



IMPROVEMENTS IN AND RELATING TO FRAMES AND EXTRUSION SECTIONS FOR FRAMES

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This invention relates to a frame. In particular, but not exclusively, this invention relates to window door or internal partition frames for buildings, being lighter in weight and/or stronger than existing frames.

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Known frames are usually made of aluminium alloy or a plastics substance, and are usually formed by the combining of a series of separate extrusion sections. However, in recent years, there has been some concern that the frames currently in use are not strong enough to prevent buckling of the frame and falling out of any accompanying pane during an earthquake or when exposed to strong winds or that the frames are not able to accomodate minor buckling. One method which has been employed to avoid this problem is to make the frame extrusion sections thicker so that they will be strong enough to resist buckling. However, this results in a significant increase in the weight and expense of the resulting frame.

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The object of this invention is therefore to overcome the above disadvantages or difficulties or at least to provide the public with a useful choice.

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Accordingly, the present invention broadly consists in a frame comprising an outer frame at least part of which is attachable to an internal or external profile of a building and comprising at least one pane supported by the outer frame and/or at least one inner frame supporting a pane, wherein the pane and/or inner frame is



resiliently displaceable relative the outer frame.

Preferably, the frame also includes a frame arrangement comprising a plurality of elongated section including at least one insertion member inserted at least partially inside at least one section of the frame.

In another embodiment, this invention broadly consists in a frame extrusion section for use in forming a frame, having a plurality of corners in cross-section, wherein 50-100% of the corners are rounded.

In a further embodiment, this invention broadly consists in a frame comprising a plurality of frame extrusion sections, wherein 50-100% of the extrusion sections, in cross-section, include closed polygon shape.

In yet another embodiment, this invention broadly consists in a frame comprising outer and inner frame extrusion sections, wherein at least the outer frame extrusion sections are each formed integrally.

Finally, in another embodiment, this invention broadly consists in a frame comprising a plurality of extrusion sections, the extrusion sections having an average wall thickness of 0.8mm, wherein the frame conforms to Chinese Standard No. GB-7106-86.

Preferred embodiments of the invention will now be described, by way of example, with reference to the accompanying drawings, in which :

Figure 1 is a first embodiment of a window having a frame of the invention.

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Figure 2 is a cross-section of through line A-A of figure 1;

Figure 3 is a cross-section through line B-B of figure 1;

Figure 4 is a vertical section through line C-C of figure 1;

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Figure 5 is a variation on the first embodiment of a window having a frame of the present invention.

Figure 6 is a cross-section through line A-A of figure 5.

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Figure 7 is a cross-section through line B-B of figure 5.

Figure 8 is vertical section through line C-C of figure 5;

Figure 9 is a further variation on the first embodiment of a window having a frame of the present invention.

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Figure 10 is a cross-section through line A-A of figure 9.

Figure 11 is a vertical section through line B-B of figure 9;

Figures 12a - 12u are cross sections through a set of window frame extrusion sections suitable for use in a frame of the type shown in figures 1 - 11;

5 Figures 13b - 13h and 24 are cross-sections of seals suitable for use in a frame of the type shown in figures 1-11;

Figure 14 is a second embodiment of a window having a frame of the present invention;

10 Figure 15 is a cross-section through line A-A of figure 12;

Figure 16 is a vertical section through line B-B of figure 12;

15 Figures 17 and 17a are a vertical cross-section through a wheel suitable for use with the frame of the present invention.

Figure 18 is a cross-section through a variation on the second embodiment of a window having a frame of the present invention.

20 Figures 19a - 19r are cross-sections through a set of window frame extrusions suitable for use in a frame of the type shown in figures 14 - 16 and 18;

25 Figures 19s-19w are cross-sections through window frame extrusions suitable for use in a frame of the present invention.

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Figures 20-23 and 25-30 are cross-sections through seals suitable for use in frames of the type shown in figures 14 - 16 and 18;

Figures 31a - 31d are cross-sections through fixed pane arrangements of the present invention;

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Figure 32-35 are cross-sections through seals suitable for use with a frame of type shown in figures 31a-31d;

Figure 36, is a cross-sectional view through brace members suitable for use with the frame of the present invention;

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Figure 37 is a plan view of the brace member of Figure 36;

Figures 38 and 39 are cross-sections and plan views through brace members of the present invention.

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Figures 40 and 41 are cross-sections through a portion of the frame of the invention showing suitable connecting member arrangements;

Figure 42 is a vertical section through a insertion member of the present invention;

Figure 43 is an end view of the insertion member of figure 42;

Figure 44 is a top view of a insertion member of figure 42;

5 Figure 45 is a cross-section through line A-A of figure 42;

Figure 46 is a detail of circled section I on figure 42;

Figures 47-49 and 49a-49f are insertion members suitable for use in a frame of the present invention;

10 Figure 50 is a window having a frame of the invention;

Figure 51 is an enlargement of the circled section II of Figure 50;

15 Figure 52 is a vertical section through line A-A of Figure 51;

Figure 53 is a view in a direction of arrow A of Figure 52;

Figure 54 is an enlarged view of the circled section I2 in Figure 50;

20 Figure 55 is a vertical section through line B-B of Figure 54;

Figure 56 is an enlarged view of the circled section I3 of Figure 50.

25 Figure 57 is cross-section through line C-C of Figure 56;

Figure 58 is a vertical section through line D-D of
Figure 56;

5 Figure 59 is an enlarged view of circled section I4 of
Figure 50;

Figure 60 is a cross-section through line E-E of Figure
59;

10 Figure 61 is a view in the direction of arrow b of
Figure 55;

Figure 62 is an enlarged view of the circled section I5
of figure 56;

Figure 63 is a cross-section through line F-F of Figure
29;

15 Figure 64 is a vertical section through line G-G of
Figure 62;

Figure 65 is a view in the direction of arrow C of
figure 64;

20 Figure 66 is a cross-section through line B-B of figure
65;

Figure 67 is a cross-section through line J-J of Figure
50;

Figure 68 is a vertical section through the line K-K of
Figure 50;

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Figure 69 is a cross-section through a window having a frame of the prior art;

5 Figure 70 is a vertical section through a window having a frame of the prior art;

Figure 71 is a vertical section through a wheel suitable for use with the frame of figure 70;

10 Figure 72 is a cross-section through a brush as used in the frames of figures 69 and 70;

Figure 73 is a cross-section through a fixed window pane in a frame of the prior art;

Referring to the drawings, a first embodiment of the invention in the form of a window frame is shown in figures 1 - 11.

15 The technology described could of course be used in a door frame, or a partition etc. As sliding windows require advanced seal and extrusion technology, figures 1 - 11 all show sliding windows and the concepts embodied in these window examples are, and have been, equally applicable to sash, hinged or any other type of window, door
20 or partition, etc. The frames are lighter, but as strong as existing frames which results in a significant reduction in the amount of the materials required. The strength of the frames derives from a number of features of the frames, each working independently to increase the strength of the frames, and which in combination result
25 in a surprisingly light weight and strong window frame. Some of these features are shown in figures 1 - 11.

Figure 1 shows a window frame generally indicated at 100 having an upper fixed pane 110 and two lower movable panes 120. The fixed pane 110 is surrounded by an outer frame having a top section 130, bottom section 140 and side sections 150. The movable panes 120 are also surrounded by an outer frame formed of a top section 140 (the same as bottom section 140), side sections 150 and bottom section 160. The movable panes 120 are each held in an inner frame having a top section 170, outer side sections 180, inner side sections 185, and bottom sections 190. The sections of the frame are extrusion sections which are illustrated in cross-section in figures 12a - 12u.

Turning now to figure 2, which is a cross-section through line A-A of figure 1, the sides of the outer frame 150 are formed of an extrusion corresponding to that shown in figure 15h. The outer sides 180 of the inner frames surrounding the panes 120, are formed of an extrusion corresponding to that shown in figure 15e. The inner sides 185 of the inner frames are formed of an extrusion corresponding to that shown in figure 15i. The panes 120 are shown as being double glazed, but of course, a pane of single thickness can also be used.

The window panes are held in the sides 180 and 185 by resilient pane support means comprising seals 220 which vary in shape, depending on the number and thickness of the panes 120, see the shapes shown in figures 13b - 13d. The seals 220 are held in place by arms 260 of sides 180 (see figure 12c), the seals and the arms 260 being of corresponding configurations, so that once the seals are positioned within the arms 260, they are difficult to dislodge. The seals may be slidably engaged within the arms 260 or, as they are resilient, pushed into position within the arms 260. The seals 220 not only hold the panes 110, 120 in place, but act as a buffer so that force on the panes is not concentrated at the points at which the panes contact the pane supports, as in known frames, but, by virtue of the resilience of the seals, is absorbed by and spread along the length of the seals. To assist in both the force distribution sealing functions, the seals preferably are formed of one piece which contacts both faces of the pane and one side of the pane.

Between the inner frames and the outer frame, is an abutment seal 230 received by a recess 240 in the sides 180 (see figure 12e), and protruding outwardly so that when the inner frames surrounding the windows 120 are in a closed position, the seals 230 are received by recesses 250 in sides 150 (see also figure 12h).

In the two centre sides 185, a further seal 270 is provided (see figure 13g) which is received by recess 280 in the sides 185 (see figure 12l), legs 275 of which extend outwardly to abut an adjacent side 185 when the sides 185 meet when inner frames are in a closed position as shown in figure 1;

When the inner frames are in a fully opened position, the seals 270 would abut sides 180. The seals 270 perform the function of preventing the sides 185 and 180 from hitting against each other along with a sealing and insulating function and a force distribution function by reducing the load on the points where the sides 180, 185 contact each other. All the seals are formed of a resilient material.

The frame 100 may optionally be provided with a further external frame 200 supporting an insect barrier 210.

The extrusions making up the insect barrier frame 200 correspond to those shown in figure 15m. The insect barrier is discussed further below.

In order to reduce the number of stress points on the outer frame, and to make it easier to fix the frame to a building, the frame 100 is preferably provided with a brace or braces 290 (see also figures 36-39) having extensions 295 which correspond in shape to arms 300 on sides 150 (see figure 12h). The sides 150 of the outer

frame are not directly attached to the building as is normally the case, but are instead slid onto the extensions 295 of the braces 290 which braces 290 are then attached to the building. The braces may be formed as one or a plurality of pieces and may be any shape which corresponds at least in part with the shape of the sides of the frame and in part with the shape of the part of the building to which it is to be attached.

10 The load on the entire frame is also reduced by the use of the braces 290. As the frame is not connected to the brace by any rivets, etc, there are no points at which the load on the frame can concentrate, and thus the load is spread throughout the frame.

Further, the frames are not buckled by the impact of a rivet or such like attaching the frame to a building, or by attempts to adjust the frame to an uneven surface. Rather, the brace can be adjusted to account for uneven walls, and the brace takes the impact of any rivet, etc, leaving the brace arms 295 undeformed to connect with the walls of the frame. Thus, the braces contribute significantly to the overall strength of the frame by reducing the number of force concentration points in the frame. The braces are suitably formed from aluminium, metal alloy or a plastics substance. Different braces may be used for different sides of the frame to correspond with the particular extrusions used.

Referring now to figure 3 which is a cross-section through line B-B of figure 1, it can be seen that a much more simple arrangement may be used for a fixed pane 110. The outer frame sides 150 are preferably attached again to a brace 290 and the panes 110 are attached to the side 150 by support seals 310, which are connected to sides 150 in a manner which will be described further below.

Figure 4 is a vertical section through line C-C of figure 1. Starting at the top, the top section 130 (see also figure 12k) of the outer frame is again suitably held against a building by use of a brace 290. The brace 290 has two extensions 295 corresponding with the arms extending from side wall 130 and a further extension 295 corresponding with the base of side 130.

The extrusion shown in figure 15b forms side 140. In this embodiment, side 140 suitably has three downwardly depending legs 320 forming two chambers which ends receive of each of the two top sides 170 of the inner frames. The inner top sides 170 contact the outer top side 140 with resilient contacting member 330 (see also figure 24). The connecting member 330 has a head 340 which is received in a recess 350 in wall 170. The connecting member 330 also comprises a blade portion 360 which extends laterally to abut and form a slidable seal with the legs 320 of wall 140. The contacting members 330 preferably extend along the

entire length of the side 170, but may be discontinuous. They again perform a plurality of functions : sealing and insulating, stabilising the inner frame and, as they are resilient, spreading any load which would normally be concentrated on the points at which the sides 170 and 140 contact, along the lengths of the contacting members 330.

In this embodiment, the windows 120 are both slidably openable. The lower side 190 of the inner frame thus suitably has a shape corresponding to that shown in figure 15d. The side 190 receives a track 370 formed upon the lower side 160 of the outer frame (see figure 15i). The track 370 is preferably of mushroom-shaped cross-section having a stem 380 and head 400 (see also figure 17). The track may also have a substantially spherical cross-section (see figure 17a). The track head 400 is in this embodiment conveniently received by a resilient pad 410 (see figure 13h) held in recess 420 in wall 190. The pad 410 should be formed of a substance hard enough to allow the pad to slide along the track 370, but also having a measure of resilience so that a force against the wall 190 will not be concentrated on the track head, but will be distributed along the length of the track pad 140 before reaching the track head 400. The advantages of using such a pad 140 are many. The pad reduces the noise of moving the window; the resilience of the pad can accomodate minor deformations in the track; the pad is hard wearing; but most importantly the pad directs force along its length and thus decreases the likelihood of track deformation from a concentration of force on

the track, and thus making the window (or door, etc) easy to use for a long period of time. The pad is suitably formed of hard rubber or engineering plastics and is also therefore very economical.

If an insect barrier is used, a suitable seal 430 (see figure 13e) is inserted within arms 440 of extrusion 200 (see figure 12m), and a further seal 740 is inserted in recess 450 of extrusion 200. Seal 430 prevents rattling and assists in holding the insect barrier frame in place. Seal 740 first has an insect barrier mesh wrapped around it, which is suitably gripped by teeth 735 formed on the seal (see figure 30), and is then inserted in recess 450.

In use, when a force is applied to the panes 110 or 120, for example a strong wind, the load is not, as in previously known frames, concentrated on the frame extrusions and any points at which the extrusions are connected to each other or to other parts of the frame, but is distributed along the lengths of the resilient seals.

The seals therefore perform not only sealing, insulating and connecting functions, but also a force distribution function.

The windows shown in figures 5 - 11 employ the same concepts as discussed above, but with various different arrangements of fixed 110 and movable 120 window panes.

Figure 6 shows the use of an extrusion 183 (see figure 12j) which has a recess 250 performing the same function as the recess 250 in side 150. This type of extrusion is useful when a plurality of movable planes 120 are arranged in series. It can be seen from figures 1 - 11 that a number of variations may be made in the number arrangement and shape of the extrusions and seals to suit whatever application is required.

10 An example of further variations along the same themes can be seen in figures 14 - 16 and 18 which show a second embodiment of a frame employing the same concepts as those of figures 1 - 11.

Referring to the figures 14 and 15, instead of the seal 230 used in the first embodiment of a window frame, a slightly a different seal 590 (see figure 23) is used in this frame. The head 600 of seal 590 is received by a recess 610 in the side wall 560 of the inner frame 560 (see figure 19b). The seal 590 has two legs 620 which when they abut the outer frame side wall 530, can splay out a little so as to ensure a good seal between the outer wall 530 and the inner wall 560.

The abutment seal 630 (see figure 20) has also been modified. The abutment seal 630 has a head 640 which is received in a recess 650 in the sides 570 of the inner frame (see figure 19e). Rather than the tails 670 of the abutment seals abutting an opposing

side wall of the inner frame as in the first embodiment, in this embodiment, the tails 670 of abutment seals 630 are designed to abut
5 each other, which provides a better seal between the two inner side walls of the inner frame.

A further seal 680 is also provided between the insect barrier frame 690 (see figures 19m and 19o), and the sides of the inner frame 560 and 570. This prevents the insect barrier pushing
10 against other parts of the window frame when under pressure. The insect barrier material 730 is held by seal 740 (see figure 30) which is received by a recess 750 in the insect barrier frame side 690. The insect barrier is provided with an abutment member 1030 (see figure 28) which is received in a recess 1040 in one side of the insect
15 barrier frame 690 (see figures 19m and 19o). When in a closed position, the pointed end 1050 of the abutment member 1030 is received by a corresponding recess 1020 in a corresponding insect barrier frame side 690. This member 1030 allows the insect barrier to be closed quietly and not to rattle. Turning to figure 16, it can be
20 seen that the insect barrier frame member 690 is supported on a leg 1060 of the extrusion 540 which is received by a receiving member 1070 (see figure 29). The frame 690 can therefore slide along the leg 1060 if necessary.

In the second embodiment shown in figures 14 - 16 the window seals 760 which are received in the arms of the sides 560 and 570 and which receive the window panes are of slightly different shapes than those of the first embodiment so as to function better (see figures 27, 25 and 26). Note that, in particular, they are provided with teeth 770 for better gripping of the glass. The seal shown in figure 27 is for a double-glazed window, and the seals shown in figures 25 and 26 are for a single-glazed window, but of two different widths. Again the seals are shaped to not be easily dislodged from the arms of the sides of the frame, once inserted.

Looking at figure 16, which is a vertical section through the line B-B of figure 14, it can be seen that instead of providing a track pad as in the previous embodiment, in this embodiment the inner frame rides on the track 370 by means of wheel or wheels 780 (see also figures 17 and 17a). The wheel is freely moveable about a central axle 790 which is fixedly connected to the bottom side 580 of the inner frame. A groove 800 in the wheel receives the head 400 of the track 370 projecting from the bottom wall 540 of the outer frame. The groove is specially shaped to not to conform to the shape of the track head, but have a wide base 805, so that minor deviations in the track will be accommodated by the base 805 of the recess 800 and will not, therefore, make the window, door, etc. difficult to open. An advantage of having the wheel freely

movable along its axle is that when the inner frame is subjected to a force, the load will not be concentrated at the point at which the wheel joins the axle, as the wheel will be able to move.

However, in order to avoid the load then being concentrated at the point at which the wheel meets an inner wall of the extrusion 580, a seal 810 (see figure 21) is provided, which has a head 820 which is received by a recess 830 in the side 580. In order to perform a sealing function under normal conditions, the seal 810 preferably has a tail 840 which abuts the bottom side 540 of the outer frame. The seal is also provided with an extension 850 which when a side wall 860 of the side 580 moves the towards the wheel 780 (as it would by virtue of the wheel being freely able to move along its axis), abuts the stem 380 of the track 370 before the side wall 860 hits the wheel 780. The load is thus concentrated on the seal 810, and is distributed along its length. The seal 810 preferably extends along the entire length of side 580, but may be discontinuous.

At the top of the inner frame, there is provided a pair of contacting seals 865, which work in a similar manner to contacting seal 330 in the first embodiment. These seals 865 (see figure 22) have heads at 870 which are received by recesses 880 (see figure 191) in the upper side of the inner frame 550. In the first embodiment, this seal had a single blade 360 which abutted legs 320 downwardly

depending from the upper outer frame. In this embodiment, for extra strength and load distribution ability, the slightly differently
5 downwardly depending legs 900 of extrusion 520 are contacted by a blade 890 of the seals 865 on both sides. The blades 890 are resilient, so that when a wind-like force is applied to the inner frame, the load is taken up by the blades 890 of the seals 865 and distributed along the length of the blades before being transferred to the legs 900
10 of outer frame. Thus, whereas in known frames a wind-like force will be concentrated on those points at which the inner frame connects the outer frame; in the present frame, the force is directed away from the connection points and distributed along the length of the seals.

15 Figure 18 shows the use of a curved section 1200 (see figure 19k) suitable for use in balcony, conservatory, glasshouse or other frames where a curved corner is required. The corner piece 1200 may be a quarter circle as shown or any other curved section as desired. The corner pieces may have integrally formed legs 1200
20 (such as the curved section of figures 12a or 12n), or may have separate sides 1220 (two of which are shown as being joined together in figure 19f) joined to it by connection members.

Sides 1220 are very versatile and may be used in a number of different variations of frames of the present invention.

In the first embodiment, the section 1200 may have recesses 250 formed in it to receive seals 230. In the second embodiment, the use of seals 590 obviate the need for recesses 250.

5 The extrusions shown in figures 19q, 19r and 19s are for three track frame, if such a frame should be desired for example for mounting a number of window panels on a single track. This arrangement is particularly suitable for indoor partitioning. 4, 5, 6 or more tracks could be provided if desired. 19s shows how the ends
10 of extensions may be bulbed if desired for safety and for better securing of seals, among other reasons. Figures 19t-19w show various other suitable extrusion shapes for different frame applications.

 Figures 31a - 31d show examples of preferred
15 arrangements for mounting fixed panes 110 to any outer frames of any of the discussed embodiments. A number of options are possible, all of which concentrate on the re-distribution of the load from the connection points between the pane and frame along the length of seals. The first example is in figure 36a, in which a single
20 plane is held in a u-shaped pane support seal 930 (see figure 35) which may be held in place by two brackets 950 (left hand side of the drawing), or by one bracket 950 and one leg 905 of the extrusion 910 (right hand side). Usually one side of a frame needs to hold the plane against a leg of the extrusion, for strength, although all the
25 sides may be so arranged for extra strength. The seals 930 and brackets 950 are preferably secured in place by use of an adhesive substance, but they may also be attached with a connecting member such as a rivet or screw etc.

In figure 31c, a single pane is shown on the left hand side as being held in place by two angled pane support seals 940 (see figure 32). On the right hand side, the pane is supported by one angled seal 940 on one face, and a rectangular seal (see figure 33) on the other face which is held in place by the leg 905 of the extrusion 910.

Figure 31b shows an arrangement for a double-glazed window, door etc, in which a double u-shaped pane support seal 960 (see figure 34) holds two panes in place. On the left hand side, the seal 960 is held in place by two brackets 950; and on the right hand side, the seal 960 is held in place by a leg 905 of the extrusion 910 and a bracket 950.

In figure 31d, which also relates to double-glazed panes, the panes are held in place by a rectangular seal 970 (see figure 33) between the two panes, and an angled seal 940 on either side of the two window panes. On the right hand side, one side of one pane is supported by rectangular seals and a leg 905 of the extrusion 910.

The pane support seals perform more than a purely sealing and connecting function, but serve, when the panes are subjected to a force, to spread the load of that force along the length of the support seal rather than having the load concentrate at the connection points between the panes and their supports or the

extrusions, as in known window frames.

Very many variations in support seal, bracket and
5 extrusion leg arrangements and shapes may be made so long as both
faces of a pane or panes directly contact a resilient pane support seal.
The seals preferably, for improved sealing and force distribution
ability, contact both faces of the pane and one side of the pane.

Further, in keeping with the load distribution feature
10 of the invention and in order to increase the strength of the entire
frame arrangement, any substantially rigid connections such as
screws, rivets, bolts, etc. which connect one part of a frame to
another are preferably buffered as shown in figure 40 by surrounding
them with sleeve 1000 for at least part of their length.

15 A further feature of the frames of the present
invention is the provision of insertion members which are slidably
engageable within the frame extrusions. These insertion members
perform a plurality of functions. Firstly, the connection members
preferably terminate by inserting into an insertion member 1010,
20 instead of screwing or otherwise biting into a wall of an extrusion of
itself. Suitably, the connection members pass through the extrusions
but do not actively engage them. Rather, they are engaged by the
sleeves 1000 and engage the insertions 1010. Thus, force does not
concentrate on the point where the connection member and the
25 extrusion engage, but rather is distributed throughout the sleeve and

insertion member. Secondly, the insertion members themselves can perform as connection members. Figures 42-46 show an insertion member 1010 which is particularly suitable for use as a connection member in connecting two sides of a frame at a corner. The insertion 1010 is corner-shaped and also preferably corresponds to the shape of the extrusions being joined. Use of this insertion makes the frames of the present invention very easy and quick to assemble as the insertion need merely to be slid into the end of appropriate side extrusions of the frame. This corner shaped insertion suitably has a notch 1015 so that one of the side extrusion will extend a little under the other side extrusion so as to provide a good seal. The two side extrusions can be sealed in any conventional manner, if necessary, such as with a sealant.

A third advantage of the insertions is that they strengthen and support the extrusion they are fitted into. Furthermore, the insertion obviates the need for other more localized connection members which would concentrate any force on discrete connection points. The insertion members thus allow force to be distributed along the points at which the extrusions contact the insertions.

Figures 47-49 and 49a-49f show other shapes of insertion suitable for use with the frame of the present invention. Figure 49b is a cross-section through section line A-A of figure 49a and figure 49c is a cross-section through line B-B of Figure 49a, similarly with figures 49d-f. The insertion members 1010 which receive connection members require no other

connection to the frame than that provided by receiving the
connecting members 980 particularly as the insertion of the
5 connecting members into the insertion members causes the insertion
members to expand a little.

By providing resilient sleeves 1000 and insertion
members 1010, load on the points where the connection members
touch the frame is significantly reduced. This is because the load,
10 rather than being concentrated on discrete points is spread throughout
the sleeve 1000 and insertion member 1010. Further, using the
insertion members avoids the need for connection members on the
outside of the frame, for example at point 1020 in figure 37, and
thus, allow a reduction in numbers of connection points. Also, the
15 frame will have no visible connection members when installed in a
building, which is an advantage for aesthetic reasons.

Figures 18 - 35 give details of how various
connections between various parts of the window frames are
achieved. These figures all relate to various parts of the
20 window shown in figure 18 (see the brief description of the
drawings), and the reference numbers correspond to reference
numbers used in describing figures 1 - 11, with exception of 980
which indicates a connection member and 1010 which indicates an
insertion member.

Figure 41 illustrates a further means of reducing the force concentration on discrete points on the frame. Usually, when connection members such as screws are to be inserted into a frame section, a hole first needs to be made. Such a hole is usually made by use of drill which leaves slightly ragged edge around the hole and which therefore weakens the frame. In the present invention, a hole is made by folding the edges of the hole into the frame with a special drill bit. This means that the edges of the hole which are folded in contact with the connection member and spread any force about the entire folded in section, rather than having the force concentrate on the points about the edge of the hole and the screw.

By way of comparison with the frame system of the present invention, a prior art frame is shown in figures 69, 70 and 73 in which it can be seen that very few seals are used. Instead of seals are provided brushes 1300 (as shown in figure 72) connecting the inner and outer frames. The brushes, however, provide inferior sealing and insulating properties and also provide no force distribution function. Seals 1310 are provided between the movable panes and the inner frame, but they provide an inferior force distribution function as they do not surround the edges of the panes. This also makes the seals weaker and less able to insulate.

In the fixed panes 110 (see figure 73) the panes are held in place with rigid extrusion sections 132 secured with screws. Thus, no force distribution function is provided. The extrusion sections 1320 may have a sealant applied over them, but that sealant would not perform the force distribution function that the pane support seals of the present invention perform.

The wheel 1330 of the prior art has a recess 1330 which corresponds in shape with the track head 1350. This arrangement has the disadvantages described earlier of not being able to accomodate for distortions of the track.

Referring now to the properties of the extrusions themselves, figures 12a - 12u show cross-sections through a set of extrusion sections which make up the sliding windows shown in figures 1-11. Figures 12n-12u are variations on the extrusions of 12a-12m. Figures 19a - 19w show a set of extrusion sections which make up the sliding windows 30 shown in figures 14 - 16.

Looking at figures 12a - 12u and 19q - 19w, it can be seen that these cross-sections have unique designs. Features of these designs are curved corners, closed polygon sections, and integrally formed pieces. Each individual piece has been designed so as to produce extrusion sections which have unique and previously unobtainable properties. The design of these frame sections results in a frame which is lighter than, but as strong, as existing frames.

For example, existing aluminium frames of the specifications indicated below, generally have weight of between 0.9 and 2kg /m of a frame. However, similar aluminium frames assembled with the frame extrusion sections of the present invention can have a weight of less than 0.9kg /m² area of window frame. In fact, even a frame having a weight as low as 0.47kg /m² can be made from the extrusion sections of the invention, without any loss strength when compared to existing frame structures (see Table 1). The significant material savings are therefore a very obvious advantage of the present invention.

One of the reasons the frame extrusion sections of the present invention can be lighter but as strong as existing frame extrusion sections, is that they have at least 50%, and preferably, 100% rounded corners as opposed to the sharp right-angled corners of known window frame extrusions (see figures 69, 70 and 73 and table 1). This arrangement better distributes any load on the extrusions about the extrusion as opposed to allowing the load to concentrate at the corners as in known extrusions. The corners preferably have a radius of curvature of between 0.4mm and 10mm, preferably between 0.4 mm and 5mm.

TABLE 1

Extrusion type	Extrusions of same thickness (0.8mm)	Present invention = 0.8mm thickness Prior art = 1mm thickness	No. of corners		
			round	sharp	total
Present invention	0.4671	0.4671	373	0	373
Prior art	0.9344	1.1364	281	338	619

The data in Table 1 is based on a sliding window made to the specification of ATC 90-1518, 1500mm x 1800mm, total area 2.7m².

In table 2, inner frame extrusion sections were tested by applying a force as shown on (a) the curved in portions of the arms of an extrusion of the present invention; (b) the middle of the inward facing section of the arms of a prior art extrusion performing the same function in a frame as that of (a); and (c) with the force on the corners shown in a prior art extrusion of (b). The force applied was in the direction of the arrow shown.

TABLE 2

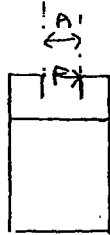
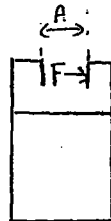
Frame, type & specification	Force loaded schematic diagram	Force F (N)	Deformation δA (mm)
(a) Frame of present invention Series 55 Wall thickness 0.8mm	Loaded length 22.5mm 	41	0.12
(b) Prior art Series 70 Wall thickness 0.8mm	Loaded length 22.5mm 	41	0.26
(c) Prior art 70-series Thickness 0.8mm	Loaded length 22.5mm 	41	0.30

TABLE 3

Frame, type & specification	Force loaded schematic diagram	Force (N)	Deformation δA (mm)								
Frame of present invention Series 55 Wall thickness 0.78mm		799.68	<table border="1"> <thead> <tr> <th>A</th> <th>B</th> <th>C</th> <th>D</th> </tr> </thead> <tbody> <tr> <td>0.6</td> <td>0.35</td> <td>1.05</td> <td>1.39</td> </tr> </tbody> </table>	A	B	C	D	0.6	0.35	1.05	1.39
A	B	C	D								
0.6	0.35	1.05	1.39								
Prior art Series 70 Wall thickness 1.1mm		799.68	<table border="1"> <thead> <tr> <th>A</th> <th>B</th> <th>C</th> <th>D</th> </tr> </thead> <tbody> <tr> <td>1.17</td> <td>0.52</td> <td>0.79</td> <td>1.49</td> </tr> </tbody> </table>	A	B	C	D	1.17	0.52	0.79	1.49
A	B	C	D								
1.17	0.52	0.79	1.49								
Frame of present invention Series 55 Wall thickness 0.78mm		Destructive force 3255.56	Plastic deformation :								
Prior art Series 70 Wall thickness 1.1mm		Destructive force 2891.92	Plastic deformation								

The window frame is supported at corners E, F, G and H, and deformation measured at points A, B, C and D. The force F is distributed evenly over the surface of the glass.

Thus it can be seen that a frame made with extrusions of the present invention, having a reduced or same wall thickness as a frame made from prior art extrusions, deforms less when a force is applied to it than does a known frame made from known extrusions. Further, the extrusions alone also deform less.

The Chinese Standard No. GB-7106-86 requires that a frame be able to withstand a force of 350 kg/m. The 70 series frame of the present invention was found to withstand a force of 1312.9 kg/m and the 55 series frame was found to withstand a force of 1476.4 kg/m, both of which significantly exceed industry standards.

5 Strength has also been imparted to the frame extrusion sections of the present invention by forming parts of the extrusions which in known window frames are joined by rivets or other connecting members, as a single integral extrusion. Another reason many of the frame extrusion sections of the present invention are
10 strong is because they include a large number of closed polygon shaped portions. In particular between 50% and 100% of the extrusion sections should have a closed polygon shaped portion, which significantly decreases the deformation of the extrusion section when the section is subjected to a force. Further, the seal, insertion,
15 brace and bracket and sleeve arrangements described above distribute the load on frames so that they are no longer required to be as thick as they were needed to be previously in order to have the same ability to withstand a certain force.

The strength of an extrusion section is often measured by the amount of force required to collapse a frame having extrusions of a certain wall thickness, amongst other parameters - see table 3. Frames made of extrusion sections of the present invention having a wall thickness of 0.78 mm are destroyed only under forces of greater than 3,000 N. However, known similar frames made of extrusion sections of a wall thickness of 1.1mm, for example, collapse under a force less than 3,000 N. The frames of the present invention generally have a destructive force to wall thickness ratio of 3.5 to 5 N/mm, whereas known frames generally have a destructive force to wall thickness ratio of between 2 and 3 N/mm under the test conditions of Table 3.

The above describes preferred embodiments of the present invention, variations and modifications in which may be made without departing from the scope of invention as claimed in the accompanying the claims.

Although the embodiments described show sliding windows and fixed panes, it is envisaged that the concepts behind the present invention may be applied to sashed and hinged and any other type of window, door or any other frame. Although specific shapes of extrusion, seals inserts, braces and brackets have been described, various other inserts, seals, extrusions, braces and brackets may be used to the same effect, that being the even distribution of load about

the frame, and the strengthening of the extrusions themselves.

An insect barrier is shown by way of example and
5 various other window or door frame attachments such as security
grills may also be attached in a similar manner.

Although the major load distribution seals are
provided along the top and bottom edges of the windows in the
embodiments described, similar seals could also be provided on the
10 sides of the window frames.

The extrusions may be made of any suitable
substance, eg. aluminium alloy, tin, PVC, or other plastics materials,
etc, and the panes may be made of glass, polycarbonate, acrylic or
any other suitable substance.

15



CLAIMS

1. A frame arrangement comprising an outer frame at least part of which is attachable to an internal or external profile of a building and comprising at least one pane supported by the outer frame and/or at least one inner frame supporting a pane, wherein the pane and/or inner frame is resiliently displaceable relative the outer frame.
2. A frame arrangement as claimed in claim 1 wherein the pane and/or inner frame is resiliently displaceable in a direction substantially perpendicular to the plane of the outer frame.
3. A frame arrangement as claimed in claim 2, wherein the pane and/or inner frame is resiliently displaceable in both directions perpendicular to the plane of the outer frame.
4. A frame arrangement as claimed in claim 1 wherein the pane is resiliently displaceable relative the outer frame by virtue at least in part, of the frame being provided with resilient pane support means contacting both the pane and frame.
5. A frame arrangement as claimed in claim 4, wherein the resilient pane support means forms a seal between the pane and the outer frame.
6. A frame arrangement as claimed in claim 4, wherein the pane support means is an elongated strip which extends along at least one face of the or each pane.



7. A frame arrangement as claimed in claim 4, wherein the pane support means simultaneously contacts both faces and one edge of the or each pane.
8. A frame arrangement as claimed in claim 4, wherein the pane support means extends along the entire circumference of the pane.
9. A frame arrangement as claimed in claim 1, wherein the outer frame is provided with a brace member which connects the frame to a surface of a building.
10. A frame arrangement as claimed in claim 1, wherein the brace member slidably engages the outer frame.
11. A frame arrangement as claimed in claim 1, wherein the inner frame is slidably movable in the plane of the outer frame, and wherein the inner frame is resiliently displaceable relative the outer frame by virtue of the frame arrangement being further provided with a resilient contacting member contacting at least part of the inner frame and at least part of the outer frame.
12. A frame arrangement as claimed in claim 11, wherein the resilient contacting member forms a seal between the inner and outer frames.



13. A frame as claimed in claim 11, wherein where the resilient contacting member contacts both the inner and outer frames, when a force is applied to the inner frame, force is transferred to the outer frame substantially via the resilient contacting member.

14. A frame arrangement as claimed in claim 13 wherein the resilient contacting member comprises at least one anchor portion received by the inner frame and a force receiving portion or portions extending from the anchor portion which contact the outer frame.

15. A frame arrangement as claimed in claim 14, wherein the force receiving portion(s) of the resilient contacting member are tapered away from the anchor portion.

16. A frame arrangement as claimed in claim 11, wherein the frame comprises a plurality of longitudinal sections and wherein the resilient contacting means extends longitudinally of at least one section of the frame.

17. A frame arrangement as claimed in claim 11, wherein the inner frame is supported by a track provided by the outer frame and wherein the track is received by an at least partially resilient pad mounted on the inner frame.

18. A frame arrangement as claimed in claim 11, wherein the inner frame is supported on a track provided on the outer frame, and wherein the inner frame is provided with a wheel or wheels



communicating with the track, the wheel being rotationally and longitudinally movably mounted on an axle.

19. A frame arrangement as claimed in claim 18, wherein the wheel is provided with a recess for receiving the track wherein the base of the recess is of a width broader than the width of the part of the track received by the recess.

20. A frame arrangement as claimed in claim 18, wherein the inner frame is further provided with resilient seal means abutting both the inner frame and the outer frame, and wherein the seal means moves relative the track when the inner frame is displaced relative the outer frame in a direction substantially perpendicular to the plane of the pane.

21. A frame arrangement as claimed in claim 18, wherein when a force substantially perpendicular to the plane of the pane is applied to the frame, the inner frame is movable in the direction of the force by virtue, in part, of the wheel being so rotationally and longitudinally movably mounted on its axle.

22. A frame arrangement as claimed in claim 21, wherein when the resilient seal means moves relative the track when the inner frame is displaced relative the outer frame in the direction of said force, the resilient seal abuts the track before the wheel reaches the limit of movement along its axle.



23. A frame arrangement having at least one frame, at least one pane, and at least one resilient member, the resilient member having at least one anchor portion receivable by part of the frame and at least one force receiving portion having an end distant from the anchor portion, such that in use, the resilient member is arranged so that the force receiving portion bends in response to a force to the distant end via another part of the frame or by the pane.

24. A frame arrangement as claimed in claim 23, wherein force on one part of the frame or a pane contacting the resilient member is transferred substantially via the resilient member to another part of the frame or pane contacted by the resilient member.

25. A frame arrangement as claimed in claim 23, wherein an anchor portion of a resilient member as claimed in claim 6 is received by the inner frame and a force receiving portion or portions of the resilient member contact the outer frame.

26. A frame arrangement as claimed in claim 23, wherein the resilient member forms a seal between the part of the frame which receives the anchor portion of the resilient member and the part of the frame or pane which contact the force receiving portion.

27. A frame arrangement as claimed in claim 23, wherein when the force receiving portion(s) bend, they bend into a shape of arcuate section.



28. A frame arrangement comprising a plurality of elongated sections including at least one insertion member inserted at least partially inside at least one section of the frame.

29. A frame arrangement as claimed in claim 28, wherein the insertion members receive the ends of elongated connection members after the connection members have passed through parts of the frame to be connected.

30. A frame arrangement as claimed in claim 28 wherein the body of each connection member is surrounded by a resilient force receiving sleeve.

31. A frame arrangement as claimed in claim 28, wherein the insertion members are slidably insertable into sections of the frame.

32. A frame arrangement as claimed in claim 28, wherein the insertion members substantially correspond in shape to the shape of the portion of a frame section into which they are inserted.

33. A frame arrangement as claimed in claim 28, wherein one insertion member can be inserted into two frame sections to hold the two sections together.

34. A frame arrangement as claimed in claim 28, wherein the insertion member is elongated and a force on a section having an insertion member inserted therein is transferred to the entire insertion member.



35. A frame extrusion section for use in a frame, wherein the section, in cross-section, has a plurality of corners, and wherein at least 50% of the corners are rounded.
36. A frame extrusion section as claimed in claim 35, wherein at least 60% of the corners are rounded.
37. A frame extrusion section as claimed in claim 35, wherein at least 70% of the corners are rounded.
38. A frame extrusion section as claimed in claim 35, wherein at least 80% of the corners are rounded.
39. A frame extrusion section as claimed in claim 35, wherein at least 90% of the corners are rounded.
40. A frame extrusion section as claimed in claim 35, wherein at least 100% of the corners are rounded.
41. A frame extrusion section as claimed in claim 35, wherein the rounded corners have a radius of curvature of between 0.4 and 10 mm.
42. A frame extrusion section as claimed in claim 35, wherein the rounded corners have a radius of curvature of between 0.4 and 5 mm.
43. A frame comprising of plurality of frame extrusion sections, wherein at least 50% of the extrusion sections, in cross-section, include a closed polygon shape.
44. A frame as claimed in claim 43, wherein at least 65% of the extrusion sections, in cross-section, include a closed polygon shape.



45. A frame as claimed in claim 43, wherein at least 70% of the sections included a closed polygon shape.
46. A frame as claimed in claim 43, wherein at least 80% of the sections include a closed polygon shape.
47. A frame as claimed in claim 43, wherein at least 90% of the sections include a polygon shape.
48. A frame as claimed in claim 43, wherein 100% of the sections include a polygon shape.
49. A frame as claimed in claim 43 wherein, in cross-section, the extrusion sections have a plurality of corners wherein 50-100% of the corners are rounded.
50. A frame arrangement comprising a plurality of outer frame extrusion sections which are each formed integrally.
51. A frame arrangement as claimed in claim 50, wherein all of the frame extrusion sections are each formed integrally.
52. A frame comprising a plurality of extrusion sections, wherein the frame can withstand a force of at least 50% more than that required by Chinese Standard No. GB-7106-86.
53. A frame as claimed in claim 52, wherein the frame can withstand a force of at least 100% more than that specified by Chinese Standard No. GB-7106-86.
54. A frame as claimed in claim 52, wherein the frame can withstand a force of at least 150% more than that specified by Chinese Standard No. GB-7106-86.



55. A frame as claimed in claim 52, wherein the frame can withstand a force of 200% more than that specified by Chinese Standard No. GB-7106-86.

56. A frame comprising a plurality of frame extrusion sections as claimed in any one of claims 35-42.

57. A frame as claimed in claim 56, wherein the frame has a weight of between 0.4 and 0.9kg/m² of frame.

58. A frame extrusion section as claimed in claim 56, wherein the frame extrusion section is formed of an aluminium alloy.

59. A frame as claimed in claim 56, wherein the edges of any holes made in the frame are pushed into the frame.