

Claim 1 has been amended to state that the first screw part has a portion adapted to abut the second screw part. Accordingly, claim 1 is considered to have at least two pertinent differences over Depperman, namely, that the coupling is connectable and disconnected at the time of shipment, and secondly that the first screw part has a portion adapted to abut and directly transmit torque both clockwise and counterclockwise to the second screw part. *The second of these two differences is what has been discussed immediately above, namely, the direct interconnection rather than the indirect coupling and many parts of the Depperman construction, resulting in the superior coupling of the present invention.*

Id. at 3 (emphasis added).

B. The Accused Device

Both Stanley devices are admittedly motor-driven screw-drive garage door openers like Genie's device as shown in the '585 patent. The Stanley devices also employ segmented screw portions which are disconnected for shipping and handling and are readily reconnectable in a fashion that allows smooth operation of the lifting mechanism. Stanley claims that the similarity between its devices and the device shown in the '585 ends with these general functional concepts. Stanley claims that it has never employed the critical improvement claimed in the '585-its unique interconnecting mechanism.

In Stanley's 1983 device (Exhibit C to this opinion),FN4 the first and second screw parts are coupled by means of a short tubular link which fits over the ends of the screw parts. Pins are inserted through pinholes in the tubular link and in the screw parts to hold the assembly together.

FN4. Exhibit C to this opinion depicts the critical portions of Stanley's 1983 and 1994 devices as well as the comparable portions of the Genie and Depperman devices.

The 1994 Stanley device has a D-shaped protuberance on the end of each screw part and a metal sleeve that receives the protuberances on the opposite end. (Exhibit C to this opinion). The sleeve has a D-shaped, axial through-hole that corresponds to the D-shaped protuberances of the screw parts. When any two screw parts are received within the sleeve, the D-shaped protuberances of each screw part extend toward each other, but do not come into physical contact with each other.

Stanley claims that, because neither of these devices employ a coupling mechanism in which the screw parts come into direct contact with one another, those devices do not contain all of the limitations of Claim 1 of the '585 and, thus, do not infringe that patent as a matter of law. Genie counters that (1) as properly construed, claim 1 covers the couplings Stanley has employed in both of its devices and (2) even if they do not do so literally, the accused openers infringe the '585 because they perform substantially the same overall function in substantially the same way to obtain the same overall result. Genie claims that, at a minimum, material disputes of fact require presentation of the second of these arguments to the jury.

III. *The Standard of Review*

Rule 56(c) of the Federal Rules of Civil Procedure dictates that, where summary judgment is sought:

The judgment sought shall be rendered forthwith if the pleadings, depositions, answers to interrogatories, and admissions on file, together with the affidavits, if any, show that there is no genuine issue as to any material fact and that the moving party is entitled to a judgment as a matter of law.

While all evidence must be viewed in the light most favorable to the non-moving party, summary judgment is appropriate whenever that non-moving party "fails to make a showing sufficient to establish the existence of an element essential to that party's case, and on which that party will bear the burden of proof at trial." *Celotex Corp. v. Catrett*, 477 U.S. 317, 322, 106 S.Ct. 2548, 2552, 91 L.Ed.2d 265 (1986). "In other words, the movant [can] challenge the opposing party to 'put up or shut up' on a critical issue. After being afforded sufficient time for discovery, as required by Fed.R.Civ.P. 56(f), if the respondent [does] not 'put up,' summary judgment [is] proper." *Street v. J.C. Bradford & Co.*, 886 F.2d 1472, 1478 (6th Cir.1989).

In this context, "[t]he trial court no longer has the duty to search the entire record to establish that it is bereft of a genuine issue of material fact." *Id.* at 1479-80 (citing *Frito-Lay, Inc. v. Willoughby*, 863 F.2d 1029, 1034 (D.C.Cir.1988)). The trial court need not seek out factual disputes nor speculate on the possibility that, under some as yet unstated scenario, a meaningful factual dispute might somehow arise. The non-moving party is under an affirmative duty to point out specific facts in the record as it has been established, which create a genuine issue of material fact. *See Fulson v. City of Columbus*, 801 F.Supp. 1, 4 (S.D.Ohio 1992).

IV. *Analysis*

A. *The Law of Infringement Generally*

"[W]hoever without authority makes, uses, offers to sell, or sells any patented invention, within the United States ... during the term of the patent ... infringes the patent." 35 U.S.C. s. 271(a). The patent owner has the burden of proving infringement, whether literal infringement or infringement under the doctrine of equivalents, by a preponderance of the evidence. *See Hughes Aircraft Co. v. United States*, 717 F.2d 1351, 1361 (Fed.Cir.1983).

"An infringement analysis entails two steps." *Markman v. Westview Instruments, Inc.*, 52 F.3d 967, 976 (Fed.Cir.1995), *aff'd*, 517 U.S. 370, 116 S.Ct. 1384, 134 L.Ed.2d 577 (1996). The first step, commonly known as claim construction or claim interpretation, "is determining the meaning and scope of the patent claims asserted to be infringed." *Id.* "The second step is comparing the properly construed claims to the

device accused of infringing." *Id.*

The construction of the patent and the terms contained therein is an issue to be determined by the court as a matter of law. *Markman*, 517 U.S. at ----, 116 S.Ct. at 1394. To ascertain the meaning of the claims, a court should consider the claim language, the other claims, the patent specification, the prosecution history, and the prior art. *See United States v. Adams*, 383 U.S. 39, 49, 86 S.Ct. 708, 713, 15 L.Ed.2d 572 (1966) (stating that "claims are to be construed in the light of the specifications and both are to be read with a view to ascertaining the invention"); *Markman*, 52 F.3d at 979-80; *SRI Int'l v. Matsushita Elec. Corp.*, 775 F.2d 1107, 1118 (Fed.Cir.1985). "Expert testimony, including evidence of how those skilled in the art would interpret the claims, may also be used." *Fonar Corp. v. Johnson & Johnson*, 821 F.2d 627, 631 (Fed.Cir.1987), *cert. denied*, 484 U.S. 1027, 108 S.Ct. 751, 98 L.Ed.2d 764 (1988). In construing a claim, claim terms are to be given their ordinary meaning unless examination of the specification, prosecution history, and other claims indicate that the inventor intended otherwise. *Carroll Touch, Inc. v. Electro Mechanical Sys.*, 15 F.3d 1573, 1577 (Fed.Cir.1993). The "[c]laims must be read in view of the specification, of which they are a part." *Markman*, 52 F.3d at 979. For purposes of construing the claim, the written description contained in the specification "may act as a sort of dictionary, which explains the invention and may define the terms used in the claims." *Id.* Normally, however, words in a claim will be given their ordinary meaning. *Envirotech Corp. v. Al George, Inc.*, 730 F.2d 753, 759 (Fed.Cir.1984).

In construing the claims, the court may look to the patent's prosecution history if it is a part of the record in the case. *Markman*, 52 F.3d at 980. "This 'undisputed public record' of proceedings in the Patent and Trademark Office is of primary significance in understanding the claims." *Id.* Although the prosecution history "can and should be used" when construing the claims, it "cannot 'enlarge, diminish or vary' the limitations in the claims." *Id.* (citation omitted). The court may also consider extrinsic evidence to aid the court in coming to a correct conclusion as to the true meaning of the language employed by the patent. *Id.* "Extrinsic evidence consists of all evidence external to the patent and prosecution history, including expert and inventor testimony, dictionaries, and learned treatises. This evidence may be helpful to explain scientific principles, the meaning of technical terms, and terms of art that appear in the patent and prosecution history." *Id.* The district court is free to use helpful extrinsic evidence and reject other evidence as unhelpful. *Id.* Extrinsic evidence, however, may not be used to vary or contradict the terms of the claims. *Id.* at 981. The district court's claim construction, enlightened by such extrinsic evidence as may be helpful, must still be based upon the patent itself and the prosecution history. *Id.* "When, after considering the extrinsic evidence, the court finally arrives at an understanding of the language as used in the patent and prosecution history, the court must then pronounce as a matter of law the meaning of that language." *Id.*

The second prong of the infringement analysis, comparison of the claim to the accused device or process, is a question of fact. *Markman*, 52 F.3d at 976 (citing *Envirotech*, 730 F.2d at 758). When an allegedly infringing product includes every limitation of the patent claim, literal infringement is made out, and that is the end of the inquiry. *See Graver Tank & Mfg. Co. v. Linde Air Prods. Co.*, 339 U.S. 605, 607, 70 S.Ct. 854, 855, 94 L.Ed. 1097 (1950). The presence of additional elements in the accused device is irrelevant if all of the claimed elements are present in it. *Amstar Corp. v. Envirotech Corp.*, 730 F.2d 1476, 1482 (Fed.Cir.1984), *cert. denied*, 469 U.S. 924, 105 S.Ct. 306, 83 L.Ed.2d 240 (1984).

[1] Even if an accused device does not literally infringe a patent claim, the accused device is still found to infringe the patent claim under the doctrine of equivalents if the accused device: (a) "performs substantially the same function," (2) "in substantially the same way," (3) "to achieve the same result." *Graver Tank*, 339 U.S. at 608, 70 S.Ct. at 856 (citation omitted). *See Goodwill Constr. Co. v. Beers Constr. Co.*, 991 F.2d 751, 758 (Fed.Cir.1993); *Pennwalt Corp. v. Durand-Wayland, Inc.*, 833 F.2d 931, 934 (Fed.Cir.1987), *cert. denied*, 485 U.S. 961, 108 S.Ct. 1226, 99 L.Ed.2d 426 (1988), *and cert. denied*, 485 U.S. 1009, 108 S.Ct. 1474, 99 L.Ed.2d 703 (1988). The doctrine of equivalents is a factor to be considered in an infringement analysis "when actual literal infringement is not found," *Hughes Aircraft Co. v. United States*, 717 F.2d 1351, 1361 (Fed.Cir.1983), but where the difference between an accused product and the asserted claim as a

whole is insubstantial. *Hilton Davis Chem. Co. v. Warner-Jenkinson Co.*, 62 F.3d 1512, 1517-18 (Fed.Cir.1995) (citing cases), *opinion supplemented by* 64 F.3d 675 (Fed.Cir.1995), *cert. granted*, 516 U.S. 1145, 116 S.Ct. 1014, 134 L.Ed.2d 95 (1996). This doctrine is designed to avoid "a fraud on a patent" by discouraging a copyist from making changes in the patent which, though adding nothing, take the copied matter outside the claim. *Graver Tank*, 339 U.S. at 607-08, 70 S.Ct. at 855-56. The range of equivalents afforded a patent varies with the degree of invention: a pioneer invention, one which represents a major advance over the prior art, is entitled to a broad and liberal application of the doctrine of equivalents, while one that adds little to the state of the art is not. *Thomas & Betts Corp. v. Litton Sys., Inc.*, 720 F.2d 1572, 1580 (Fed.Cir.1983).

B. Prosecution History Estoppel

[2] [3] While the doctrine of equivalents may, in appropriate circumstances, have the effect of broadening the preclusive effect of claim language, a patentee may never obtain patent protection in an infringement suit for subject matter it relinquished during prosecution of that patent. *Zenith Lab., Inc. v. Bristol-Myers Squibb Co.*, 19 F.3d 1418, 1424 (Fed.Cir.), *cert. denied*, 513 U.S. 995, 115 S.Ct. 500, 130 L.Ed.2d 409 (1994). Thus, a patent holder is estopped by actions it took or limitations it agreed to in order to obtain allowance of the claims of its patent from asserting that its patent covers subject matter beyond those limitations. *Id.* This principle, known as prosecution history estoppel, "serves as a check on the applicability of the doctrine of equivalents," counseling against its use where to do so would be inconsistent with a fair reading of the prosecution history. *Mark I Mktg. Corp. v. R.R. Donnelley & Sons Co.*, 66 F.3d 285, 291 (Fed.Cir.1995), *cert. denied*, 516 U.S. 1115, 116 S.Ct. 917, 133 L.Ed.2d 847 (1996).

[4] [5] The test for determining whether a particular embodiment or claim interpretation was relinquished during the prosecution of the patent at issue is an objective one—it requires assessment of "what a reasonable competitor would conclude from the patent's prosecution history." *Id.* The question of whether prosecution history estoppel prohibits use of the doctrine of equivalents to find infringement in a given case is one of law, to be decided by the court. *Id.* (citing *LaBounty Mfg., Inc. v. United States Int'l Trade Comm'n*, 867 F.2d 1572, 1576 (Fed.Cir.1989)).

C. The Stanley Devices Do Not Literally Infringe the Claims of the '585 Patent

1. The Court's Reading of Claim 1

[6] Stanley claims that the language of claim 1 claims and requires a device in which the segmented parts of the screw drive, while disconnectable, are to be reconnected in such a way that the screw segments are in physical, direct contact with one another. This Court agrees; indeed Stanley's interpretation of claim 1 is the only interpretation that is consistent with the common meaning of the language used in and the prosecution history of the '585.

As noted above, Genie finally overcame rejection of its claims in the '585 by appending the words "abut and" to the words "directly transmit torque," so that claim 1 claims a coupling of the screw segments in a motor driven screw drive opener in which "the first screw part ha[s] a portion adapted to *abut and directly transmit torque* both clockwise and counterclockwise to the second screw part." In the *Oxford English Dictionary*, "abut" is generally defined as follows: "to touch at one end, border on." Beyond that general definition, usage of the term in relation to adjoining structures is explained as follows: "... [to] terminate at a point of contact...." While the word "direct" has various meanings, the most pertinent are: "from the source or original without interruption or diversion; c: mechanically joined or in mean; mechanically or electrically in contact; d(1): without any intervening agency or step; without any intruding or diverting factor; without use of a broker or other middleman...." And, finally, "transmit," in the context of mechanical applications, is defined as: "... (1) to cause (as light or force) to pass or be conveyed through space or a medium (2) to admit the passage of: conduit...."

Giving each of these words their literal meaning, claim 1 can only be read to claim a coupling in which the screw segments come in physical contact with, "i.e., touch," one another in such a way as to allow for the passage of torque from one screw segment to the next without the aid of any intervening coupling mechanism. This is precisely the device Genie describes throughout the '585's specification and its prosecution history.

In its "Summary of Invention," for instance, after repeating the language used in claim 1, Genie explains, *inter alia*:

Accordingly, an object of the invention is to provide a door operator screw coupling with a minimum of parts, and hence with a minimum possible cumulative tolerance.

Another object of the invention is to provide a door operator screw coupling wherein the coupling includes first and second hermaphroditic parts which are mutually interengageable in only one possible way to preclude mismatch of the threads from the screw parts upon attempted traversal by the partial nut.

'585 Patent, col. 2, at lines 16-25. Thus, Genie sums up a mechanism in which the screw segments serve both a screw and coupling function simultaneously ("i.e., are hermaphroditic") FN5 and do so by directly engaging each other (i.e., are "mutually interengageable") so as to allow coupling "with a minimum of parts" and to ensure "good torque transmittal capability."

FN5. A "Hermaphrodite" is a person or thing which simultaneously combines "diverse elements" such as a plant or animal having both male and female reproductive organs. Here, Genie describes the end parts of its respective screw segments as having "male" and "female" shoulders which interengage or interfit to serve the coupling function and allow for transmission of the torque.

Genie further explains the advantage of its design in the specification:

Phase means are provided so that the couplings are mutually interengageable in only one possible manner, and this precludes interconnecting these screw parts in an incorrect phase of threads on the screw parts. The phase means is provided by the hermaphroditic style of coupling. The interconnecting male and female shoulders 44 and 45, for example, provide direct transfer of longitudinal compression force therebetween.... The two couplings 11 and 71 illustrate ways in which a part of the first screw directly engages a part of the second screw for directly transmitting torque both clockwise and counterclockwise between the screw parts.

'585 Patent, col. 7, at lines 27-45. Indeed, the specification and the drawings repeatedly emphasize the "interconnected," "interengaged," or "interfitting" of the screw segments. *See* Figures 2, 4, 5 and 6 and references in virtually every column of the '585.

A reading of claim 1 which requires physical contact between and among the screw segments is consistent with and wholly supported by the prosecution history. As noted, Genie labored to overcome repeated rejection of the claims in its '585. Genie was finally successful in that regard when it added and emphasized the phrase "*abut and directly transmit torque*" in describing the relationship between, and operation of, its screw segments. As Genie explained to the patent examiner, it is the direct interconnection of the screw segments in the '585, rather than the indirect coupling of those segments, which constitutes the patentable improvement over Depperman.

2. Genie's Reading of Claim 1

In the face of the plain meaning of the words, the specification and drawings and the clear teachings of the prosecution history, Genie counsels a contrary reading of claim 1-one in which "abut" is read to mean

"close to" and "directly transmit torque" is read to mean "to transmit torque along the same longitudinal axis." Specifically, Genie points out that Figures 2 and 5 show a coupling mechanism in which the screw parts which interconnect *protrude from the threaded portion* of their screw segments, and that, in operation, those *threaded* segments, while close enough to be traversed by the partial nut, technically remain separated. As Genie notes, this design differs from that depicted in Figure 6 where the *threaded* segments of the screw actually interconnect. Genie also points out that, in those circumstances depicted in Figures 2 and 5, the '585 employs a sleeve over the coupling to assist passage of the partial nut. Therefore, Genie argues that claim 1 should be read to include screw segments which approach one another in such a fashion as to allow torque to be transmitted, through the assistance of a sleeve, along a common axis, from one threaded screw segment to the next.FN6

FN6. As Stanley points out, there is nothing in the '585 itself which supports Genie's contention that the function of the sleeve 50 shown in figure 2 was to transmit torque. Indeed, if it were, Genie's assurance to the patent examiner that torque is transmitted in the '585 *directly* from one screw segment to the next-i.e., without the aid of intervening or additional parts-would have been inaccurate.

Despite some arguable support for this reading in the drawings, this Court finds that it is simply not supported by and is, indeed, inconsistent with the language in the claims. There is, moreover, no support in the claims or its specification for the distinction Genie attempts to draw between "screw parts" and "threaded screw parts." Claim 1 claims *screw segments* which "abut" for purposes of "directly" transmitting torque. The screw segments shown in all of the figures of the '585 do just that-"touch one another"-they simply do so in slightly different ways. Genie's present attempt to interpret its claims in a way that is inconsistent with the common meaning of the language it chose for the very purpose of overcoming a rejection of those claims is unpersuasive.

3. The Stanley Devices Do Not Literally Read On Claim 1

[7] It is undisputed that in the Stanley devices-both the 1983 and the 1994 models-the screw parts do not come in physical contact with one another. They do not, accordingly, "abut" each other as this Court interprets that term in claim 1. It is also undisputed that the Stanley devices do and necessarily must employ additional or intervening elements in its coupling mechanism in order to (1) effectuate the connection between the screw segments and (2) transmit torque among those screw segments. As the inventor of the '585 device explained, the torque on the Stanley unit is transmitted to a reduced section (i.e., a protuberance), to a sleeve, to a pin and then to a second reduced section or protuberance. (Spalding Depo. at p. 113). Thus, torque is transmitted through various coupling pieces and is not transmitted "directly" from screw segment to screw segment as described in claim 1. Because neither Stanley device reads on the critical claims of claim 1, as this Court now interprets those claims as a matter of law, the Stanley devices do not literally infringe the '585.

D. The Stanley Devices Do Not Infringe the Claims of the '585 under the Doctrine of Equivalents

[8] Alternatively, Genie claims that, if the court refuses to hold that the accused Stanley devices literally infringe the '585 patent, they infringe under the doctrine of equivalents. Genie argues that, like its device, the Stanley couplings (a) transmit torque in only a straight line, (b) do not fold (unlike Depperman), (c) cause adjacent screw ends to interconnect, (d) do so in a way that still allows for traversal of the partial nut, and (e) accomplish all of this by holding the screw parts in close proximity within a rigid sleeve. Thus, Genie contends, the Stanley devices serve substantially the same function in substantially the same way to achieve substantially the same result. Accordingly, Genie argues that the Stanley devices infringe the claims of the '585, despite the fact that the screw ends do not come in contact with one another.

Moreover, Genie asserts that the space between the two screw parts serves no function and, thus, cannot

alone be relied upon to take the accused devices outside the reach of claim 1. Faced with the many functional similarities between the devices, there is, at least initially, substantial appeal to Genie's argument. Nonetheless, Genie's functional assessment of the gap between the screw ends in the Stanley devices, assuming it is correct, cannot overcome the hurdle Genie faces based on prosecution history estoppel. Thus, the doctrine of equivalents will not allow Genie to broaden its claims to cover the Stanley devices.FN7

FN7. Stanley asserts (without evidentiary support) that the gap allows Stanley to simplify the manufacturing process because the dimensioning of the screws is less critical where interconnection of the screw segments is not necessary.

Genie went to great lengths to avoid rejection of its claims based on the existence of prior art in the field. The prosecution history reveals that Genie was unsuccessful in obtaining allowance of its claims until they were narrowed to require actual physical contact between the ends of the screw segments in a manner that allows for direct transmission of torque from one screw segment to the next. And, Genie asserted that this narrowing rendered its claims patentably distinguishable from the prior art because of the uniquely interconnected nature of the resultant coupling. Thus, a competitor would reasonably conclude, as does this Court, that Genie surrendered any claim to couplings in which the screw segments remain spacially distinct, even slightly so. Under such circumstances, the doctrine of equivalents will not allow for an expansion of the claims of the '585 to cover the very design surrendered to secure that patent. *See, e.g.*, Mark I Mktg., 66 F.3d at 292. This is especially so where, as here, the patent examiner obviously believed that the '585's contribution to the prior art was relatively insubstantial. *See Thomas & Betts Corp.*, 720 F.2d at 1580.

V. Conclusion

This Court finds that no reasonable trier of fact could find that the accused devices infringe the '585 patent, rendering summary judgment of non-infringement appropriate. *See* Mark I Mktg., 66 F.3d at 292 (citing *Brenner v. United States*, 773 F.2d 306, 307 (Fed.Cir.1985)). Defendant's Motion for Summary Judgment is **GRANTED**.

IT IS SO ORDERED.

***1431**

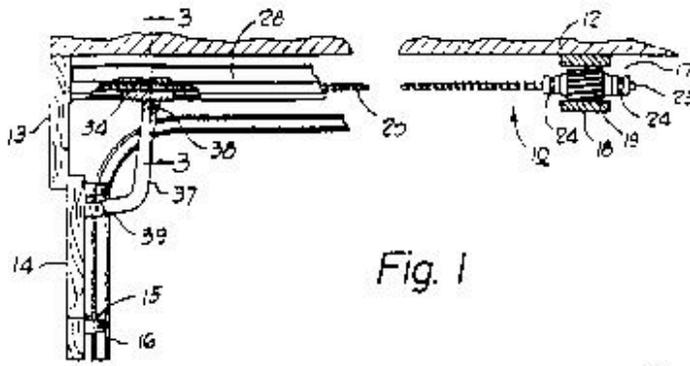


Fig. 1

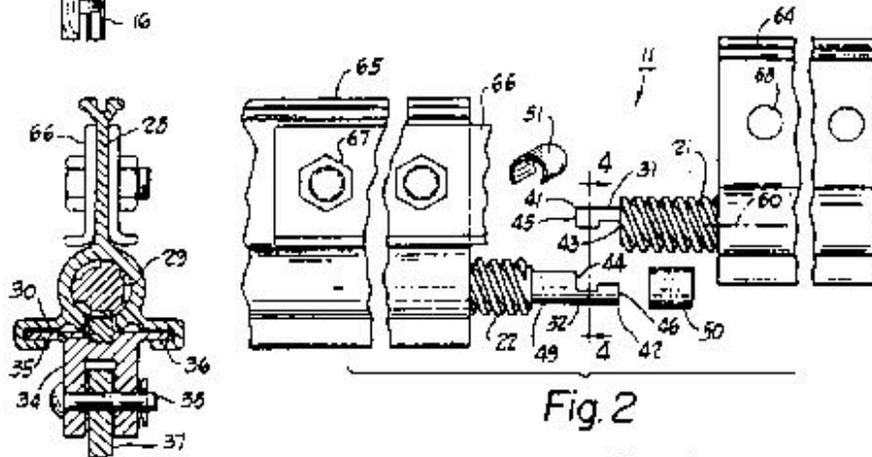


Fig. 2

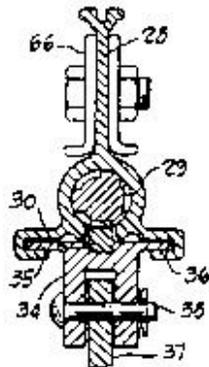


Fig. 3

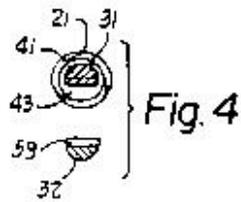


Fig. 4

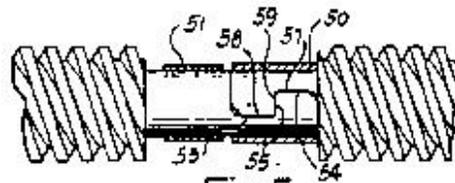


Fig. 5

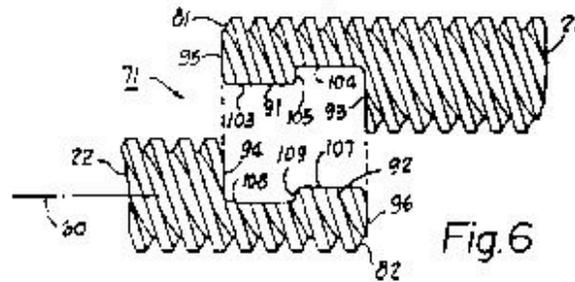


Fig. 6

DOOR OPERATOR SCREW COUPLING

BACKGROUND OF THE INVENTION

Garage door operators have been conceived and constructed for over 40 years. The concept of a longitudinally stationary but rotating screw to act on a traveling nut to open an overhead-type garage door was known to be conceived nearly 45 years ago by U.S. Pat. No. 2,056,176. Cable-operated or chain-operated garage door operators have also been proposed, for example, as shown by U.S. Pat. Nos. 3,439,327 and 3,444,650. Typically, garage door operators are ones which have a traverse of the door operator mechanism of about eight or nine feet in order to accommodate the usual garage door plus the 90 degree angle through which the door turns. In the chain-type of garage door operator that has been manufactured, it has been customary for many years to shorten the package in which the door operator is shipped by cutting the guide channel into two or three parts which may be spliced together. Thus, the channel which was previously nine feet long now comprises three parts of about three feet in length. However, the screw drive door operators which have been marketed for many years have retained a one-piece screw and a one-piece guide means of about nine feet in length, which makes the package costs higher and, more importantly, makes the shipping and storage costs higher because the shipping charges are usually based upon the cubic volume rather than on the weight.

Recently, there has appeared on the market a screw drive garage door operator wherein the guide means is in two parts and the screw is in two parts and interconnected by coupling means which has an interconnecting link with a pivot pin at each end pivoted to the two screw parts. The guide means and screw parts are folded for shipment and then, upon installation, are straightened to be coaxial, and splice plates are bolted onto the sides of the guide means to maintain the coaxial alignment of the screw parts. A problem with such construction is the weakness of this coupling relative to the rest of the screw, the problem of providing a properly straightened guide means, and the problem of whipping of the screw during rotation which, because of two different pivot points, acts somewhat like a universal joint to whip around inside the guide means.

More importantly, the coupling for the two screw parts has so many different parts that the possible cumulative error in the tolerance of all these manufactured parts can make it possible that the threads on the two screw parts will be mismatched relative to the traversing partial nut, and thus the nut will fail to traverse this elongated coupling. Also, the very many parts in such coupling means and the necessary clearance between the parts in order to fold means that the coupling will tend to destroy itself upon repeated reversals of the screw. In practically all screw drive garage door operators, the motor reverses each time it is started, first driving the screw clockwise and then driving it counter-clockwise in order that the nut traverses forward and then in reverse for closing and opening directions of the garage door. This continual reversing of torque through the coupling and the looseness or "play" in all the parts will tend to batter the coupling apart and make the clearance of the parts even greater, which will therefore create the great possibility of mismatch of the threads in

the future during life of the operator, if they are not mismatched at the time of initial assembly.

SUMMARY OF THE INVENTION

This problem is solved by a garage door operator having a motor-driven screw at least partially within guide means, a partial nut guided by said guide means and movable longitudinally therealong by engagement with said screw and connectable to open and close the garage door, the screw being in at least first and second parts, and a coupling adapted to interconnect adjacent ends of the first and second screw parts, the improvement comprising said coupling being readily connectable and being disconnected at the time of shipment to the customer.

Accordingly, an object of the invention is to provide a door operator screw coupling with a minimum of parts, and hence with a minimum possible cumulative tolerance.

Another object of the invention is to provide a door operator screw coupling wherein the coupling includes first and second hermaphroditic parts which are mutually interengageable in only one possible way to preclude mismatch of the threads from the screw parts upon attempted traversal by the partial nut.

Another object of the invention is to provide a simple and effective door operator screw coupling with a long life and a good torque transmittal capability.

Other objects and a fuller understanding of the invention may be had by referring to the following description and claims, taken in conjunction with the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a side elevational view, partly schematic, illustrating the invention;

FIG. 2 is an enlarged, side elevational view of the door operator screw coupling;

FIG. 3 is an enlarged, sectional view on line 3-3 of FIG. 1, to the same scale as FIG. 2;

FIG. 4 is a sectional view on line 4-4 of FIG. 2;

FIG. 5 is an enlarged, partial elevational view of the screw coupling of FIG. 2 assembled; and

FIG. 6 is an enlarged, partial elevational view of a modified door operator screw coupling.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The drawing illustrates a garage door operator 10 which incorporates the screw coupling 11 of the invention. The garage door operator is intended to be installed within a garage having a ceiling 12 and a door header 13. The operator 10 may open and close almost any type of an enclosure, including slab doors, which can be pivoted or operate on a form of a track. However, a sectional door 14 is illustrated which has sections hinged together and provided with rollers 15 to roll on a track 16 between the closed position shown and an open position near the ceiling 12. The door operator 10 includes a motor 17 having a stator 18 and a rotor 19, rather schematically shown in FIG. 1. The motor 17 is connected to drive a screw 20 having first and second screw parts 21 and 22, respectively. The motor 17 has a shaft 23 connected to rotate the screw 20, and this shaft 23 has bearings, including thrust bearings 24, to absorb the longitudinal thrust in both directions on the screw 20.

The screw 20 is mounted at least partially within guide means 28, and this guide means has a generally cylindrical bore 29 circumscribing about 300 degrees of the screw 20. In the remaining approximately 60 degrees of the periphery of the screw 20, a partial nut 30 is disposed, which nut has a length sufficient to bridge across the length of the screw coupling 11, which is formed of first and second coupling parts 31 and 32, respectively. The guide means 28 provides a guide not only for the screw 20, but also for the nut 30. A slide 34 has wings 35 slidably disposed in grooves 36 in the guide means 28, and this slide 34 carries the partial nut 30. A door arm 37 is pivotally connected at 38 to the slide 34, and at 39 to the door 14. Accordingly, as the motor 17 rotates the screw 20 in either a clockwise or counterclockwise direction, the partial nut 30, engaged with the screw 20, traverses the guide means 28 longitudinally to open or close the garage door 14.

The screw coupling 11 is better illustrated in FIGS. 2, 4, and 5, and the first and second coupling parts 31 and 32 are hermaphroditic parts whereas the first part 31 has a male extension 41 and a female shoulder 43, and the second coupling part 32 has a male extension 42 and a female shoulder 44. The male extension 41 has a male shoulder or forwardly facing shoulder 45, and similarly, the male extension 42 has a male shoulder or forwardly facing shoulder 46. In the embodiment of FIGS. 2, 4, and 5, the coupling parts 31 and 32, when interengaged as shown in FIG. 3, form a reduced diameter portion of the screw 20. The male extension 42 is extended from a reduced diameter portion 49 of the second screw part 22. It is reduced in diameter in order to accommodate the I.D. of a sleeve 50 and also to accommodate the I.D. of a C-clip 51. The male extension 41 is formed of a first flat portion 53 and a second flat portion 54 interconnected by a rear facing or proximal facing shoulder 55. Similarly, the male extension 42 is provided with a third flat portion 57 and a fourth flat portion 58 interconnected by a rear facing or proximal facing shoulder 59. In this preferred embodiment, the flat portions 53, 54, 57, and 58 are parallel to the axis 60 of the screw 20, and the shoulders 55 and 59 are perpendicular to this axis. The flat portion 53 is disposed on one side of the axis 60 approximately the same distance that the flat portion 54 is disposed on the other side of this axis.

The guide means 28 is provided in two parts 64 and 65, which are shown misaligned in FIG. 2 but may be aligned after the screw coupling 11 is interconnected, and then splice plates 66, only one of which is shown in FIG. 2, may be provided one on each side of the guide means 28 and fastened with bolts 67 extending through apertures 68 to secure together the two parts of the guide means 28 in alignment.

OPERATION

The garage door operator 10 is one which has the screw 20 in at least two parts 21 and 22, and the guide means 28 in at least two parts 64 and 65 during shipment. This is in order to reduce the overall length of the package in which the door operator is shipped. Since the shipping costs are based primarily on the cubic volume rather than the weight, the length of the package can be reduced to approximately half if the screw and guide are in two parts, or can be reduced to approximately one-third if the screw and guide are in three parts. This not only saves shipping charges, but saves storage charges, because door operators can be packed, shipped, and stored in a much smaller volume of space.

This is of benefit to the distributor as well as the dealer. It is also of benefit to the ultimate customer because the prior art system using an elongated screw of nine to ten feet in length, and a similar length package, could not be brought home in the trunk of an automobile by an ordinary purchaser. If the length is reduced to three and a half or five feet, however, then truck transport by the ultimate user is greatly facilitated.

As shipped, the two parts of the screw 21 and 22 preferably extend outwardly from the respective parts 64 and 65 of the guide means, approximately as shown in FIG. 2. The sleeve 50 is first slipped over the male extension 41 onto the reduced diameter portion 49. The two screw coupling parts 31 and 32 are then disposed side-by-side and axially parallel about as shown in FIG. 3. Next, the guide parts 64 and 65 are moved to be coaxial to interengage the coupling parts 31 and 32. By such movement, the first flat portion 53 engages the fourth flat portion 58 and the second flat portion 54 engages the third flat portion 57. Next, the sleeve 50 may be slid to the right as viewed in FIG. 5, and the C-clip 51 transversely inserted over the reduced diameter portion 49. This prevents the sleeve 50 from moving to the left whereas it would not be covering the interengaged coupling parts 31 and 32.

Next, the guide parts 64 and 65 may be axially moved together, sliding over the screw 20, and then the splice plates 66 bolted in place, using the bolts 67 through the apertures 68. The door operator 10 may then be installed against the ceiling 12 and door header 13 in the usual manner, and connected to the door 14 to move it between open and closed positions.

FIG. 6

FIG. 6 shows a modified screw coupling 71 which may replace the screw coupling 11. This screw coupling 71 has first and second coupling parts 81 and 82, respectively, which are hermaphroditic parts in that the coupling part 81 includes a male extension 91 and a female shoulder 93, and the second coupling part 82 includes a male extension 92 and a female shoulder 94. A male shoulder 95 is provided on the end of the male extension 91 and a male shoulder 96 is provided on the end of the male extension 92. The first coupling part 81 is unitary with the first screw part 21, and the second coupling part 82 is unitary with the second screw part 22. These screw parts are again rotatably guided within the guide parts 64 and 65, respectively. In a manner similar to that in the first screw coupling 11, the first coupling part 81 is provided with first and second flat portions 103 and 104 interconnected by a rearwardly facing or proximal facing shoulder 105. Also, the second coupling part 82 is provided with a third flat portion 107 and a fourth flat portion 108 interconnected by a rearwardly facing or proximal facing shoulder 109. Just as in FIGS. 2 to 5, the flat portion 103 is disposed a small distance on one side of the axis 60 and the flat portion 104 is disposed substantially the same distance on the other side of this axis 60. The flat portions 103, 104, 107, and 108 are preferably parallel to the axis 60, and the shoulders 105 and 109, along with the shoulders 93-96, are substantially perpendicular to this axis.

OPERATION

The door operator 10, whether equipped with the screw coupling 11 or 71, is shipped in a collapsed condition, i.e., with the two screw parts 21 and 22 disposed side-by-side within the respective guide means 64 and

65 Upon unpacking, the dust on the installer first positions the guide means 64 and 65 about as shown in FIG. 2. The screw part 21 can already be properly in working connection to the motor 17. In the position of FIG. 2 or 8, the axes of the two screw parts are parallel, but misaligned. Next, the two guide means 64 and 65 are relatively moved transversely to have the flat portion 103 engage the flat portion 108 and to have the flat portion 104 engage the flat portion 107. This interengages the screw coupling 71 and then the two guide parts 64 and 65 may be relatively axially moved together, sliding over the screw 20. With the screw part 21 in operative connection with the motor 17, this will mean that the guide part 65 slides to the right, while screw part 22 remains stationary until the guide part 65 abuts guide part 64. At this time, the splice plates 66 may be bolted in place, as in FIGS. 2 and 3. The door operator 10 may then be mounted to the ceiling 12 and door header 13 in the usual manner.

The screw couplings 11 and 11 of the present invention are ones where it is not possible to put the two screw parts together in incorrect phase. A triple thread screw has been illustrated in the figures, and in such case it is quite important that the phase of each of the two screw parts 21 and 22 at the coupling 11 or 71 be proper so that they are not mismatched relative to the partial nut 30, which will have to traverse this coupling once for each door opening or closing movement. Because the couplings 11 or 71 are hermaphroditic couplings, i.e., couplings which have partly male and partly female properties, it is impossible to put these couplings together in other than the correct manner. Still further, the way in which the two coupling parts interconnect minimizes the possible cumulative tolerance errors which are inherent in machining the coupling parts.

A two-piece screw for a garage door operator which is currently on the market utilizes a multipart coupling. This screw coupling has a fork on the two adjacent ends of the screws and then an intermediate link is pivoted at each end within these two forks. This makes a type of a universal joint connection so that the two pivot points are far enough apart that the screw may be folded back upon itself, while within the guide parts, without interference between the two guide parts. This makes a long screw coupling and one which has many parts, the cumulative tolerance of which may be excessive and may result in mismatch of the threads on the screw relative to the threads on the partial nut. The possible cumulative tolerance errors, in the longitudinal dimension, in such unit now on the market are: (1) the jig or fixture to hold the first screw at the correct axial position, (2) the diameter of the hole in the first fork, (3) the diameter of the hole in the first tongue, (4) the axial position of the hole in the first fork, (5) the dimension between the two pivot holes in the intermediate link, (6) the axial position of the hole in the second fork, (7) the diameter of the hole in the second tongue, (8) the diameter of the hole in the second fork, and (9) the jig or fixture to hold the second screw at the correct axial position. These are all things which will affect the axial dimension, and hence proper phase match, of the threads on the two screw parts relative to that on the nut. Additionally, there are other tolerances which affect the rotational position of one screw relative to the other, but these will be disregarded as being of lesser importance than the cumulative tolerance on the axial position. If each of the above nine dimensions is held to plus or minus 0.002 inch in tolerance, then this is a total

of nine times 0.004 inch, or 0.036 inch possible cumulative tolerance. This is about half the width of the crest of the square thread on the screw. These screw drive screw operators are ones which typically reverse the direction of rotation of the screw each time the motor is started. That means the screw will rotate clockwise, for example, for door opening, and counterclockwise for door closing. This continuous reversal of rotation means that first there is an axial compression force on the coupling and next an axial tension force on the coupling. This results in continual battering of the coupling so that the dimensional tolerances will increase from that occurring at the time of manufacture. The stress and shock on the coupling are perhaps worst in the initial acceleration from rest of a 200 or 300 pound door, to overcome the inertia of such door. Even if mismatch of the threads on the nut with that on the two screw parts does not occur at the time of manufacture, there is increasing likelihood that the screw threads will become mismatched sometime during use of the door operator.

The present invention teaches the structure of the screw coupling 11 or 71 which minimizes such possible cumulative tolerance error. In order to compare the present invention with the door operator existing on the market, the present invention has the following possible cumulative tolerance errors:

- (1) the axial phase position of the end of the thread on the first screw part 21 to the female shoulder 43 or 53;
 - (2) the axial dimension of the flat portion 54 or 104;
 - (3) the axial dimension of the flat portion 57 or 107;
 - (4) the axial dimension of the flat portion 57 or 107;
 - (5) the axial dimension of the flat portion 58 or 108;
- and
- (6) the axial dimension between the female shoulder 44 or 54 and the same phase position of the thread on the second screw part 22.

At first, this appears that there is only a 9-6 or 3.2 improvement in the possible cumulative tolerance error. However, it will be noted that the first and second coupling parts 31 and 32 or 41 and 42 interfit, and this eliminates two of the possible cumulative tolerance errors. For example, suppose that the length of the first flat portion 53 fits closely relative to the first or flat portion 56, and more closely than the two flat portions 54 and 57 interfit, then it will be the shoulders 44 and 45 which take the axial compression force rather than shoulders 43 and 46. Shoulders 53 and 59, of course, take the axial tension force. This means that it is only the possible tolerance error on the length of the first flat portion 53 which is of importance out of all of the four lengths of flat portions, plus the first and sixth on the flat immediately above for a total of three possible tolerance dimensions. If each of these is established at plus or minus 0.002 inch, as in the example given above, then this will be three times 0.004 inch, or 0.012 inch possible cumulative tolerance. This is three times better than the unit currently on the market, and shows the advantage of the hermaphroditic interfitting coupling 11 or 71.

The coupling 11 shown in FIGS. 1 to 5 incorporates the sleeve 50, which is closely received on the two interfitting male extensions 41 and 42. This sleeve 50, then, helps absorb the clockwise or counterclockwise torque transmitted by the first screw part 21 to the second screw part 22. The load of the door 14 on the motor 17 and especially the starting and stopping acceleration and deceleration forces, tend to split apart the two coupling parts 31 and 32. The sleeve 50 may be a

hardened steel sleeve. In cases such torque caused separation in the screw coupling 71 there is the same type of torque-caused tendency to spread apart the two coupling parts 41 and 42. In this design, this tendency is resisted by the guide means 28, which, in the preferred embodiment, is a heavy-walled aluminum extrusion circumscribing about 300 degrees of the periphery of the screw 20. The screw coupling 71 has the advantage of threads along the entire outer periphery of the coupling, so that the partial nut rides easily along the matched threads at this coupling. In the screw coupling 11 of FIGS. 2 to 5, the length of the coupling 11 between threads, assembled as shown in FIG. 5, is only about 0.75 inch, including the reduced diameter portion 49, for a pitch diameter of the screw of about 0.5 inch, and the partial nut may have a length of about 2.6 inches in a typical door operator, so such partial nut easily spans this 0.75 inch screw coupling 11 whereas there are no external threads. Of course, the reduced diameter portion 49 is reduced to a diameter to permit the sleeve 50 to be mounted yet to have the outside diameter thereof below the root diameter of the thread form on the screw 20.

The above descriptions of the screw couplings 11 or 71 show a coupling which is readily connectible by the user or installer, yet it is disconnected at the time of shipment to the ultimate customer. Phase means are provided so that the couplings are mutually interengageable in only one possible manner, and this precludes interconnecting these screw parts in an incorrect phase of the threads on the screw parts. The phase means is provided by the hermaphroditic style of coupling. The interconnecting male and female shoulders 44 and 45, for example, provide direct transfer of longitudinal compression force therebetween. This eliminates any whipping action which may be caused by the double pivoted screw coupling of the prior marketed unit. The interconnected rearwardly facing shoulders 55 and 59, or 105 and 109, directly transmit longitudinal tension forces therebetween, which would be the case for door opening movement. The two couplings 11 and 71 illustrate ways in which a part of the first screw directly engages a part of the second screw for directly transmitting torque both clockwise and counterclockwise between the screw parts.

The present disclosure includes that contained in the appended claims, as well as that of the foregoing description. Although this invention has been described in its preferred form, with a certain degree of particularity, it is understood that the present disclosure of the preferred form has been made only by way of example and that numerous changes in the details of construction and the combination and arrangement of parts may be resorted to without departing from the spirit and the scope of the invention as hereinafter claimed.

What is claimed is:

1. In a garage door operator having a motor-driven screw at least partially within guide means, a partial nut guided by said guide means and movable longitudinally therealong by engagement with said screw and connectible to open and close the garage door, the screw being in at least first and second parts, and a coupling adapted to interconnect adjacent ends of the first and second screw parts, the improvement comprising said coupling being readily connectible and being disconnected at the time of shipment to the customer said coupling in the connected condition being capable of being traversed by the partial nut, the first screw part

having a portion adapted to abut and directly transmit torque both clockwise and counterclockwise to the second screw part.

2. A screw coupling as set forth in claim 1, including a male extension on the first screw part with a proximal facing shoulder.

a male extension on the second screw part with a proximal facing shoulder, and said two shoulders being interengageable with the two screw parts disposed coaxially to transmit longitudinal tension force therebetween.

3. A screw coupling as set forth in claim 1, including a forward-facing and a rearward-facing shoulder on each screw part,

said two rearward-facing shoulders being interengageable with the two screw parts disposed coaxially to transmit longitudinal tension force therebetween, and

said two forward-facing shoulders being interengageable with the two screw parts disposed coaxially to transmit longitudinal compression force therebetween.

4. A screw coupling as set forth in claim 1, including first and second portions on the first screw part disposed in that order from the end thereof, third and fourth portions on the second screw part disposed in that order from the end thereof,

said second and fourth portions having a thinner transverse dimension than said first and third portions, respectively, and

said first and second portions being those portions adapted to abut and transmit torque to the second screw part.

5. A screw coupling as set forth in claim 4, wherein said first through fourth portions are substantially flat planes.

6. A screw coupling as set forth in claim 1, including phase means in said coupling to preclude connecting said coupling in the incorrect phase which would result in a mismatch of the thread on the screw parts as traversed by the partial nut.

7. A door operator screw coupling as set forth in claim 1, wherein said coupling includes first and second hermaphroditic parts unitary with the first and second screw parts, respectively, and mutually interengageable in only one possible way to preclude interconnecting the screw parts in an incorrect phase of the threads on the screw parts.

8. A screw coupling as set forth in claim 7, wherein said first coupling part has male and female shoulders, said second coupling part has male and female shoulders, and

at least one of a pair of male and female shoulders is interengageable for direct transfer of longitudinal compression force therebetween.

9. A screw coupling as set forth in claim 7, including first and second portions on said first coupling part disposed in that order from the end thereof,

third and fourth portions on said second coupling part disposed in that order from the end thereof, and

said second and fourth portions having a thinner transverse dimension than said first and third portions, respectively.

10. A screw coupling as set forth in claim 9, including a first proximal-facing shoulder on said first coupling part between said first and second portions, and

a second proximal-facing shoulder on said second coupling part between said third and fourth portions.

11. A screw coupling as set forth in claim 10, wherein said first and second shoulders are adapted to be abutting with the screw parts coaxial to transmit longitudinal tension forces through said coupling.

12. A screw coupling as set forth in claim 10, wherein said first through fourth portions are disposed substantially parallel to the screw axis.

13. A screw coupling as set forth in claim 9, wherein said first and second coupling parts may be interengaged with the two screw parts coaxial to establish said second and third portions adjacent each other and said first and fourth portions adjacent each other for transmission of clockwise and counterclockwise torque through said coupling.

14. A screw coupling as set forth in claim 13, wherein the thread on the two screw parts is substantially continuous along the interengaged coupling.

15. In a garage door operator having a motor-driven screw at least partially within guide means, a partial nut guided by said guide means and movable longitudinally therealong by engagement with said screw and connectable to open and close the garage door, the screw being in at least first and second parts, and a coupling adapted to interconnect adjacent ends of the first and second screw parts, the improvement comprising:

said coupling being readily connectable and being disconnected at the time of shipment to the customer;

first and second hercaphroditic parts unitary with the first and second screw parts, respectively, and mutually interengageable in only one possible way

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to preclude interconnecting the screw parts in an incorrect phase of the threads on the screw parts; first and second portions on said first coupling parts disposed in that order from the end thereof; third and fourth portions on said second coupling part disposed in that order from the end thereof; said second and fourth portions having a thinner transverse dimension than said first and third portions, respectively;

said first and second coupling parts being interengageable with the two screw parts coaxial to establish said second and third portions adjacent each other and said first and fourth portions adjacent each other for transmission of clockwise and counterclockwise torque through said coupling; and said first and second coupling parts in the interengaged condition having a substantially circular cross section and having a diameter reduced to less than the root diameter of the screw.

16. A screw coupling as set forth in claim 15, including a sleeve closely surrounding said reduced diameter.

17. A screw coupling as set forth in claim 16, including a longitudinally extended reduced diameter portion on one of said screw parts to accommodate said sleeve in a position remote from said coupling.

18. A screw coupling as set forth in claim 17, including a spring clip engageable with said extended reduced diameter portion to inhibit longitudinal movement of said sleeve.

19. A screw coupling as set forth in claim 1, wherein a multiple start thread is provided on the first and second screw parts.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

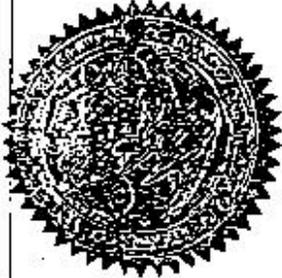
PATENT NO. : 4,352,585
DATED : October 5, 1982
INVENTOR(S) : Wilbur J. Spalding

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Claim 1, column 8, line 1, delete "about" and insert --abut--.

Signed and Sealed this

Twenty-eighth Day of December 1982



Attest

Ruth M. Hwang

Attesting Officer

Gerald L. Moxinghoff
GERALD L. MOXINGHOFF

Commissioner of Patents and Trademarks

G 001389

*1439

United States Patent (19)

(1) 4,241,540

Depperman

(4) Dec. 30, 1980

[54] FOLDING SCREW AND RAIL ASSEMBLY
FOR A GARAGE DOOR OPENER[51] Inventor: Walter B. Depperman, Waterloo,
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[21] Appl. No.: 58,678

[22] Filed: Jul. 18, 1979

[51] Int. Cl.³ E05F 31/00

[52] U.S. Cl. 49/399; 206/221;

49/362

[53] Field of Search 49/399, 200, 362, 365;
206/100, 102, 16/163, 166, 198/668; 206/323;
163/194, 193

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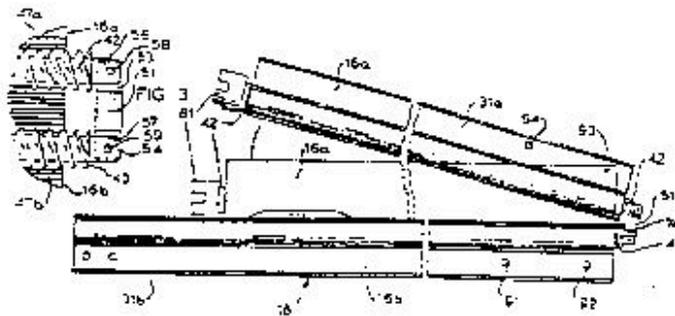
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 CHIARA & SIMPSON

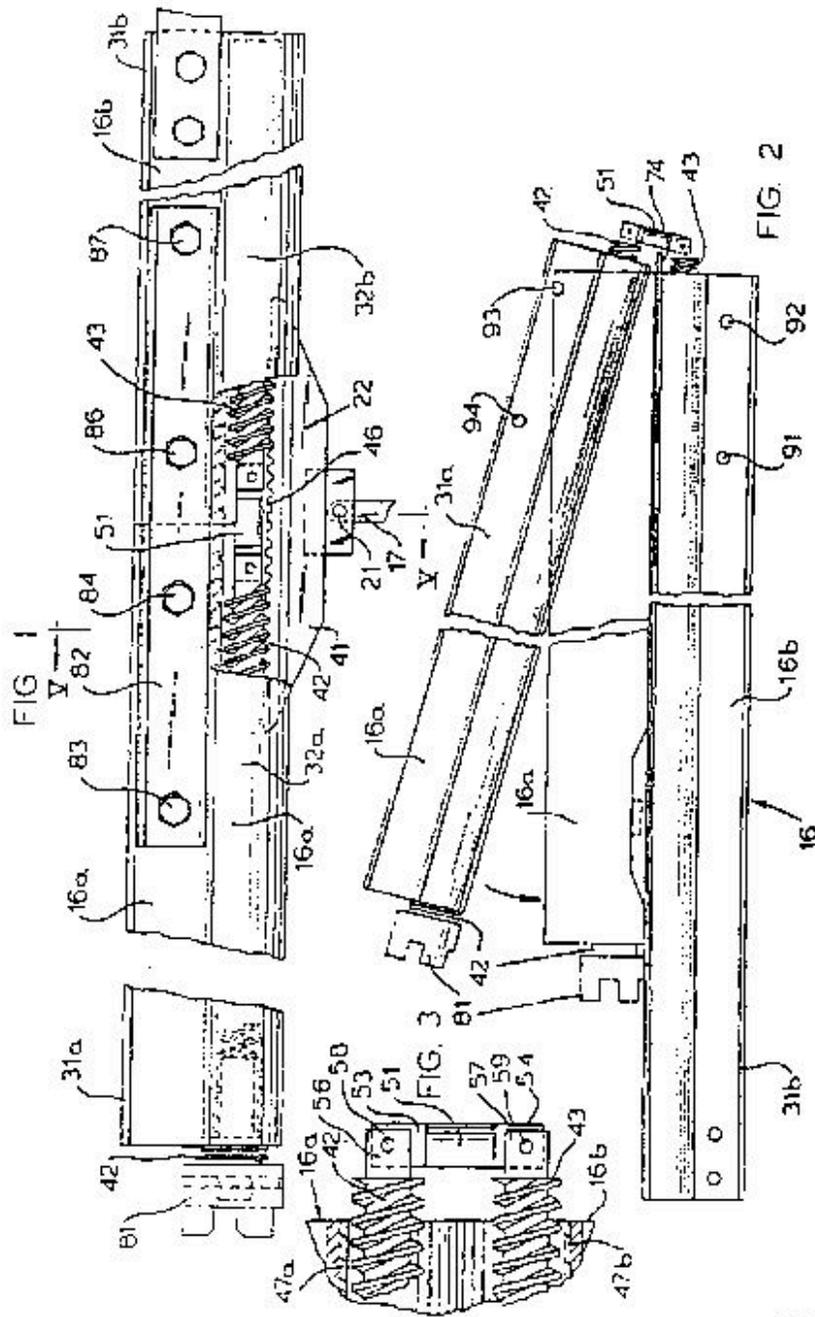
[57] ABSTRACT

A hinged screw section for a worm drive garage door operator which allows the worm shaft to be assembled at the factory and folded back upon itself so that it can be shipped in a smaller and shorter package. Two different joints have been developed, one of a "I" type in which the connecting link between the two sections of worm shaft is merely a flat metal section with a hole in each end which fits into a slot in the ends of the two worm shaft sections and the assembly is pinned together with two rivets or bolts and the spacing between the two threaded shafts is such that a rack driver carrier will mate with threads of each portion. A second configuration utilizes an "H" joint and the link contains slots and flat tangs are formed on the ends of the two threaded shafts and joined with rivets to the link.

10 Claims, 8 Drawing Figures



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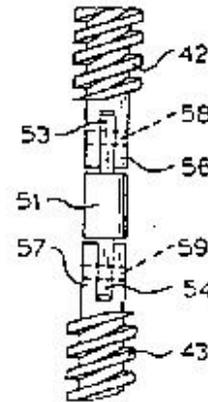
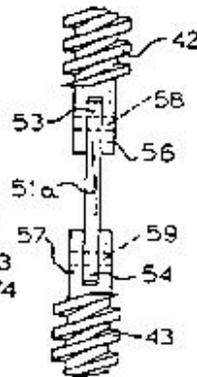
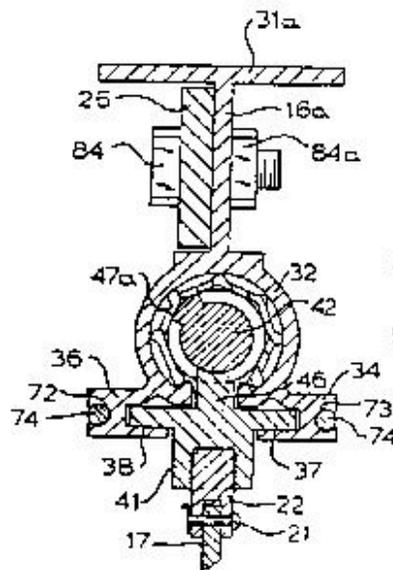
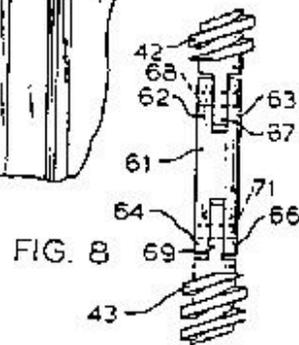
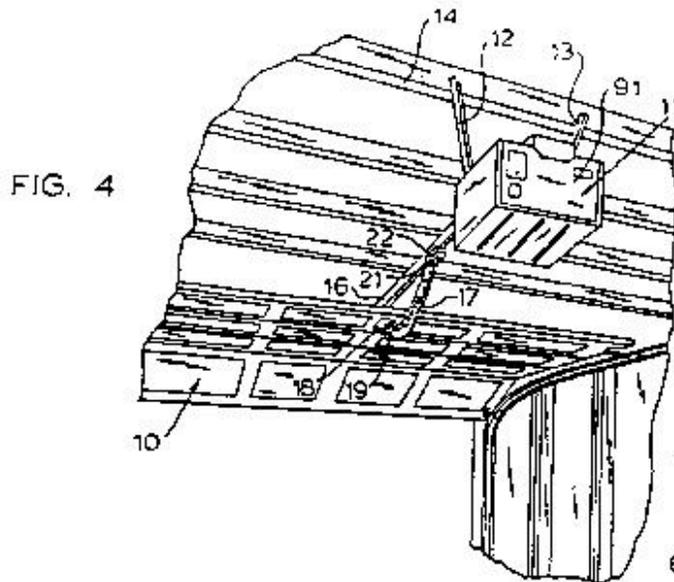


FIG. 5

FIG. 6

FIG. 7

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FOLDING SCREW AND RAIL ASSEMBLY FOR A GARAGE DOOR OPENER

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates in general to garage door operators and in particular to an improved worm drive garage door opener.

2. Description of the Prior Art

Worm drive garage operators presently use a one piece worm and rail section. This requires that a very long container be utilized in shipping the garage door opener since the one piece worm and rail section are ten or more feet in length. This makes it very expensive and very difficult for the average customer to transport from the retail outlet to his home for installation. It is very desirable to provide that the T rail unit and the worm fit in a box that can be placed into the average automobile.

SUMMARY OF THE INVENTION

The present invention comprises a lugged screw worm shaft which can be factory assembled and then folded back upon itself. Two joints are used, one being the "I" type wherein the connecting link comprises a flat metal section with a hole in each end and the ends of the two threaded shafts are slotted and holes are formed through the ends of the shafts and the link and rivets are placed through the holes to flexibly join the two threaded shafts together. The slots and holes are accurately machined so that thread alignment will be maintained between the two threaded shafts so that the door carrying trolley will smoothly pass over the joint thus formed.

A second joint design comprises an "H" joint wherein the connecting link resembles the letter "H" and is formed with slots on either end and flat tangs are formed on the ends of the worm shafts. The ends of the worm shaft fit into the "H" joints and connection is made by a pair of rivets or bolts.

The length of the connecting link can be such that the worm shaft can be installed in the rail sections and the complete assembly can be folded for transportation and packaging.

During installation, the customer merely unfolds the assembly and bolts the rail sections spliced together to complete the assembly of the rail sections and the worm shaft.

Since the installation does not require making the splice by the customer between two rail sections, the threads will be aligned to smoothly move the door carrying trolley over the joint.

Other objects, features and advantages of the invention will be readily apparent from the following description of certain preferred embodiments thereof taken in conjunction with the accompanying drawings although variations and modifications may be made without departing from the spirit and scope of the novel concepts of the disclosure and in which:

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side plan view of the rail, the worm shaft and the door moving trolley with certain portions cut away.

FIG. 2 illustrates the rail and worm shafts in the folded position.

FIG. 3 is a detail view of the threaded shaft connecting joint.

FIG. 4 illustrates the garage door operator installed to move a door.

FIG. 5 is a sectional view taken on line 5-5 in FIG. 1.

FIG. 6 is a detail view of the I shaped joint.

FIG. 7 is a detail view of a modified form of the connecting link; and

FIG. 8 is a detail view of a modified form of the connecting link.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. 4 illustrates a garage door opener designated generally as 11 mounted on a rafter 14 by hanger members 12 and 13 and connected to a door 10. The rail 16 of the garage door opener carries the worm shaft upon which the trolley 22 rides and a link 17 is pivoted by pivot pin 21 to the trolley at one end and has its other end 19 pivoted to a bracket 18 mounted on the door such that as the trolley is moved by the worm shaft, the door 10 will be moved to the opened or closed positions.

FIG. 1 is an enlarged partially cut-away view of the rail and worm shaft and trolley. The first T rail portion has a cross-portion 16a and downwardly extending portion 16a as best shown in sectional view of FIG. 5. A generally cylindrical portion 32 is attached to the lower end of the vertical portion 16a and is formed with a second horizontal portion 34 and 36 which are respectively formed with horizontal internal slots 37 and 38. The trolley 22 is formed with a threaded rack plate portion 41 which has teeth which engage the spiral worm of the worm shafts 42 and 43, respectively, and the teeth 46 extend for a substantial longitudinal length along the rail 16 as shown in FIG. 1.

As shown in detail in FIG. 5, an inner plastic bearing and guide liner 47 is mounted in the hollow portion 32 of the T rail 16 and the threaded shaft 42 is supported in the plastic liner 47. The portion 32 has an opening through which the teeth 46 of the trolley 22 extend so as to make engagement with the spiral worm of the worm shafts 42 and 43, respectively.

A link 51 is pivotally connected to the ends of the worm shafts 42 and 43 so that the T rail portions 16a and 16b and the worm shafts 42 and 43 can be pivoted to a stored position as shown in dotted line in FIG. 1 for shipping. The link 51 has flat end portions 53 and 54 which are respectively receivable between U-shaped openings 56 and 57 formed respectively in the ends of shafts 42 and 43. Flat head rivets 58 and 59 make pivotal connections between the ends 53 and 54 of link 51 and portions 56 and 57 of the worm shafts 42 and 43.

FIGS. 2, 3 and 7 illustrate links 51 wherein the portion between the extending portions 53 and 54 are generally cylindrical shaped by FIG. 6 illustrates an embodiment of the link 51a wherein the link is merely a flat plate.

FIG. 8 illustrates a modification of the link 51 which is formed as an H-shaped portion 61 having a slot formed by extending portions 62 and 63 at one end and 64 and 66 at the other end. The worm shaft 42 is formed with an extending flat portion 67 that is received between the portions 62 and 63 and a rivet 68 pivots the two members together. The shaft 43 is formed with an extending portion 69 and a rivet 71 joins the portions together.

As best shown in FIG. 5, a pair of generally cylindrical shaped grooves 72 and 73 are formed in the portions 36 and 37 respectively and are adapted to receive reinforcing pins 74 which extend from rail portion 160 as illustrated in FIG. 2 and are receivable in the openings 72 and 73 so as to make a firm joint between the rail portions 160 and 166 when in the assembled position illustrated in FIG. 1.

It is to be realized that since the worm shafts 42 and 43 are supported by the plastic bearing members 41 they are free to move longitudinally in the openings 32 of the T rail.

When the T rail assembly is unpacked it is in the form shown in dotted line in FIG. 2. The portion 160 is pivoted clockwise relative to FIG. 2 to the position shown in FIG. 1 and the T rail portions 160 and 166 are joined by using a plate 82 which is attached by bolts and nuts 83, 84, 86 and 87, respectively, to the T rail portions 160 and 166. The bolts 83, 84, 86 and 87 pass through openings 91, 92, 93 and 94 in the T rail sections 160 and 166, respectively.

The motor not shown is mounted in the housing 91 and connects to a coupling 81 on the end of worm shaft 42 so as to rotate it and through the linkage 51 the worm shafts 43 and thus drive the trolley 22 to move the door up and down.

As the shafts 42 and 43 are rotated by the motor, the teeth 46 of the trolley 22 engage the worm shafts 42 and 43 so that the trolley can move from end to end along the shafts 42 and 43. The linkage 51 and the worms 42 and 43 are positioned relative to each other such that the teeth 46 mate with the worm shafts 42 and 43 as the trolley 22 moves from shaft 42 to 43.

It is seen that this invention provides a new and novel coupling means for worm shaft and T rail for a garage door opener which allows the unit to be compactly packaged for shipping and installation.

Although it has been described with respect to preferred embodiments, it is not to be so limited as changes and modifications may be made therein which are within the full intended scope as defined by the appended claims.

I claim as my invention:

1. A garage door opener comprising, a movable trolley with a worm engaging portion coupled to said door to move it up and down, a pair of worm shafts mounted end to end and said worm engaging portion of said trolley engageable therewith, and means pivotally connecting the adjacent ends of said worm shaft together so that in the unassembled position said worm shaft can be folded along side each other.

2. A garage door opener according to claim 1 including a pair of longitudinal rail portions formed with cylindrical openings in which the pair of worm shafts are respectively mounted, trolley guiding and supporting portions formed in each of said pair of rail portions and slots formed in said pair of rail portions through

which said worm engaging portion of said trolley extends to engage said pair of worm shafts.

3. A garage door opener according to claim 1 including a pair of hollow slotted plastic cylindrical members respectively receivable within said cylindrical openings of said pair of longitudinal rail portions and acting as bearings for said pair of worm shafts.

4. A garage door opener according to claim 2 including a locking plate attachable to said pair of longitudinal rail portions to lock them in end to end position.

5. A garage door opener according to claim 4 wherein at least one guide hole is formed in the end of one of said pair of longitudinal rail portions and at least one mating locking pin extending from the end of the other of said pair of longitudinal rail portions and receivable in said guide hole formed in said one longitudinal rail portion.

6. A garage door opener according to claim 4 wherein said means pivotally connecting the adjacent ends of said worm shafts together comprises a link with openings formed adjacent opposite ends, a first U-shaped portion formed in the end of one of said worm shafts and one end of said link receivable therebetween, and a first pivot pin extending through the opening formed in one end of said link and through mating openings formed through said first U-shaped portion, a second U-shaped portion formed in the end of the other of said worm shafts and the other end of said link receivable therebetween, and a second pivot pin extending through the opening formed in the other end of said link and through mating openings formed through said second U-shaped portion.

7. A garage door opener according to claim 6 wherein said link is a flat plate.

8. A garage door opener according to claim 6 wherein in the central portion of said link is cylindrical shaped.

9. A garage door opener according to claim 4 wherein said means pivotally connecting said worm shaft together comprises a link with a pair of U-shaped portions formed on opposite ends thereof, a first flattened portion formed on the end of one of said worm shafts and receivable between one of said pair of U-shaped portions and a first pivot pin extending through aligned openings through said first flattened portion and said one U-shaped portion and a second flattened portion formed on the end of the other of said worm shafts and receivable between the other of said pair of U-shaped portions and a second pivot pin extending through aligned openings formed through said second flattened portion and said other of said pair of U-shaped portions.

10. A garage door opener according to claim 1 wherein said worm engaging portion extends across the space between said pair of worm shafts to engage both worms.

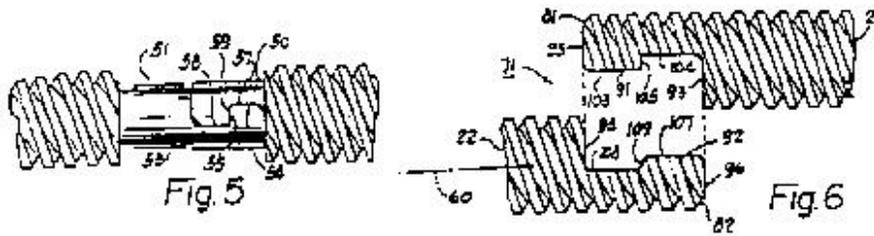
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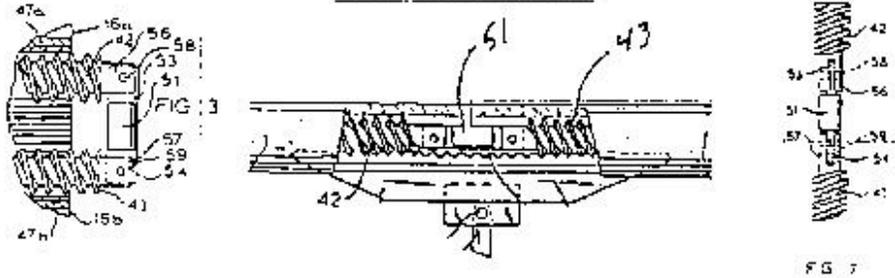
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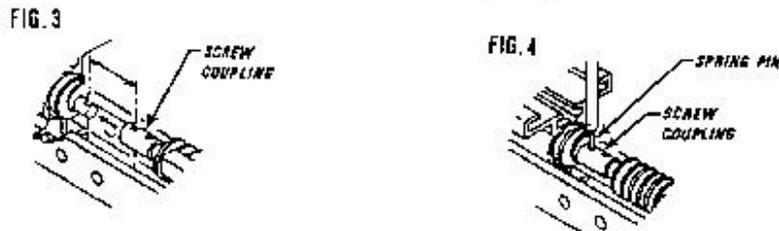
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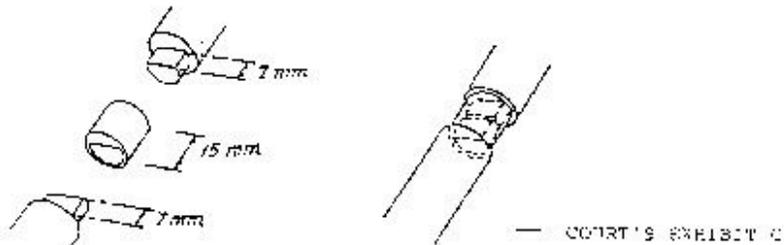
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