

IMPROVEMENTS IN FRICTION STAYS FOR WINDOWS

05 This invention concerns improvements in friction stays for windows or the like.

Such friction stays are designed and arranged to mount a sash (as hereinafter defined) on a fixed frame for adjustable movement of the sash relative to the frame.

10 The term "sash" as used herein means a closure member adjustable relative to a frame and arranged to close an aperture in the frame. The term "sash" is deemed to include a glazed light for top, bottom or side opening, or a non-glazed or partly glazed member
15 such as a fan-light, door or casement.

Various kinds of stays are already known in which arms or links and mounting plates or brackets are connected together by pivot joints. The arms or links extend between the sash and the frame to which they are
20 pivotally connected by the mounting plates or brackets, and a sash is supported on each of two opposed sides by a respective stay. The arrangement of the stays is such that the stays fold up and are confined within a rebate between the sash and the frame when the sash is
25 closed, and for opening and closing movement of the sash, the stays act as hinges with the arms or links pivoting relative to the plates or brackets. The links may comprise two or more elements pivotted together, and the stay may comprise more than one set
30 of arms or links.

In use the sash cannot be permitted to pivot freely on such stays, and some form of restraint is provided, and this invention is particularly concerned with friction stays wherein the frictional restraint is

01 provided by rivetted pivot joints in which the rivet is
clinched under pressure to hold the stay parts tightly
together for controlled pivotal movement with designed
frictional resistance.

05 These rivetted friction pivot joints are not as
simple and easy to manufacture as may be expected, and
there are substantial problems arising both in mass
manufacture and in subsequent installation and use in
service. Particular problems arise in manufacture from
10 the need to maintain tight tolerances for the rivet
centres, special control of the materials used, and
precision in the rivetting operation to achieve and
maintain the requisite tension in the rivet following
clinching.

15 Problems in use of such rivetted friction stays
arise from the loads which have to be supported by the
stay, such as the glazed weight of the sash and
substantial wind loads arising when the stay is
extended carrying the sash. There are also the abusive
20 conditions which the stay has to withstand in service,
such as weathering, movement of the sash or frame and
lack of maintenance. A special problem stems from the
corrosion or weathering and wear in the rivetted pivot
joints for one condition may excite or promote the
25 other.

These rivetted friction stays have to be designed
to a wide range of specifications, this being necessary
to accommodate different dimensions, weights,
applications, materials and service conditions as well
30 as customer preferences. This leads to further
critical requirements which have to be satisfied by the
performance of each rivetted friction pivot joint in
the stay.

01 It is an object of this invention to provide an
improvement in friction stays having rivetted friction
pivot joints whereby the rivetted joint is of simple
form facilitating precision in manufacture of the
05 stays.

Another object of this invention is to provide a
rivetted friction stay wherein the rivet joints are
neat and compact.

A further object of this invention is to provide a
10 rivetted friction stay in which the rivetted pivot
joint is resistant to wear and is designed to uniformly
distribute the load.

Further objects of this invention include
providing an improved pivot joint which can be easily
15 assembled and clinched in the mass manufacture of
rivetted friction stays, and providing particular
arrangements of rivetted friction stays for special
applications or uses.

According to this invention, we provide a rivetted
20 friction stay having first and second elements
pivotally connected together by a rivet having a head,
shank and tail, a spacer is disposed between said first
and second elements to space said elements apart for
relative movement, the shank of the rivet extends
25 through aligned holes in both of said elements and the
spacer, the head and shank of the rivet are coated with
a plastics material providing low friction surfaces on
the rivet, the head of the rivet is of frusto-conical
form received for relative pivotal movement in a
30 complementary recess in that face of the first element
remote from the spacer, the hole in the first element
is concentric with the recess and is oversize relative
to the plastics coated shank of the rivet to provide
radial clearance between the hole and the low friction
35 surface on the shank, the tail of the rivet is clinched
under pressure on that face of the second element
remote from the spacer and the tail is located

01 to prevent rotation of the rivet relative to said
second element.

05 With this invention, by providing the frusto-
conical head on the rivet and the complementary recess
in the first stay element a substantial load bearing
area for uniformly distributing loads is provided.
This load bearing area is one of the critical factors
for obtaining optimum performance. Previously it has
been the standard practice to use flat headed rivets
10 which, size for size, provide a bearing area of about
20% less.

Furthermore, by the provision of the frusto-
conical head and complementary recess, the assembly of
the joint, and the joint itself is self-centering which
15 avoids many of the difficulties in prior forms of
pivotal rivetted joints wherein the flat headed rivet
has to be accurately located in the respective stay
element. It is also considered that the strength of
the rivet where it is subject to high shear in service
20 is greater with a frusto-conical head than with a flat
head, particularly at the juncture of the head and the
shank where the rivetted joint is subject to twisting
and/or bending loads.

Additionally, by providing the plastics coating on
25 the rivet, metal to metal contact between the head of
the rivet engaging the recess face of the first element
is avoided without any necessity to provide any
intervening low friction washer which, if it was used,
would lead to a number of problems such as changing of
30 the designed frictional restraint in service due to
creep or deformation of the washer material.

The coating on the rivet also permits the
selection of different metals for the stay elements and
the rivet and avoids problems of corrosion between
35 dissimilar metals at interfaces.

01 The first stay element is provided with an
oversize clearance hole through which the rivet shank
extends with adequate clearance both to permit the
afore-mentioned self-centering and to prevent the
05 plastics coating on the rivet shank being damaged by
the edge of the hole.

This invention may be applied to friction stays
having stay elements of aluminium or steel, and these
elements may be given suitable surface treatments for
10 corrosion resistance and/or visual enhancement.

Preferably, the spacer interposed between the
first and second elements has a low friction surface
for sliding supporting engagement of the first element
on pivotal movement of said first element.

15 By providing a low friction surface, wear is
avoided and on pivotal movement a support face is
provided immediately adjacent to the rivet shank to
reduce the bending and shear forces applied to the
shank on opening and closing movement of the stay.

20 Conveniently, the spacer comprises an annular
washer. The washer may be of metal coated with a
plastics material.

In a preferred arrangement, the spacer comprises a
plate seated on the second element and having a recess
25 in which the washer is received.

The plate is arranged to provide a substantial
load supporting surface and the plate overlies the
second element. The plate is preferably of a low
friction plastics material and may have means for
30 locating it against movement relative to the second
element. The plate is secured in situ during the
clenching of the rivet, and as well as providing the
support face it provides a reinforcement to the second
element to preclude deformation of the second element
35 by the clinching pressure.

For certain applications of friction stay, the plate comprises a stop face for abutment by the first element to limit pivotal movement thereof.

05 By such an arrangement, the pivotal movement of the stay is limited in a simple expeditious manner incorporated in the pivot joint during assembly of the stay.

10 The clinching pressure applied to the rivet is sufficient to provide the desired friction restraint within the joint in known manner for the particular friction stay and the specification of service therefor. Traditional methods of clinching may be employed such as rolling or turning as appropriate to the particular type and material of rivet.

15 Accordingly to another aspect of this invention, the second element is provided with a frusto-conical recess into which the underside of a frusto-conical plunge in the first element may be received with the spacer of frusto-conical form being interposed
20 therebetween.

Preferably such an arrangement is applied to a friction stay wherein the elements are made of steel where the oversize clearance hole in the first element can be formed by a plunge and piercing operation with a
25 similar manufacturing technique being employed for the second stay element.

The tail of the rivet is prevented from rotating relative to the second stay element, and this may be achieved in several ways.

30 In a preferred arrangement the second element is provided with formations into which the tail of the rivet is clinched. The formations may comprise a series of ribs or splines in the underside of the second element, or teeth or radial serrations formed in

the marginal edge of the hole in the second element through which the tail of the rivet extends.

By such arrangements of formations, the ribs or splines or teeth provide discrete projections about or
05 on which the tail of the rivet is clinched so as to hold the mass of the clinched tail against rotation. The ribs or splines may be an integral feature of an extrusion used for the second element and provide the additional advantage of strengthening the second
10 element. The radial serrations or teeth on the marginal edge of the hole may be formed simply in the piercing operation when the hole is formed.

In an alternative arrangement, the tail of the rivet may be located relative to the second element by
15 interposing a spiked washer under the tail so that on clinching pressure being applied, the spikes bite into the second element and locate it whilst the tail is forced into and between the spikes to secure the tail to the spiked washer.

20 This invention is deemed to include various configurations of rivetted friction stays but has special application to friction stays having two mounting plates adapted respectively for securing to a fixed frame and a sash, and two arms one being longer
25 than the other. In such a stay, each of the opposed ends of the two arms is pivotally connected to a respective mounting plate with the pivotal connections being rivetted joints as aforementioned. However, in other applications of this invention, the first and
30 second elements may be constituted by any combination of stay parts, for instance, an arm and a plate, two link parts, a plate and a link, a bracket and an arm, or the reverse of any of same.

The invention will now be described in further detail with reference to exemplary embodiments depicted in the accompanying drawings wherein:-

05 FIGURE 1 is a side elevation of a first embodiment of a rivetted friction stay shown in an open position;

FIGURE 2 is a sectional view on line II-II of Figure 1 showing a rivetted pivot joint; and

10 FIGURE 3 is an exploded perspective view of the assembly of the rivetted pivot joint depicted in Figure 2.

FIGURE 4 is an exploded perspective view of the assembly of a rivetted pivot joint of a second embodiment;

15 FIGURE 5 is a sectional view of the clinched rivetted pivot joint of Figure 4; and

FIGURE 6 is an underneath plan view of the rivetted pivot joint of Figure 5.

20 FIGURE 7 is an exploded perspective view of the assembly of a rivetted pivot joint being a modification to the second embodiment; and

FIGURE 8 is a sectional view of the clinched rivetted pivot joint of Figure 7.

25 FIGURES 9, 10 and 11 depict a third embodiment with the views of Figures 9 and 10 being similar to those of Figures 4 and 5, with Figure 11 being a top plan view of the rivetted pivot joint.

FIGURE 12 is a side elevation of a fourth embodiment of a friction stay shown in the open position.

30 With reference to the first embodiment shown in Figures 1, 2 and 3, the friction stay comprises a first mounting plate 1 having spaced apart holes 2 through which the plate 1 may be secured to the fixed frame of a window (not shown) by suitable screws or similar

fasteners (not shown). The plate 1 is rectangular of L-section and is an extrusion of aluminium alloy which may be anodised.

05 The friction stay further comprises a second rectangular mounting plate 3 similar to the first mounting plate 1 being an L-section aluminium extrusion. The second mounting plate 3 also has spaced apart holes 4 through which the plate 3 may be secured to a sash of a window (not shown) by suitable screws or
10 fasteners (not shown).

The first and second mounting plates 1, 3 are coupled together by a first arm 5 and a longer second arm 6. The arms 5, 6 are of substantially rectangular section with radiused ends and are also aluminium alloy
15 extrusions. The ends of each arm are pivotally mounted and connected to a respective mounting plate by rivetted friction pivot joints generally designated by reference 7. The pivot joints 7 permit the mounting plates 1, 3 to fulfil a hinging movement relative to
20 each other controlled by the respective lengths of the arms 5, 6 and the centres of the pivot joints.

In known manner, in a window two such friction stays are used to support a sash for opening and closing movement relative to the fixed frame. For a
25 top hung window, for which the stay of this first embodiment is suitable, the friction stays are mounted one on each side of the frame and the sash. In the open position of the stays as shown in Figure 1, the stays support the sash projecting outwardly from the
30 frame. When the sash is closed to the frame, the arms fold upwards from the position shown in Figure 1 and lie between the overlying mounting plates 1, 3 with the folded stay being confined within a rebate extending between the frame and the sash.

01 The pivot joints 7 connecting the ends of arms 5
and 6 to the mounting plate 1 are the same and the
assembly comprises a rivet 8, a spacer 9 comprising an
annular washer 10 and a support plate 11, and a spiked
05 location washer 12.

 The rivet 8 has a metal body with a frusto-conical
head 13 and a cylindrical shank 14. The rivet head and
shank have a coating 15 of plastics material such as
10 nylon applied by powder coating followed by thermal or
other bonding treatment. The coating 15 is firmly
bonded to the metal surfaces of the rivet and provides
an integral low friction surface as well as a
protective layer on the rivet.

 Each end of the arms 5, 6 is provided with a
15 through hole 16 and the outer face of the arm is formed
with a frusto-conical recess 17 concentric with the
hole 16 and complementary to the frusto-conical head 13
of the rivet. The hole 16 is over-size with respect to
the diameter of the rivet shank 14 so that an annular
20 clearance is provided between the rivet shank and the
marginal edge bounding the hole when the rivet is
assembled as shown in Figure 2. The clearance is
sufficient to prevent the marginal edge face bounding
the hole 16 from rubbing or abrading the coating 15 on
25 the rivet shank during assembly and use in service.
Furthermore, the clearance is also sufficient to
provide a tolerance for accurate centering of the rivet
during assembly.

 For each pivot joint 7, the mounting plate 1 is
30 also formed with a hole 18 pierced and plunged through
the plate to provide a recess 19 on the underside of
the plate. The centres of the holes 18 are accurately
spaced along the length of the mounting plate 1 for the
designed pivotal and hinging movement of the arms 5, 6.

The end of each arm is connected to the mounting plate 1 by a rivet 8 and the spacer 9 separates the opposed metal surfaces of the arm and the plate to prevent metal to metal contact. The annular washer 10 is received in a complementary hole in the support plate 11 to locate the washer 10. The washer 10 is preferably a plastics coated metal washer or a plastics washer. The support plate 11 is flat and of rectangular dimensions to lie wholly under the end portion of the arm around the pivot joint. One side of the plate 11 abuts against the upstanding edge flange 20 of the mounting plate 1 to prevent the plate 11 rotating on pivotal movement of the arm. The support plate 11 is of low-friction plastics material such as an acetal resin.

As best shown in Figure 2, in the pivot joint 7 the faces of the support plate 11 and the washer 10 provide opposed thrust faces for load transmission and on pivotal movement of the arm relative to the plate 1, the end of the arm is supported for sliding bearing engagement over a significantly large area adjacent the pivot axis.

In the assembly of the pivot joint, the shank of the rivet extends through the hole 18 in the mounting plate 1 and projects into the underside recess 19 with the spiked washer 12 being received on the end of the shank.

To rivet the assembly together the tail 21 of the rivet is clinched under a predetermined load so that the rivet is maintained in tension to a required and designed degree to impart a frictional resistance within the pivot joint. The tail 21 is clinched under load by rolling or turning, and on such clinching the spiked washer 12 is caused to bite into the underside

of the plate 1 and the material of the tail is pressed onto the washer 12. The washer 12 thereby locates the rivet against rotation relative to the mounting plate 1 and the clinched tail is seated and confined within the recess 19. Under the clinching pressure some local deformation of the support plate 11 occurs but this is accommodated in the design.

As will now be appreciated, the pivot joint is such that only the arm can pivot with respect to the mounting plate for the rivet is located against turning. On pivotal movement of the arm, the bearing forces are transmitted through the frusto-conical faces of the rivet head 13 and the recess 17 with the additional support provided by the spacer 9. The residual tension in the rivet provides the frictional restraint required in the pivot joint.

In this stay of the first embodiment, the pivot-joints 7 connecting the other ends of the arms 5 and 6 to the sash mounting plate 3 are similar but the spacer 9 is a flat annular washer 22 similar to washer 10 but of greater external diameter. If desired, the spacer 9 at these pivot joints may include a flat support plate as aforescribed.

The other embodiments of this invention will now be described with reference to the relevant Figures of the drawings wherein the same references as given for the first embodiment are used to designate similar parts. The following description is directed to the essential differences between the first embodiment and the other embodiments.

With reference to the second embodiment illustrated in Figures 4, 5 and 6, there is shown a pivot joint 7 suitable for a friction stay similar to the first embodiment. The pivot joint comprises a

rivet 8, a spacer 9 comprising a washer 10 and support plate 11. The mounting plate 1 is of flanged channel section providing on the underside a wide groove 23. The base of the groove 23 is formed with longitudinal ribs or splines 24. The mounting plate 1 is an aluminium extrusion with the ribs or splines 24 being integrally formed on extrusion.

On clinching of the rivet tail 21, the rivet material is deformed into the ribs or splines 24 and this prevents rotation of the rivet 8 relative to the mounting plate 1. To locate the support plate 11 of the spacer 9 on the mounting plate 1, the support plate 11 has opposed flanges 25 on the underside which complement the edge flanges 26 of the mounting plate 1. The arrangement of the flanges 25 with the mounting plate 1 prevent the support plate 11 turning on pivotal movement of the arm 6.

With reference to the modification of the second embodiment depicted in Figures 7 and 8, the spacer 9 comprises a flat annular washer 27 of metal coated with a plastics material or of a plastics material. In this modification the support plate of the spacer is omitted and such a pivot joint is suitable for short small friction stays with relatively low weight carrying capacity in service.

With reference to the third embodiment depicted in Figures 9, 10 and 11, this is designed for the manufacture of rivetted friction stays with the mounting plates and arms of stainless steel or coated steel wherein smaller sectional material may be employed to give the same load carrying capacity as aluminium materials. Only part of the stay is shown being the arm 6 and the mounting plate 1. The mounting plate 1 is of channel section providing on the

01 underside a groove 28 extending lengthwise of the
plate. A hole 18 is pierced and plunged through the
central portion of the plate 1 so as to provide a
frusto-conical recess 29 surrounding the hole. The
05 marginal edge of the hole is formed with teeth or
serrations 30 (as best seen in Figure 9) and the
tail 21 of the rivet 8 is clinched into these teeth to
prevent the rivet from rotating relative to the
mounting plate 1.

10 The arm 6 is cranked or joggled adjacent the end
which is radiused and provided with the over-size
hole 16 that is also pierced and plunged to provide a
frusto-conical recess 17 complementary to the frusto-
conical head 13 of the plastics coated rivet 8.

15 Intermediate the arm 6 and the plate 1 there is a
spacer constituted by a washer 31 through which the
shank of the rivet extends. The washer is of low
friction material or has a low friction surface and has
a special part-conical form similar to the type of
20 washer known as Belleville. The cone angle of the
washer 31 corresponds to that of the opposed faces of
the arm and the plate to ensure adequate thrust and
load bearing surfaces.

As in the other embodiments, the rivet is clinched
25 to ensure a residual frictional force in the pivot
joint and the arm is pivotally connected to the
mounting plate by the rivet. The thrust and load
transmitting faces are substantial for supporting the
high loads, and in this embodiment the arm is also
30 located relative to the mounting plate by the provision
of the two complementary plunges in the arm and
mounting plate which engage each other.

With reference to Figure 12, this depicts a
rivetted friction stay suitable for high weight
35 carrying capacity in service and it has particular

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application for sashes to be side hung in a frame with the sash opening sideways about a vertical hinging axis.

As previously described with reference to
05 Figure 1, the stay comprises mounting plates 1, 3 and two arms 5, 6 which are pivotally connected together by rivetted pivot joints 7. The rivetted pivot joints 7 connecting the arms 5, 6 to the sash mounting plate 3 and the joint 7 connecting the arm 6 to the frame
10 mounting plate 1 are substantially the same as described in the first embodiment. The essential difference is the provision of a special support and stop plate 32 forming part of the spacer.

The support and stop plate 32 is rectangular in
15 plan view and includes an arcuate support rib 33 of which the face is in supporting engagement with the arm 5. The plate 32 also has an upstanding pad 34 of which one side is arranged to provide a stop face 35 to limit the extent of pivotal movement of the arm 5.
20 Additionally, the plate 32 provides a further support face 36 which, on folding movement of the longer arm 6 provide a support for the underside of the arm 6. Preferably, the support and stop plate 32 is a plastics moulding secured to the mounting plate 1 by screws or
25 like fasteners (not shown) extending through holes 37 provided in the plate 32.

It will now be appreciated that the friction pivot joint in the friction stay is compact and of simple form with the frusto-conical faces of the rivet head
30 and the recess in the arm providing the substantial areas for load transmitting engagement not only for rotation but also for the tensile loads. Furthermore, due to the over-size hole in the arm, and the use of the frusto-conical faces, on assembly and clinching,

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the rivet is self-centering to align correctly despite any manufacturing tolerances within specified limits. In particular, variations arise in the overall dimensions of the rivet due to the plastics coating thereon.

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The use of a frusto-conical head recessed in the arm permits the design of a compact neat joint if the head is arranged to be flush with the upper surface of the arm. This is in contra-distinction to other forms of rivetted joints where a flat rivet head stands proud of the arm or has to be seated in a special counter-bore reducing the overall thickness of the arm over a substantial part where strength is required.

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It should be noted that only exemplary forms of stay including the improved rivetted friction joint have been described herein. Other forms of friction stays can have such friction pivot joints.

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The mounting plate and the arm may be of suitable configuration and/or section to suit the particular application or design requirement such as may be dependent on or dictated by the type of window system with which the stay is to be employed.

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01 Claims:

1. A rivetted friction stay having first and second elements pivotally connected together by a rivet having a head, shank and tail, a spacer is disposed between
05 said first and second elements to space said elements apart for relative movement, the shank of the rivet extends through aligned holes in both of said elements and the spacer, the head and shank of the rivet are coated with a plastics material providing low friction
10 surfaces on the rivet, the head of the rivet is of frusto-conical form received for relative pivotal movement in a complementary recess in that face of the first element remote from the spacer, the hole in the first element is concentric with the recess and is
15 oversize relative to the plastics coated shank of the rivet to provide radial clearance between the hole and the low friction surface on the shank, the tail of the rivet is clinched under pressure on that face of the second element remote from the spacer and the tail is
20 located to prevent rotation of the rivet relative to said second element.
2. The friction stay according to claim 1 wherein the spacer has a low friction surface for sliding supporting engagement of the first element on pivotal
25 movement of said first element.
3. The friction stay according to claim 2 wherein the spacer comprises an annular washer.
4. The friction stay according to claim 2 wherein the spacer comprises a plate seated on the second element
30 and having a recess in which the washer is received.
5. The friction stay according to claim 4 wherein said plate provides a stop face for abutment by the first element to limit pivotal movement thereof.

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- 01 6. The friction stay according to claim 4 or claim 5 wherein the plate provides an arcuate support rib for the underside of the first element.
- 05 7. The friction stay according to claim 1 wherein the second element is provided with a frusto-conical recess into which the underside of a frusto-conical plunge in the first element is received with the spacer of frusto-conical form being interposed therebetween.
- 10 8. The friction stay according to any one of the preceding claims wherein the second element is provided with formations into which the tail of the rivet is clinched to prevent rotation of the rivet relative to the second element.
- 15 9. The friction stay according to claim 8 wherein the formations comprise a series of ribs or splines in the underside of the second element.
- 20 10. The friction stay according to claim 8 wherein the formations comprise teeth or radial serrations formed in the marginal edge of the hole in the second element.
- 25 11. The friction stay according to any one of claims 1 to 7 wherein a spiked washer is interposed between the second element and the clinched tail of the rivet to prevent rotation of the rivet relative to the second element.
- 30 12. The friction stay according to any one of the preceding claims wherein the first element comprises a first arm and the second element comprises a mounting plate adapted for securing to a fixed frame of a window.
- 35 13. The friction stay according to claim 12 further comprising a second arm longer than said first arm and a second mounting plate adapted for securing to a sash, each of the opposed ends of the first and second arms being pivotally connected to a respective mounting plate.



14. The friction stay according to claim 13 wherein the spacer provides a support face for the underside of the second arm.

15. A rivetted friction stay substantially as hereinbefore described with reference to any one of the embodiments depicted in the accompanying drawings.
