US 20050284030A1

(19) United States

(12) Patent Application Publication (10) Pub. No.: US 2005/0284030 A1

Autovino et al. (43) Pub. Date: Dec. 29, 2005

(54) FIRE RETARDANT PANEL DOOR AND DOOR FRAME HAVING INTUMESCENT MATERIALS THEREIN

(76) Inventors: **Enrico Autovino**, Avenel, NJ (US); **James Jelinski**, Avenel, NJ (US)

Correspondence Address:
EZRA SUTTON
PLAZA 9
900 ROUTE 9
WOODBRIDGE, NJ 07095 (US)

(21) Appl. No.: **10/867,051**

(22) Filed: **Jun. 14, 2004**

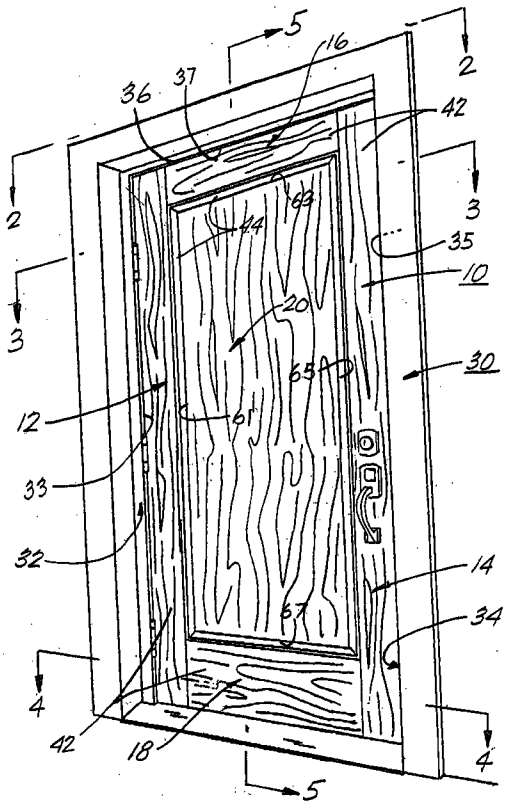
Publication Classification

(51) **Int. Cl.**[7] **E04H 14/00**

(52) **U.S. Cl.** **52/1**

(57) **ABSTRACT**

A fire retardant panel door and door frame that prevents the spread of fire through the door during a fire. The fire retardant panel door has at least one door panel and stiles and rails. The door panel includes an interior center composite section formed by a first plurality of layers of intumescent materials and a first plurality of layers of fire resistant materials disposed between and laminated to a pair of outer sections formed of wood for enclosing the interior center composite section to form a composite laminated door panel. Each of the stiles includes a first center core formed of wood enclosed by a second plurality of layers of intumescent materials and a second plurality of layers of fire resistant materials; and the second layers of intumescent and fire resistant materials are enclosed by a first applique layer formed of wood to form a composite laminated stile. Each of the rails includes a second center core formed of wood enclosed by a third plurality of layers of intumescent materials and a third plurality of layers of fire resistant materials; and the third layers of intumescent and fire resistant materials are enclosed by a second applique layer formed of wood to form a composite laminated rail. The first, second, and third plurality of layers of intumescent materials are activated to expand upon exposure to heat and/or fire to prevent the heat and/or fire from passing through at least one door panel, the stiles and the rails of the panel door during a fire for at least 90 minutes. At least one door panel is connected to the panel door by tongue and groove joints; and the tongue and groove joints have a fourth plurality of layers of intumescent materials and a fourth plurality of layers of fire resistant materials in the tongue and groove joints; and wherein the fourth plurality of layers of fire resistant materials in the tongue and groove joints are activated to expand upon exposure to heat and/or fire to seal the joints in order to prevent the heat and/or fire from passing through the panel door during a fire for at least 90 minutes.



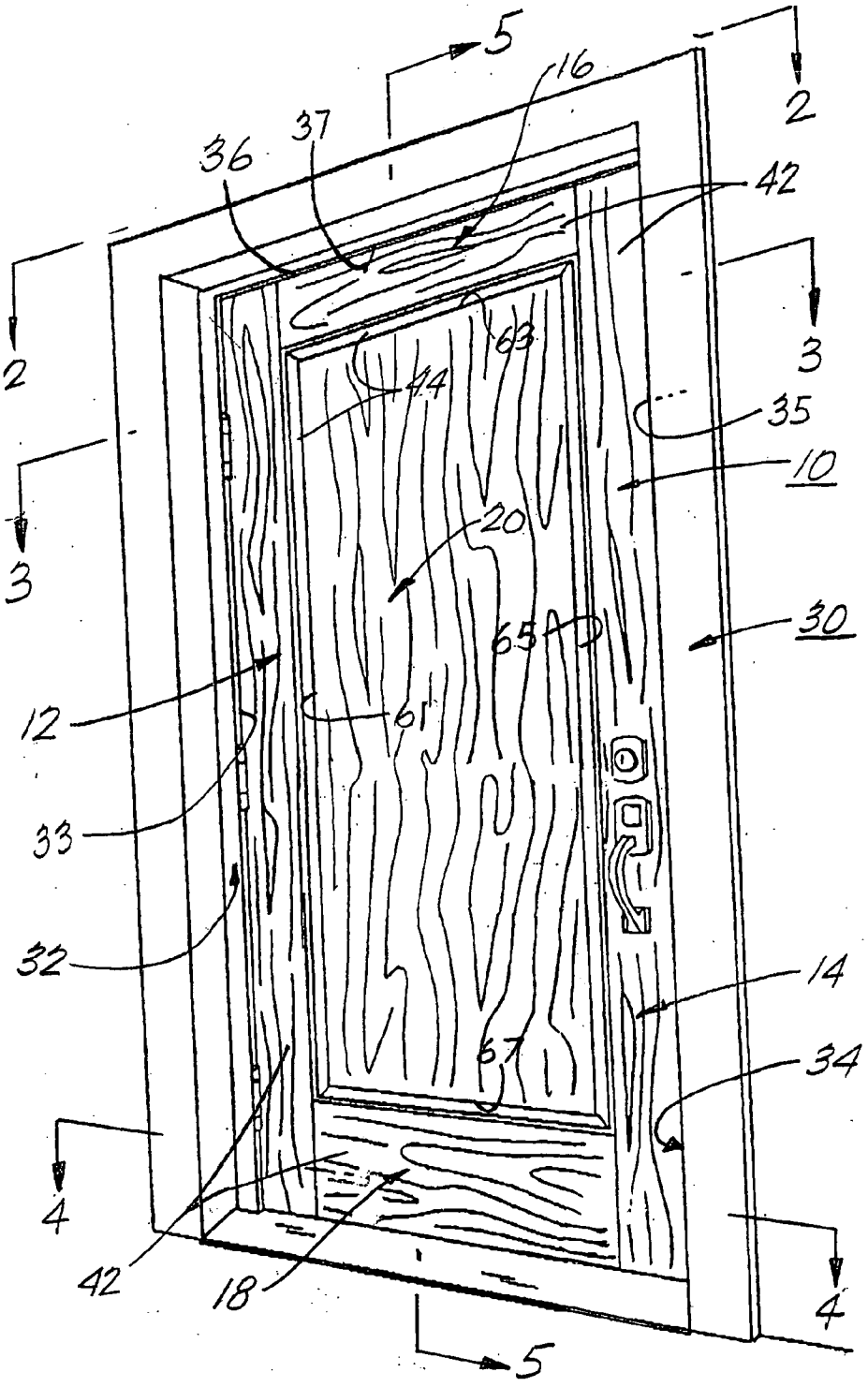


FIG. 1

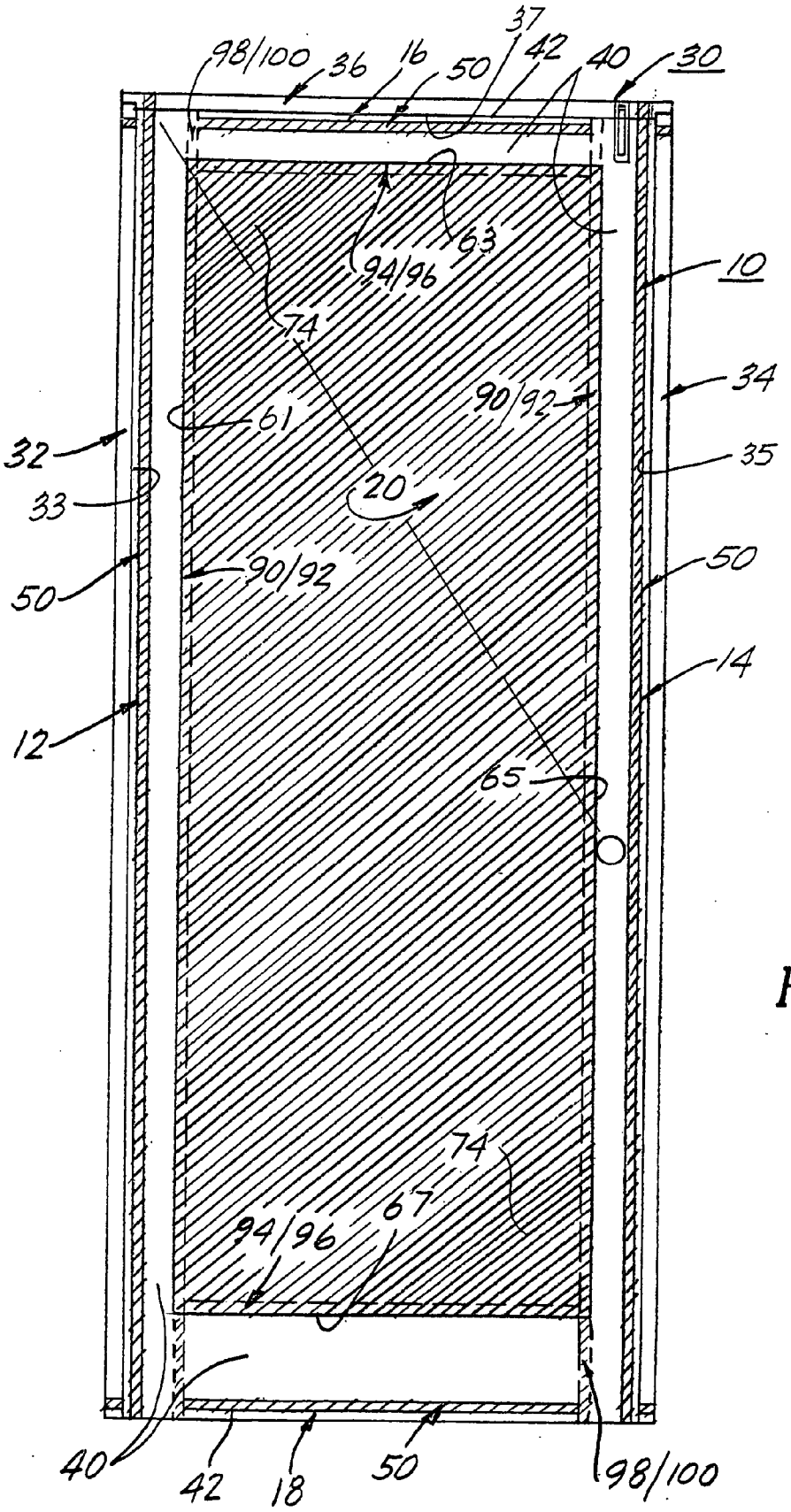

37
98/100
36
16
50
42
40
30
63
94/96
10
74
34
90/92
61
32
35
20
33
50
90/92
50
14
12
65
74
67
94/96
40
42
18
50
98/100

FIG. 2

FIG. 2A

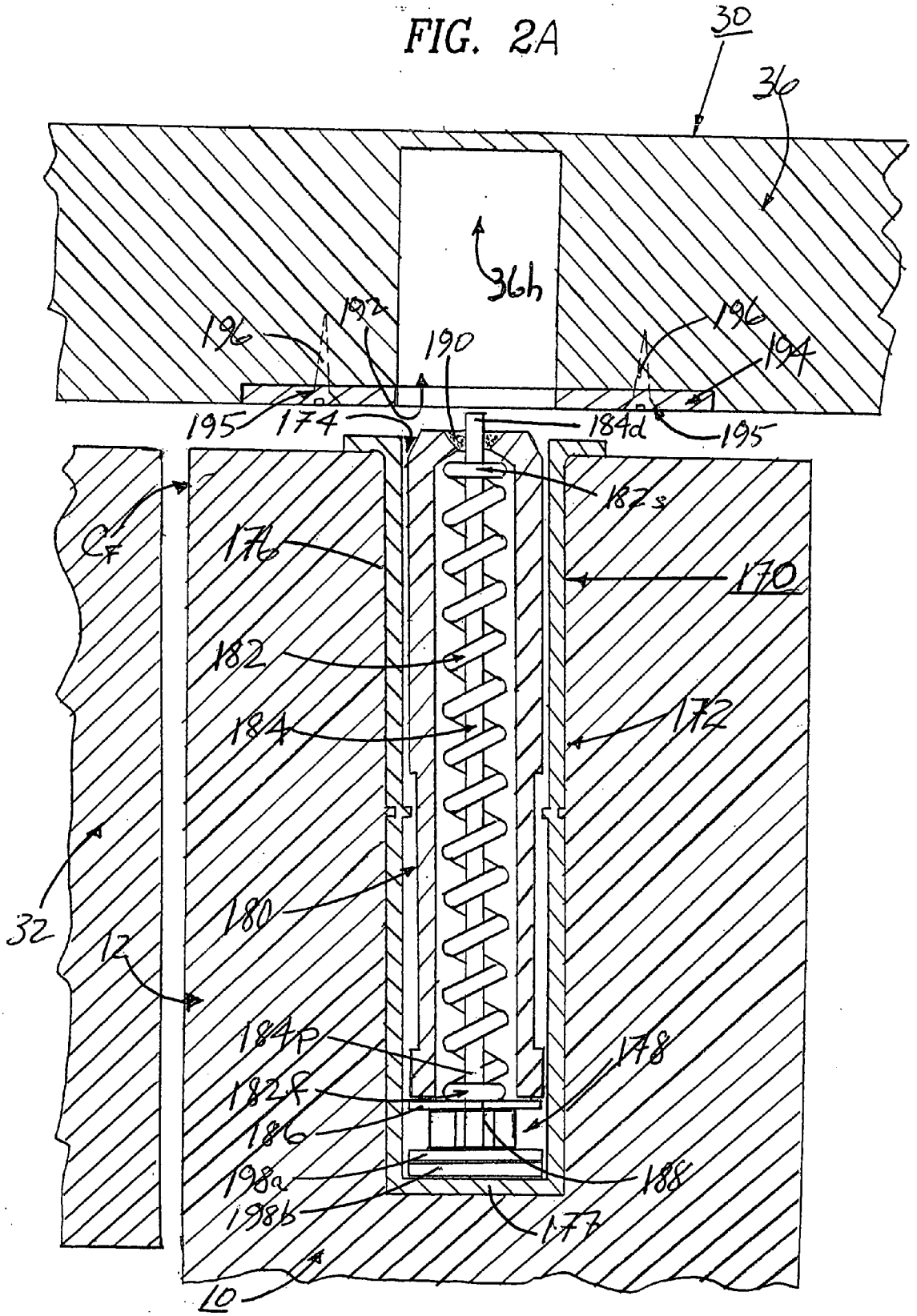
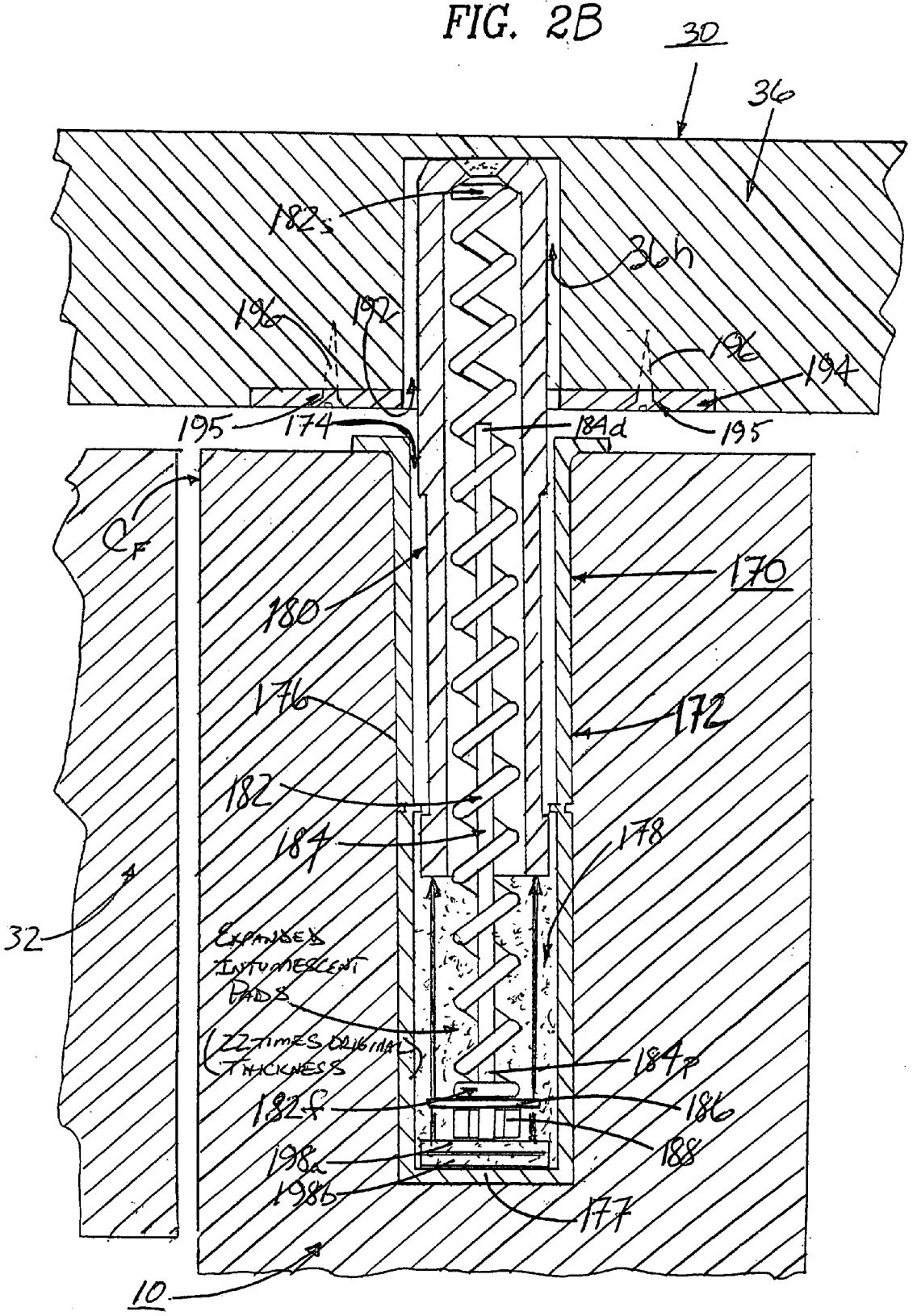

30
36
36h
196
192
190
194
195
174
184d
195
182s
170
170
182
184
172
180
32
12
184p
178
182f
186
198a
188
198b
177
10

FIG. 2B


30
36
182
36h
196
192
194
195
174
18Ad
195
C_F
170
180
176
172
182
184
178
32
EXPANDED INTUMESCENT BAND
(2 TIMES ORIGINAL THICKNESS)
184P
182f
186
188
198a
198b
177
10

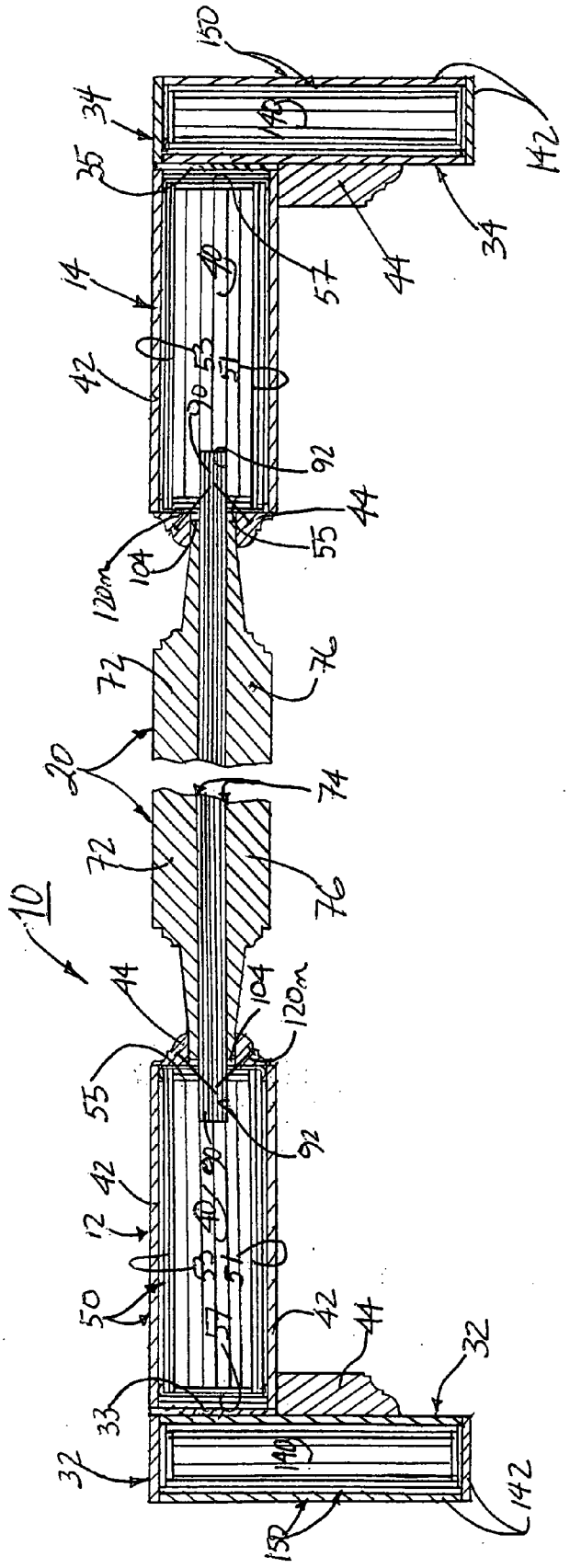

150
34
35
140
142
14
40
57
44
42
53
51
92
55
104
120m
72
76
20
74
10
12
50
33
32
152

FIG. 3

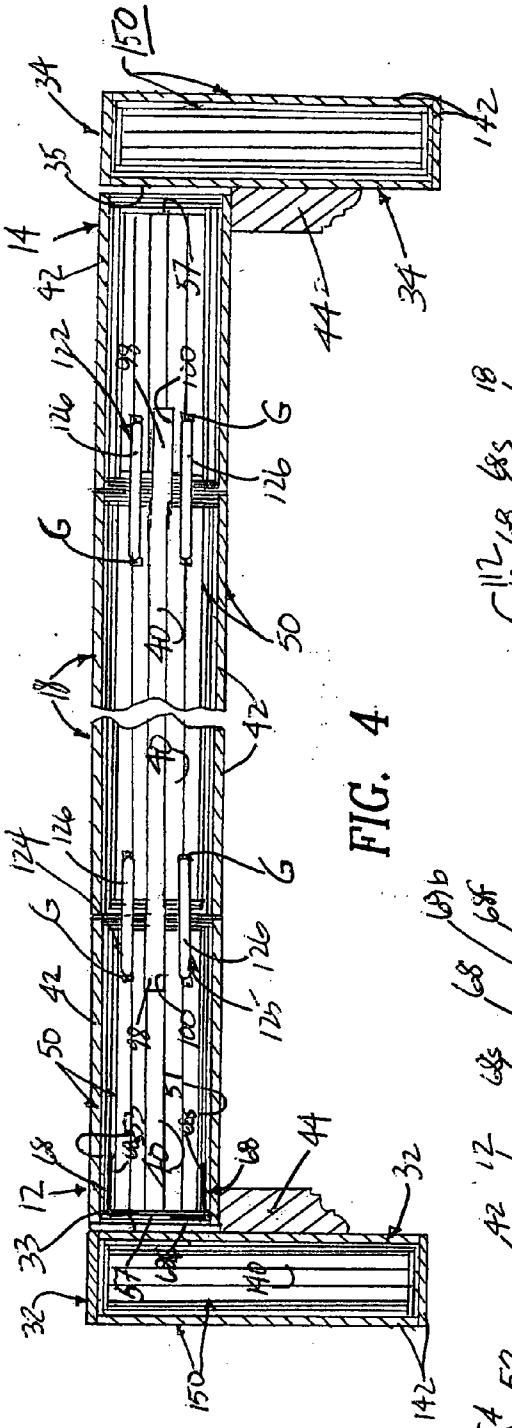


FIG. 4

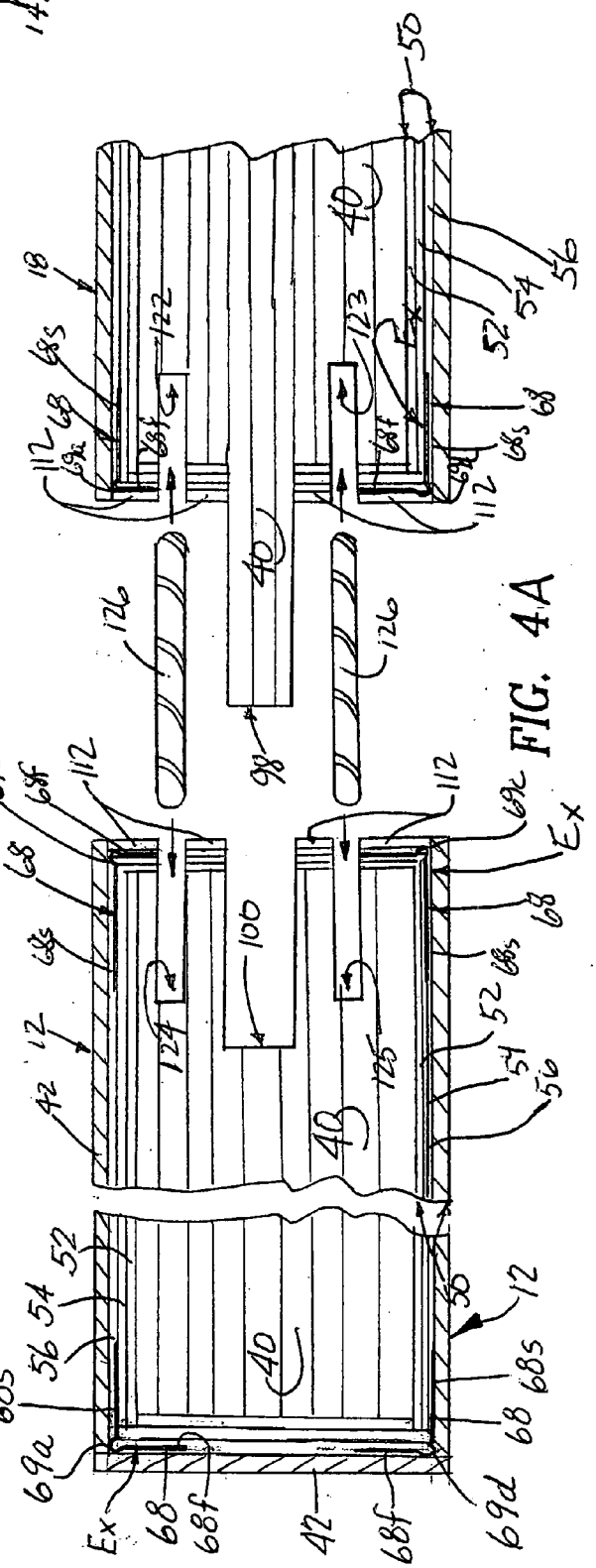


FIG. 4A

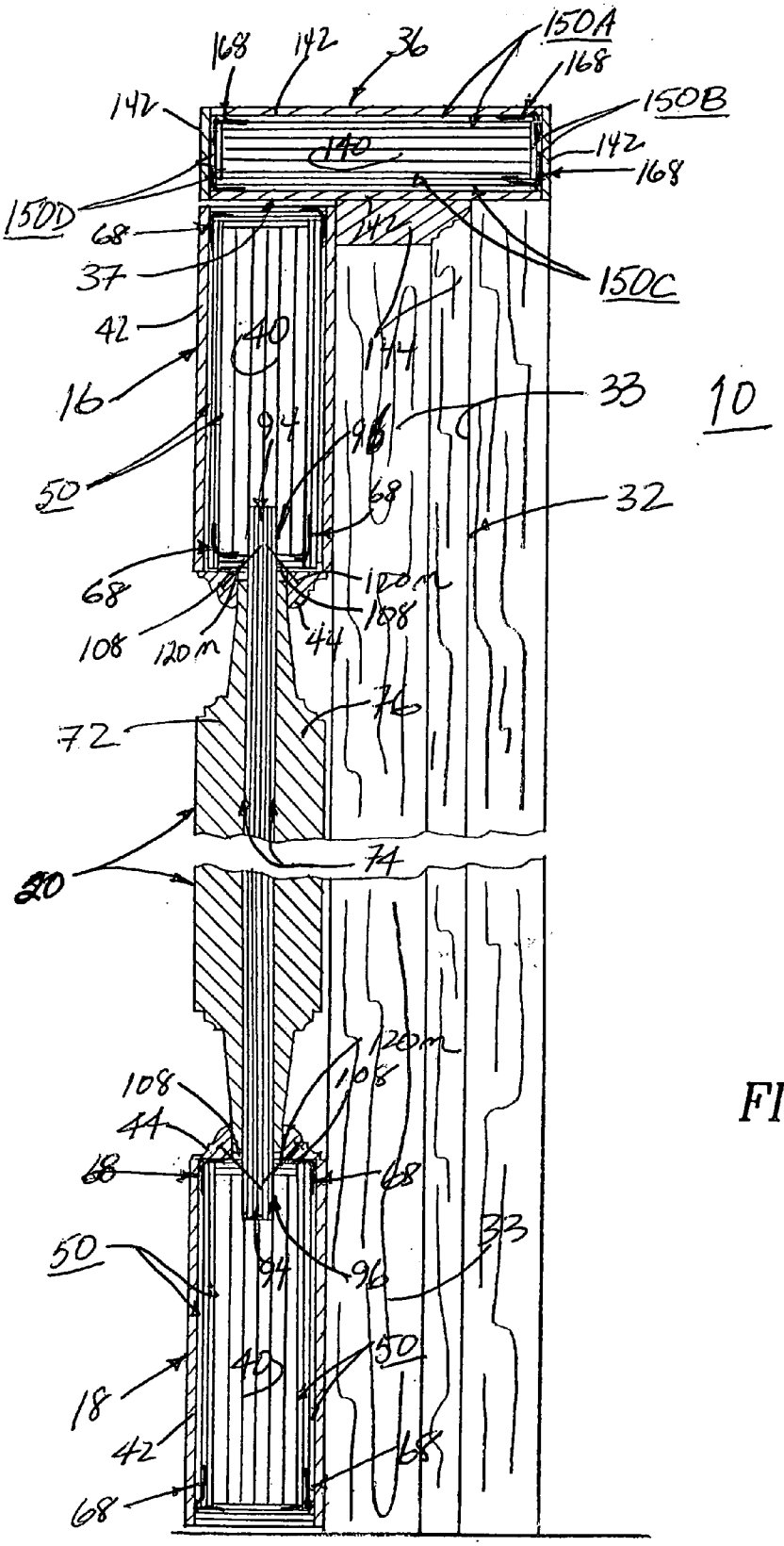

168
142
36
150A
168
142
150B
142
140
168
150D
68
37
42
16
50
40
94
96
33
10
32
68
108
120m
44
72
74
20
108
44
68
50
18
42
68
150C

FIG. 5

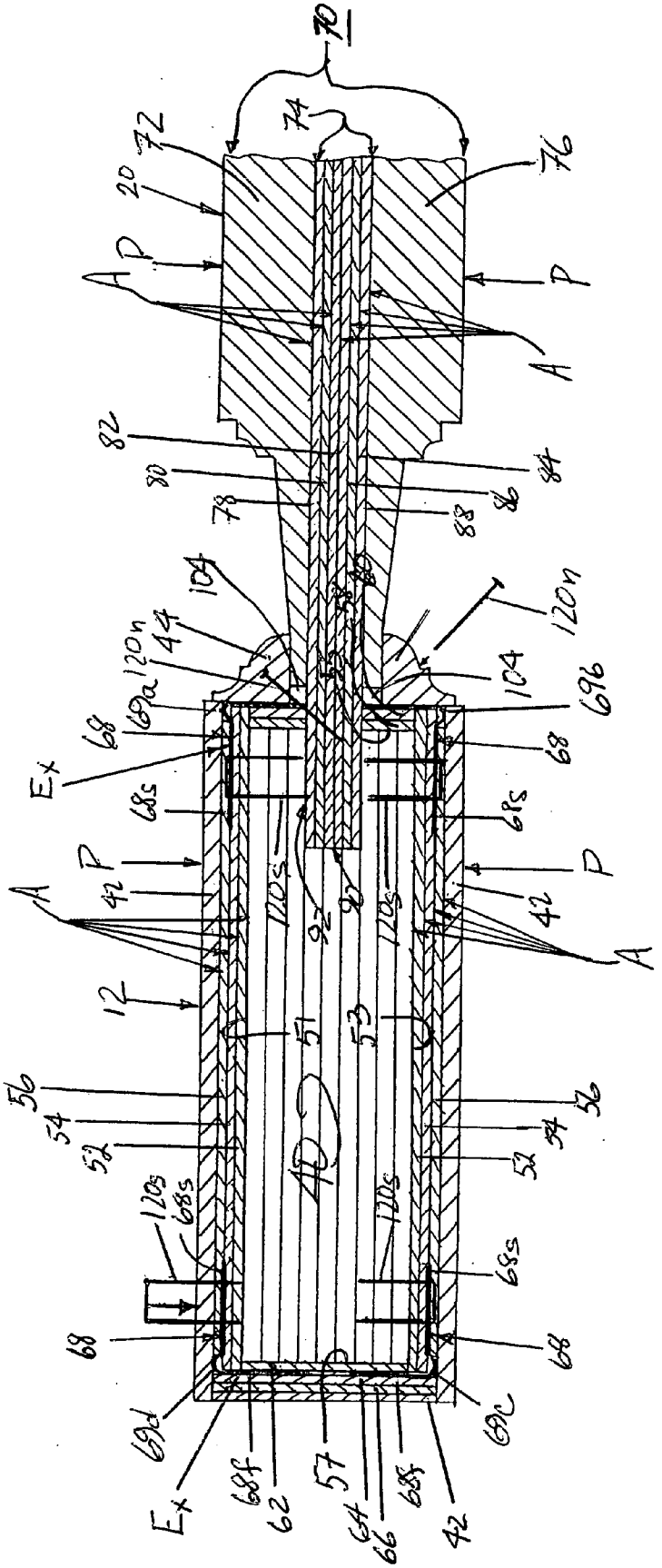

70
72
74
76
20
A
P
82
80
78
84
86
88
104
120a
44
68
69a
69b
69c
68s
Ex
42
12
51
53
92
110s
56
54
52
40
57
62
64
66

FIG. 6

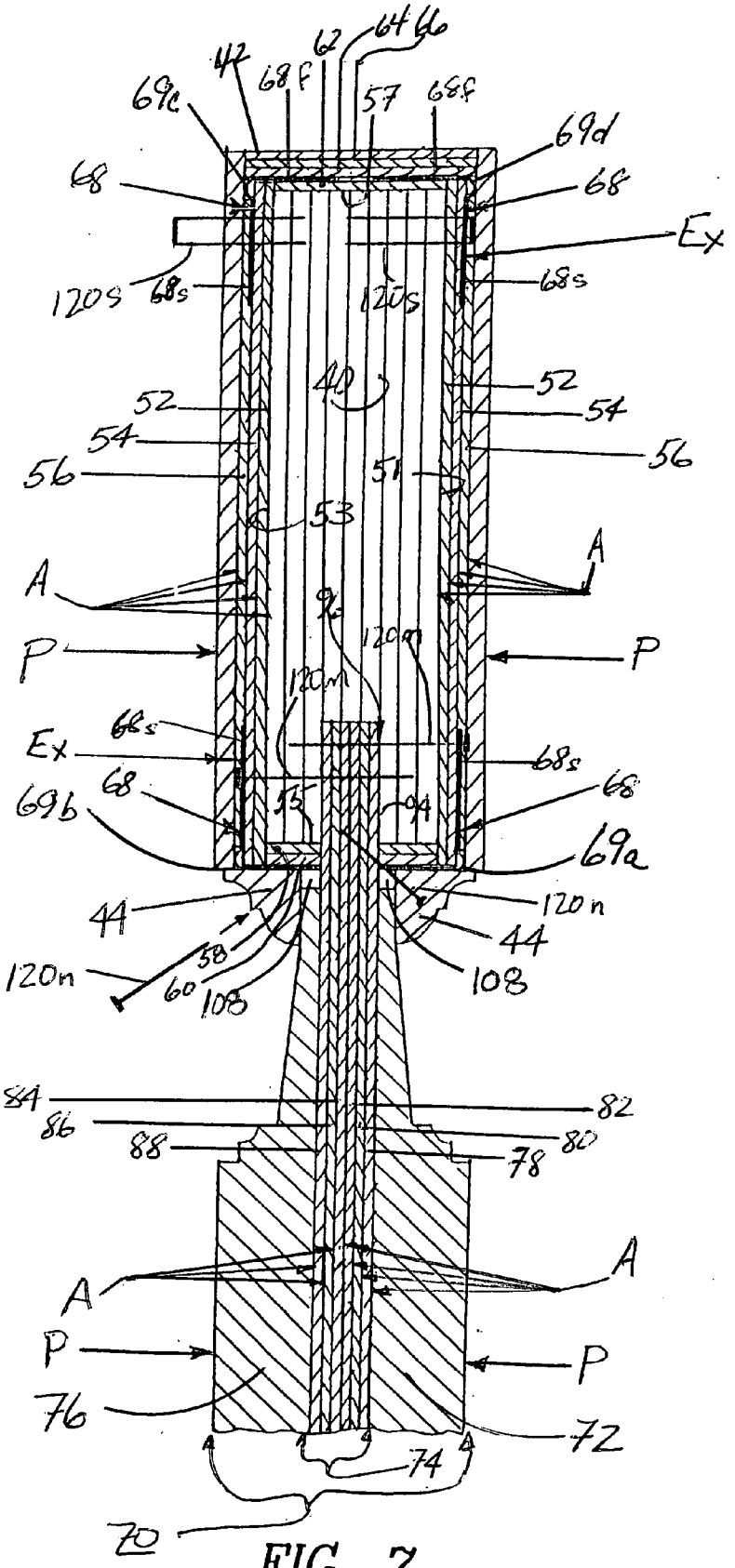

42
62
64
66
68f
57
68f
69c
69d
68
68
Ex
120s
68s
68s
120s
52
52
54
54
56
56
40
51
53
A
A
P
P
120m
120m
Ex
68s
68s
68
68
69b
69a
15
94
44
120n
44
58
120n
60
108
108
84
82
86
88
80
78
A
A
P
P
76
72
74
70

FIG. 7

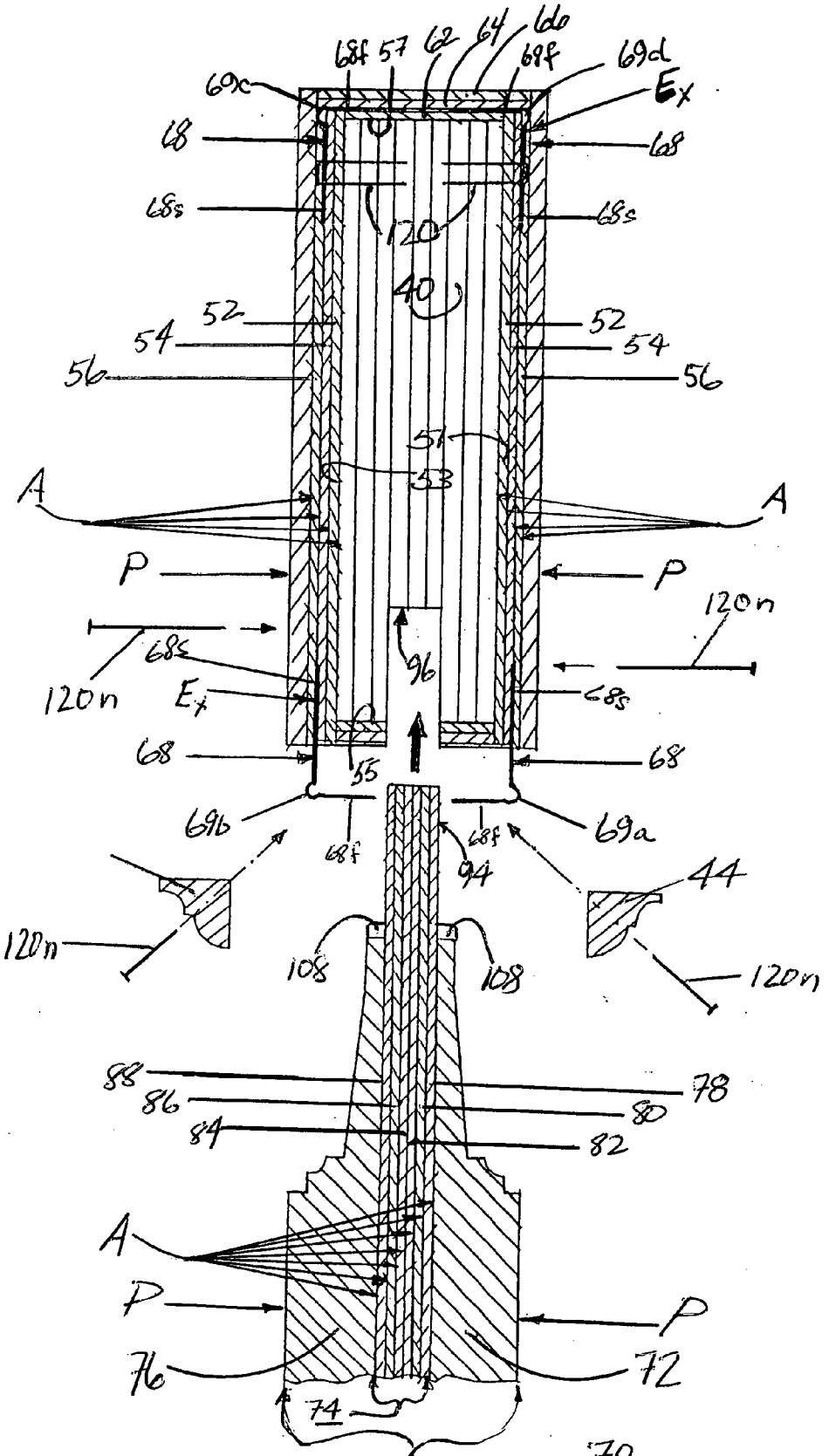

68f
57
62
64
66
69f
69d
69c
Ex
68
68s
120
40
52
54
56
51
53
A
P
120n
96
55
69b
69a
94
44
108
88
86
84
78
80
82
76
72
74
70

FIG. 8

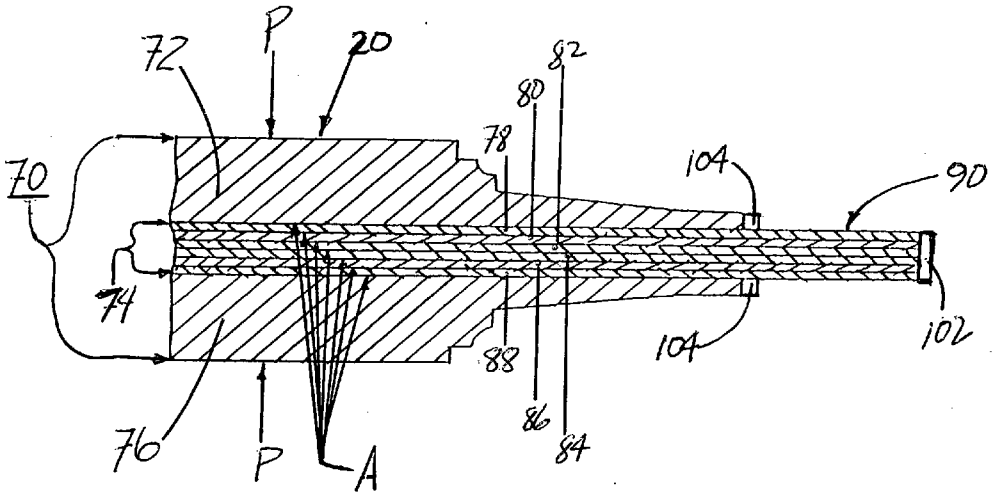

72
P
20
82
80
78
70
104
90
74
88
104
102
86
84
76
P
A

FIG. 9

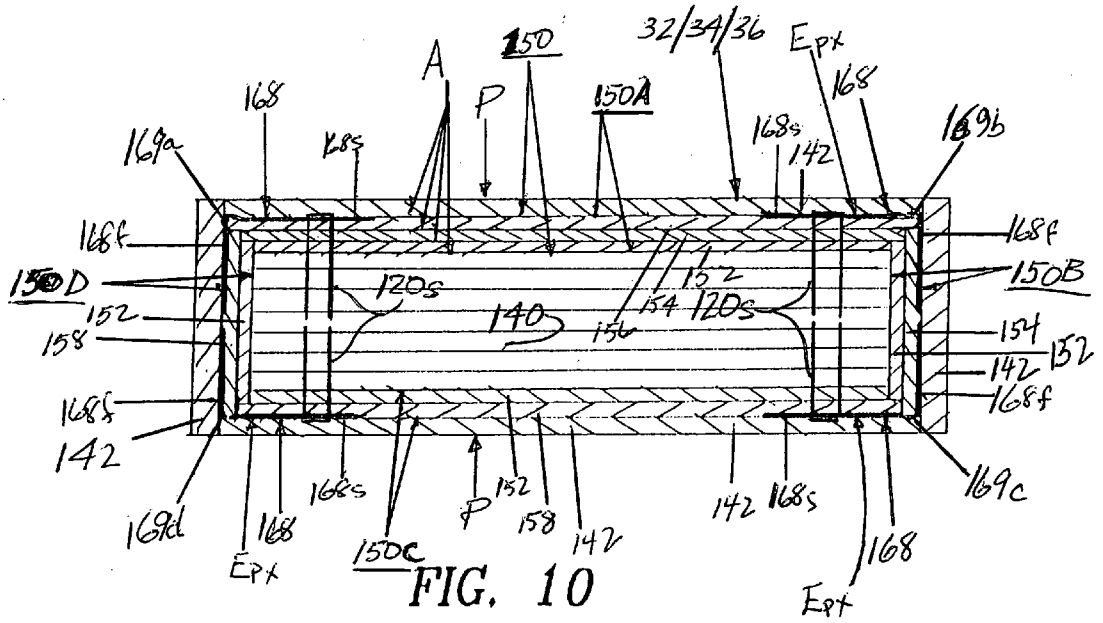

A
150
32/34/36
Epx
168
P
150A
168
169a
168s
142
169b
168f
168f
150D
152
158
120s
140
154
156
152
120s
150B
154
152
142
168f
168s
142
169c
169d
168
Epx
168s
150C
P
152
158
142
142
168s
168
Epf

FIG. 10

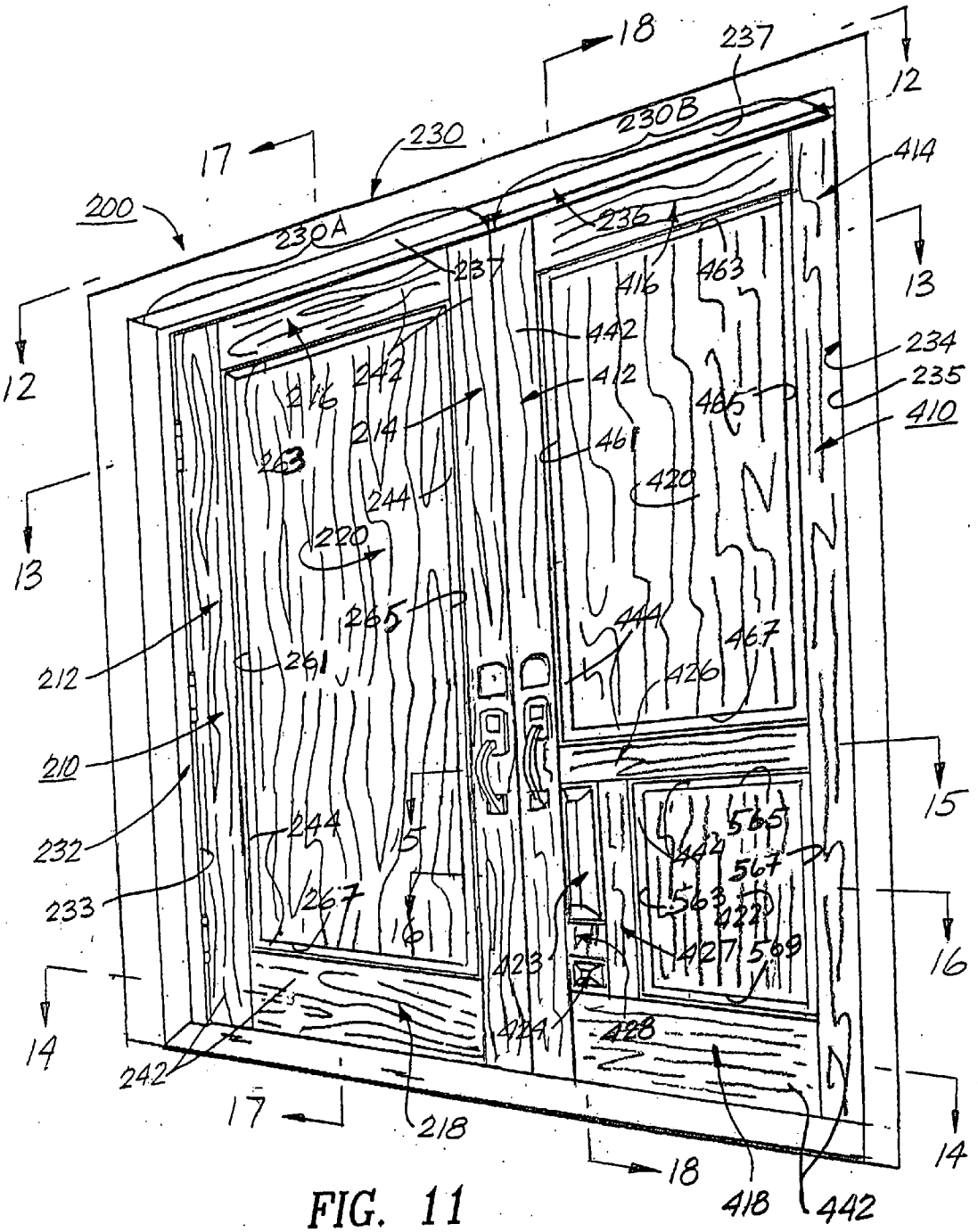

18
237
12
230B
230
17
414
200
230A
236
13
416
463
12
442
234
242
412
235
216
214
485
410
263
461
244
420
220
13
265
444
467
212
261
426
210
15
565
232
244
15
442
567
233
267
16
563
422
16
423
427
569
14
424
428
242
17
218
18
14
418
442

FIG. 11

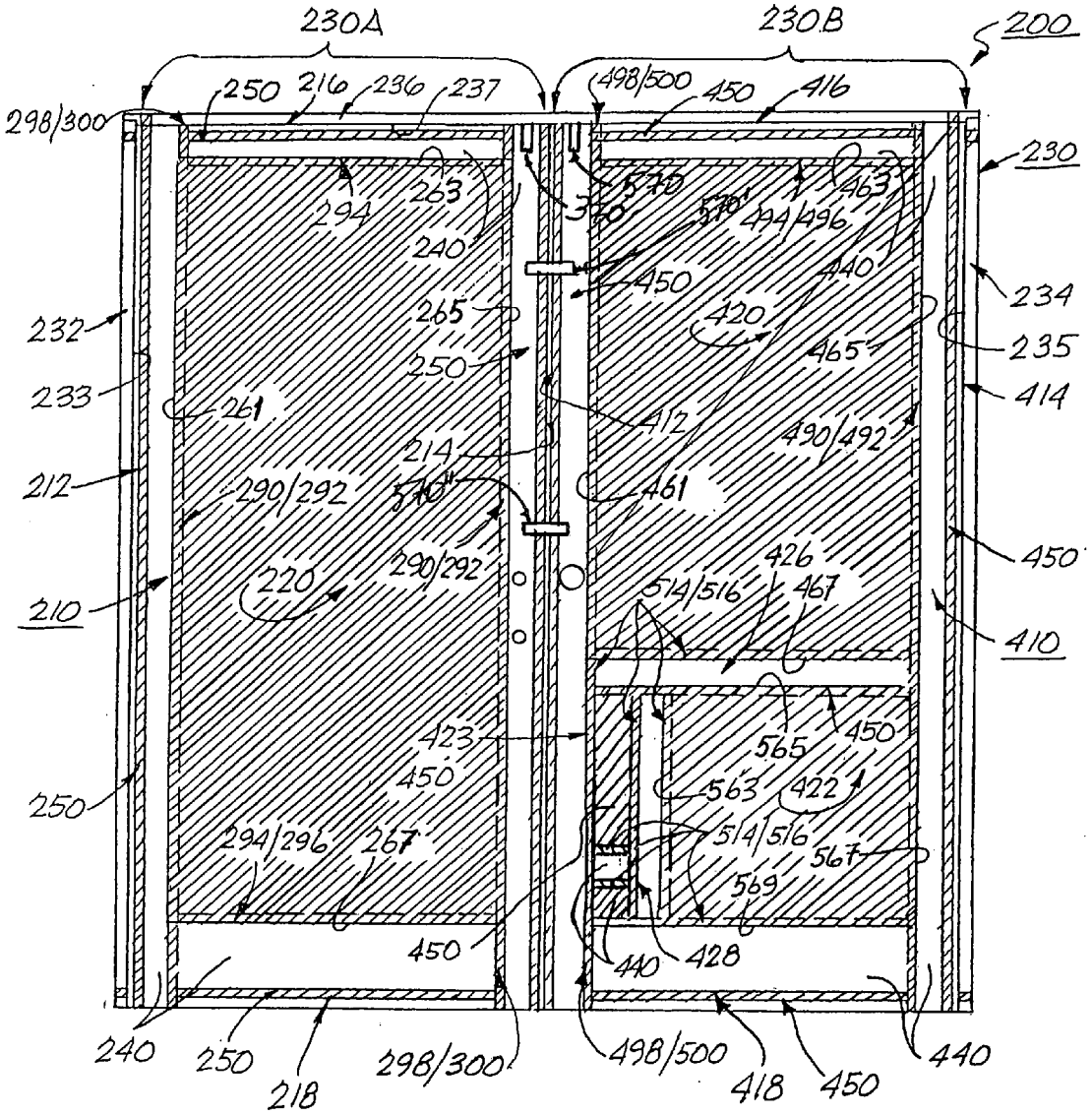

230A
230B
200
250
216
236
237
498/500
450
416
298/300
230
294
263
240
570
494/496
463
440
234
450
265
420
232
250
465
235
233
261
212
414
214
490/492
461
212
290/292
570
450
220
290/292
426
514/516
467
210
410
423
565
450
450
563
422
250
294/296
267
514/516
567
569
450
440
428
240
250
218
298/300
498/500
418
450
440

FIG. 12

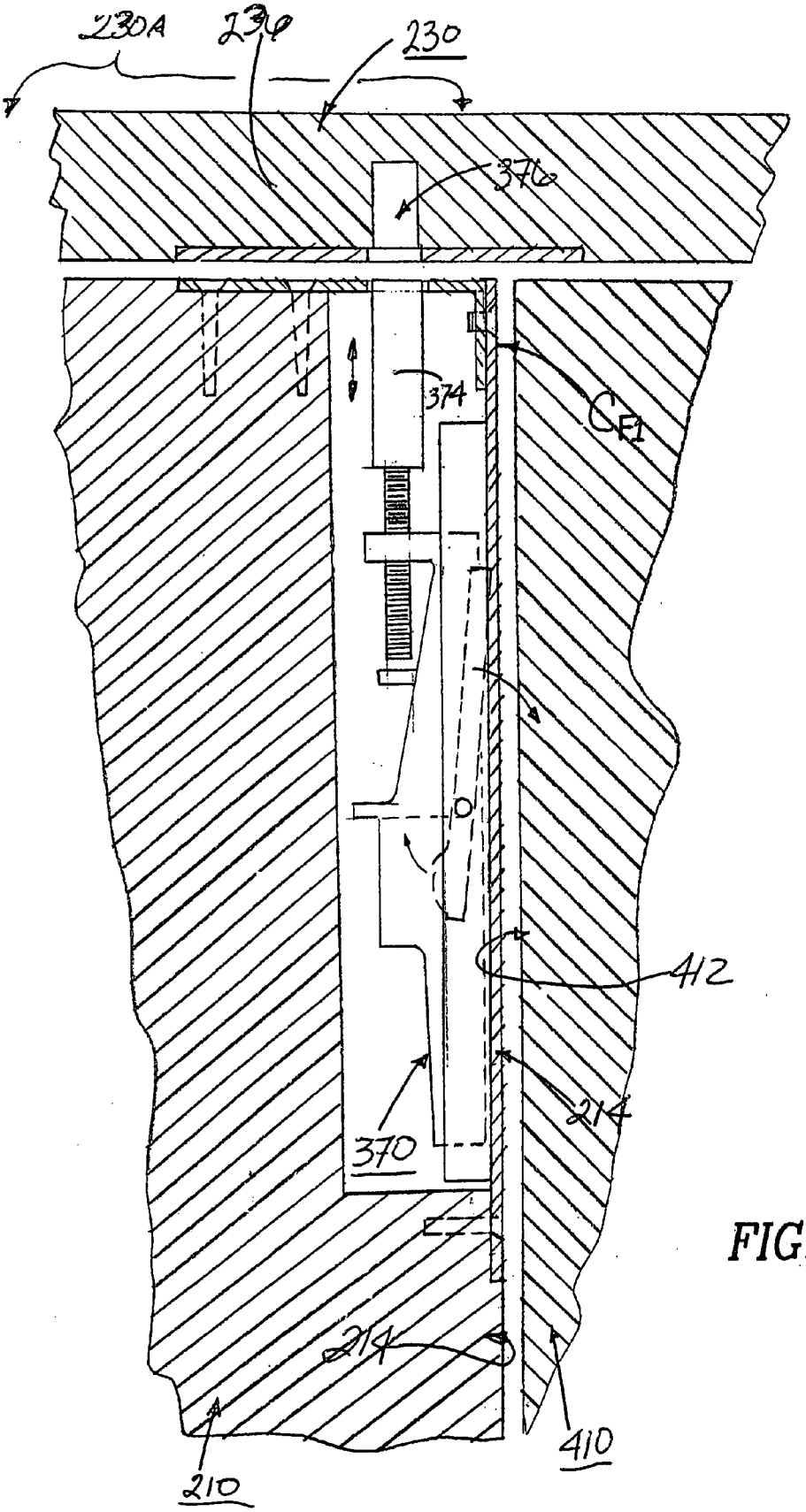


FIG. 12A

FIG. 12B

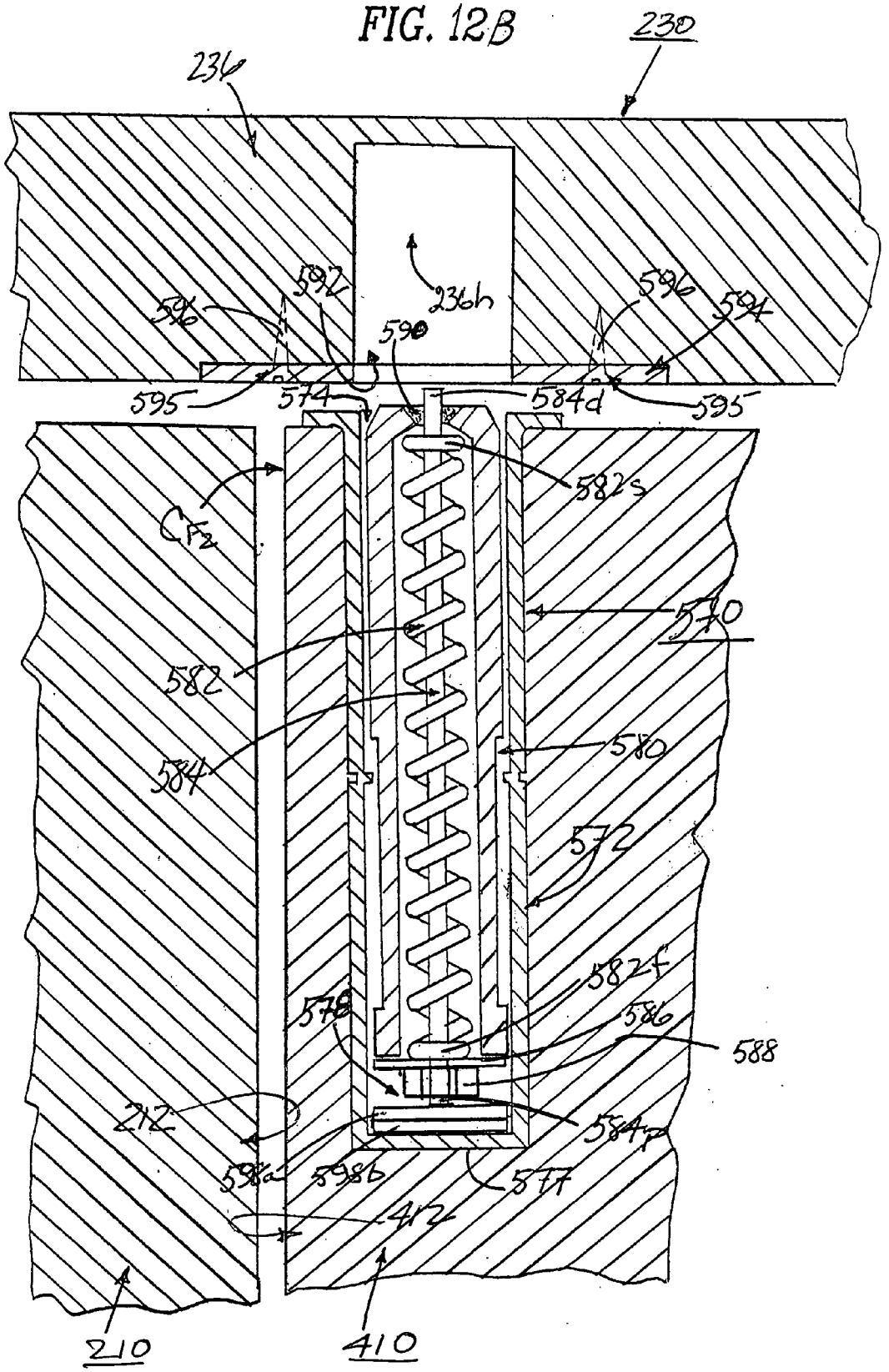

230
236
236h
592
596
590
596
594
595
574
584d
595
582s
CF2
570
582
584
580
572
582f
578
586
588
212
584p
598
598b
577
412
210
410

FIG. 12C

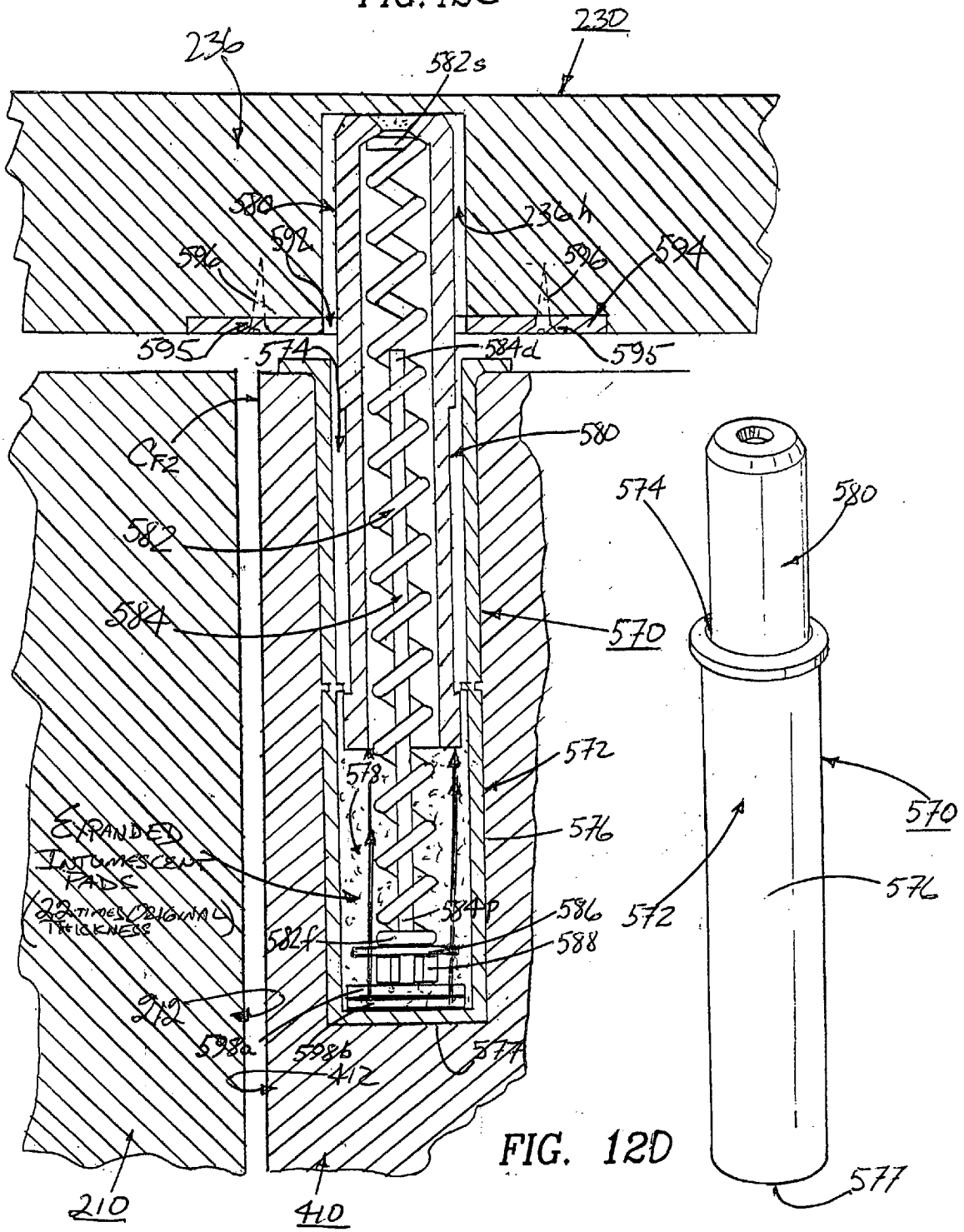


FIG. 12D

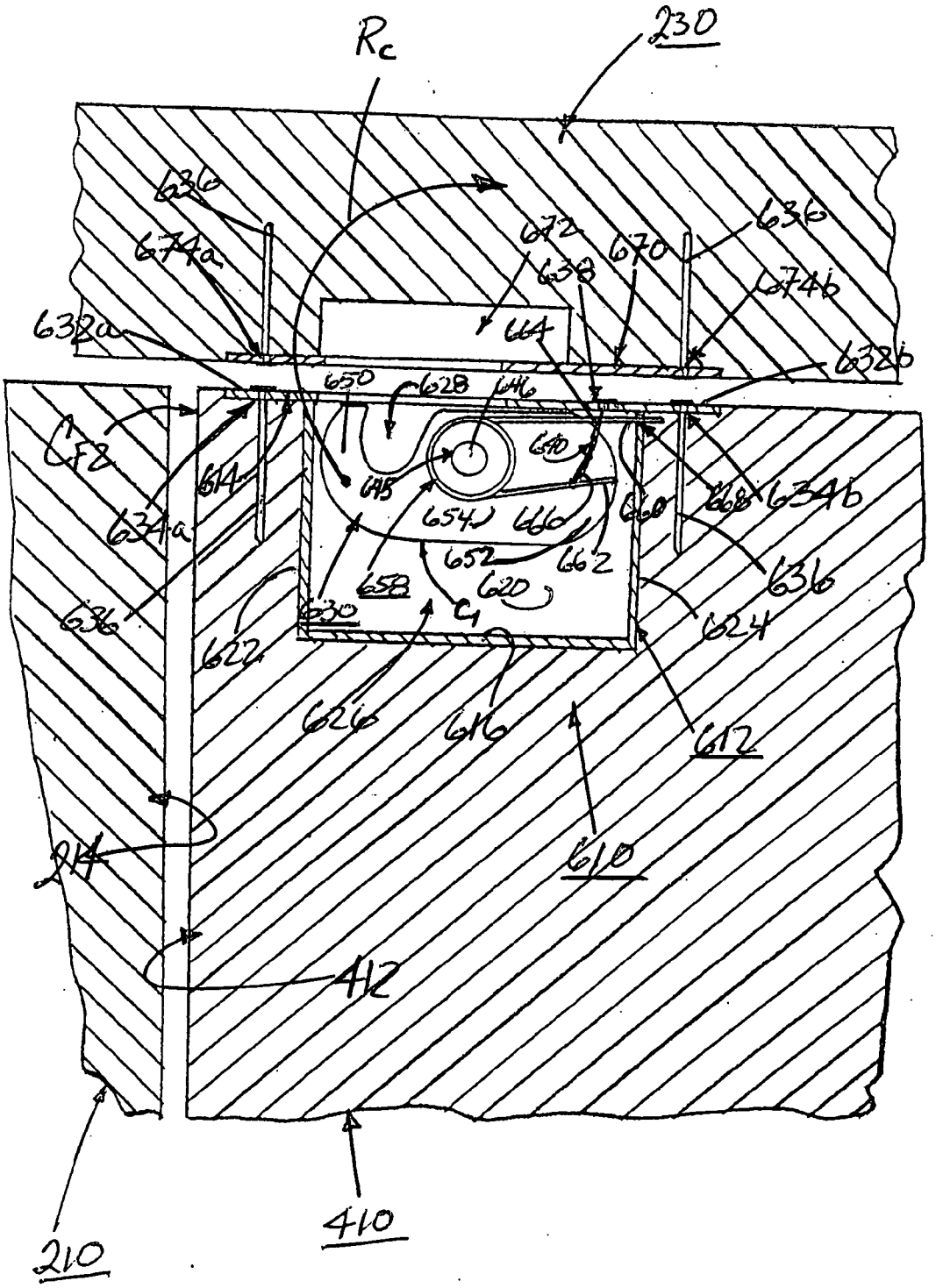

Rc
230
636
674a
672
638
670
636
674b
632a
644
632b
650
628
646
640
614
645
654
646
660
668
634b
652
662
634a
658
620
636
636
624
630
622
626
616
612
610
214
412
410
210

FIG. 12E

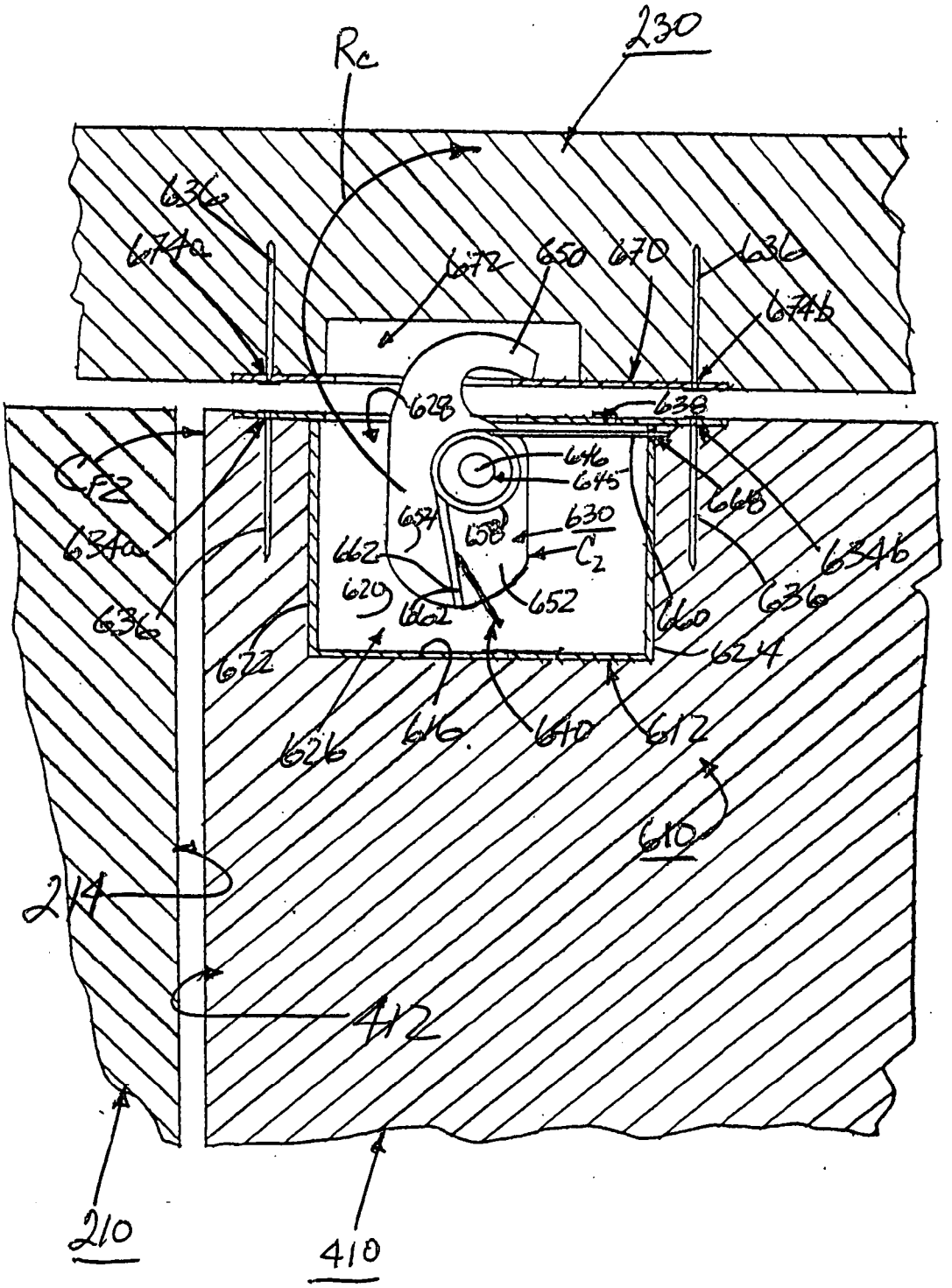

Rc
230
636a
674a
672
650
670
636
674b
628
638
646
645
668
634a
662
658
630
C_2
652
620
662a
636
634b
622
660
624
626
616
640
612
610
214
412
210
410

FIG. 12F

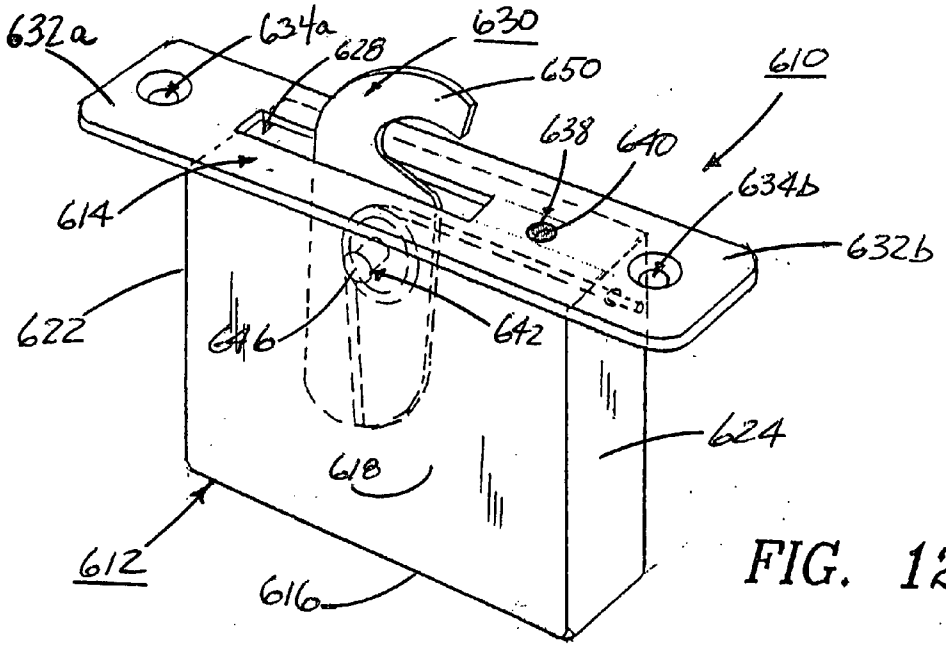


FIG. 12G

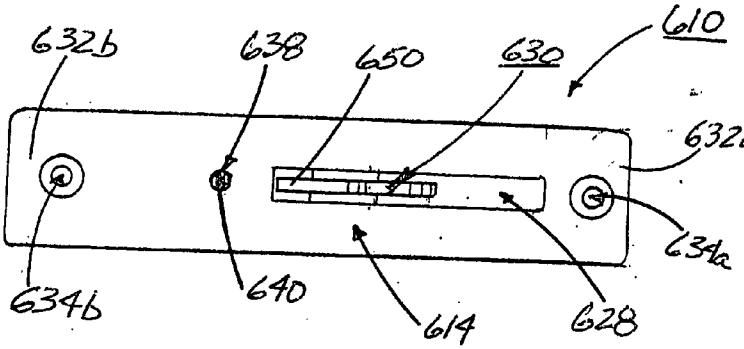


FIG. 12H

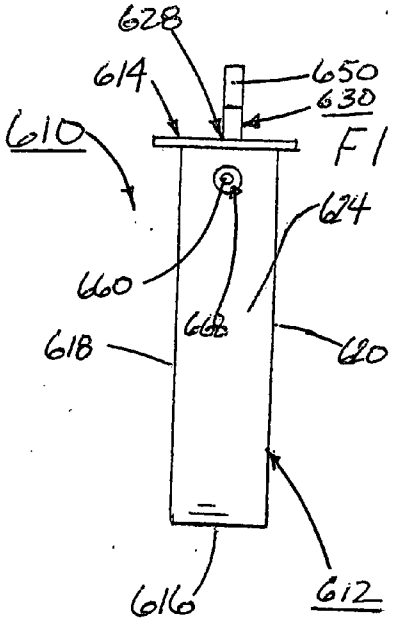


FIG. 12J

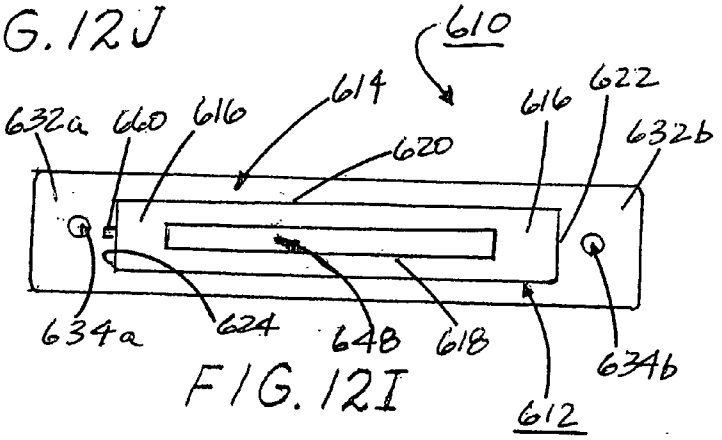


FIG. 12I

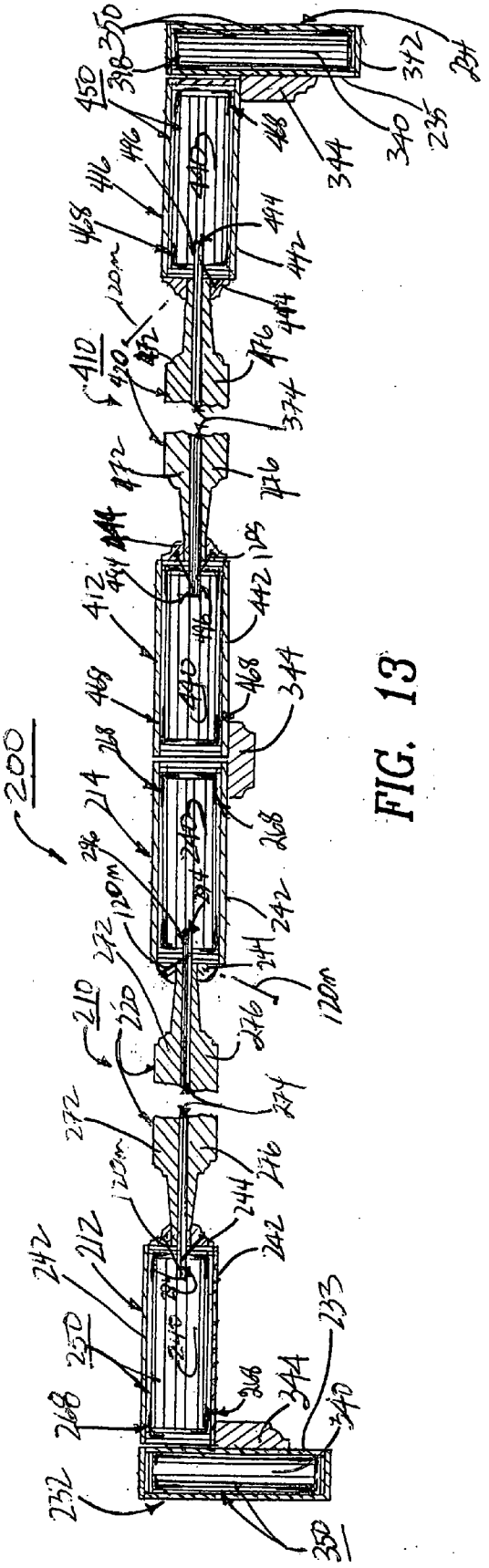


FIG. 13

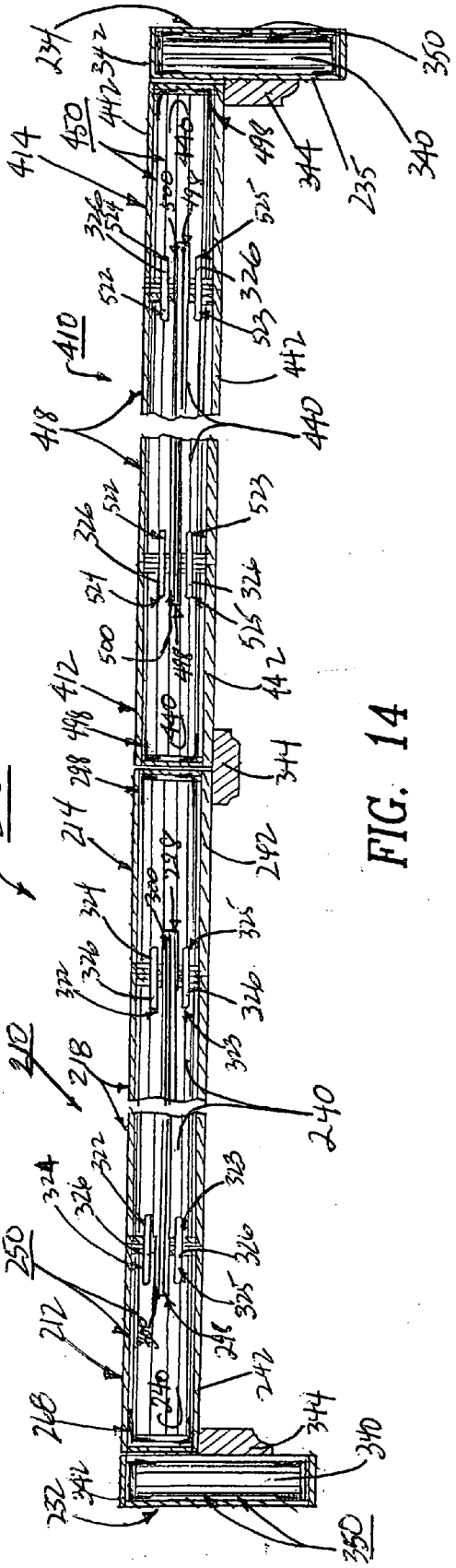


FIG. 14

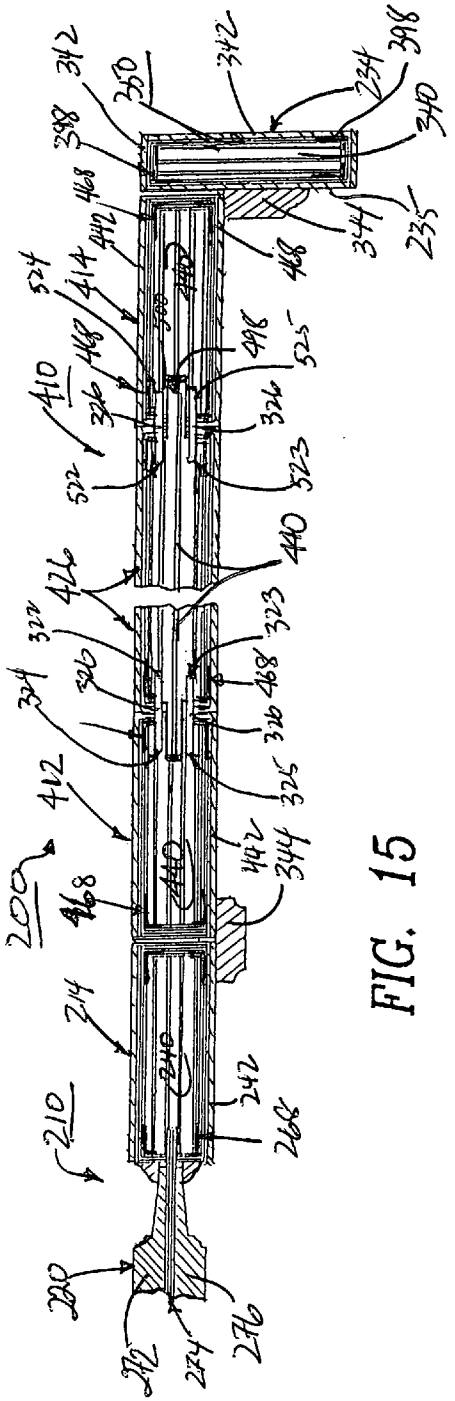


FIG. 15

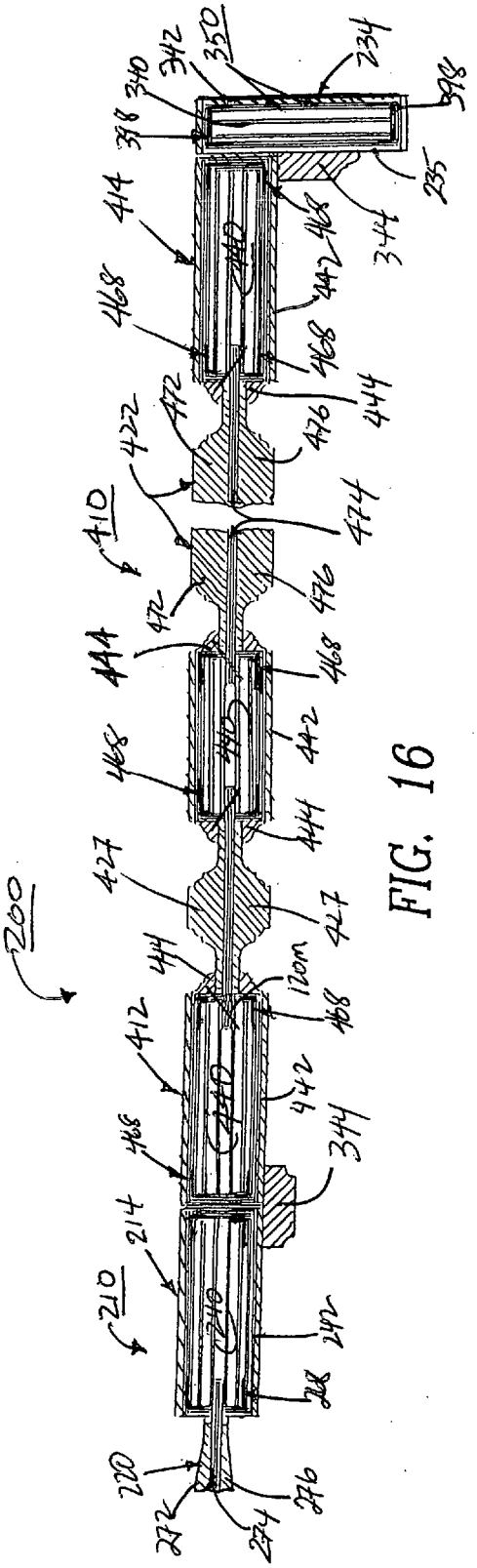


FIG. 16

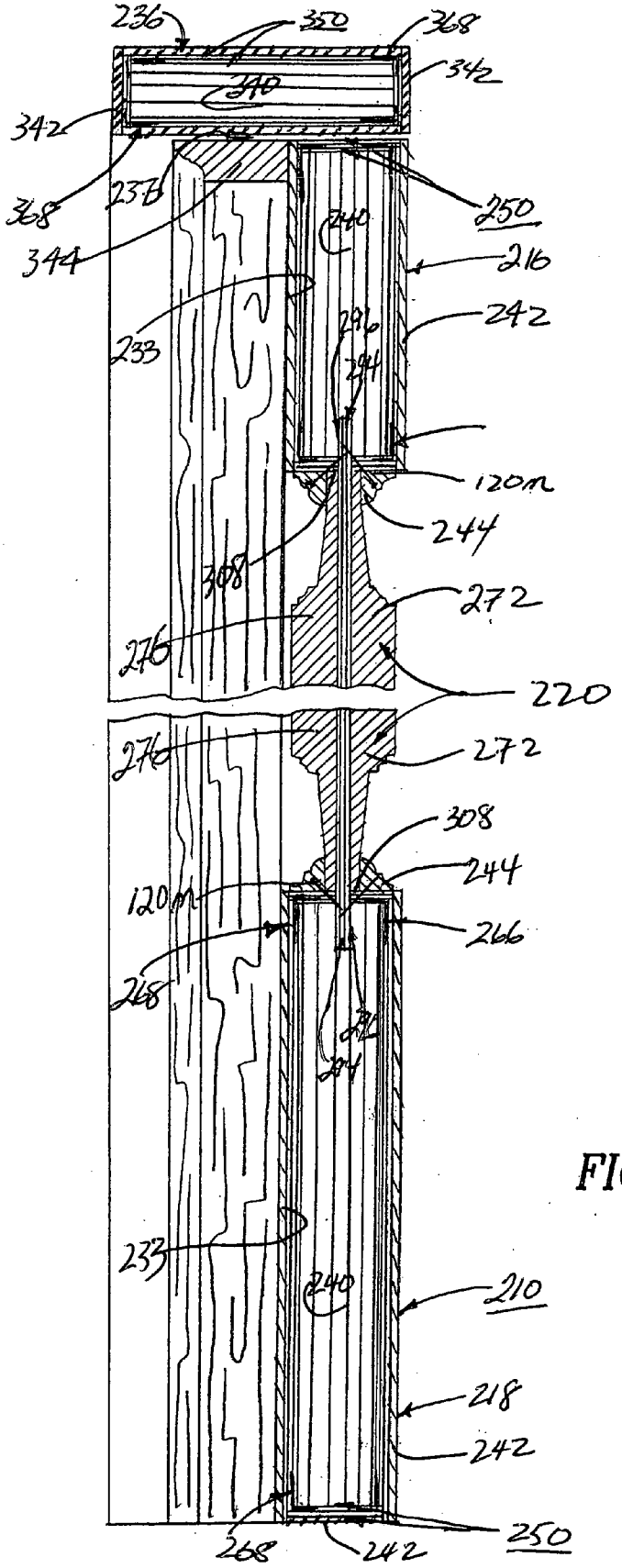

236
350
368
342
340
342
368
238
344
250
240
216
242
233
296
294
120m
244
308
272
276
220
276
272
308
244
120m
266
268
294
233
240
210
218
242
268
242
250

FIG. 17

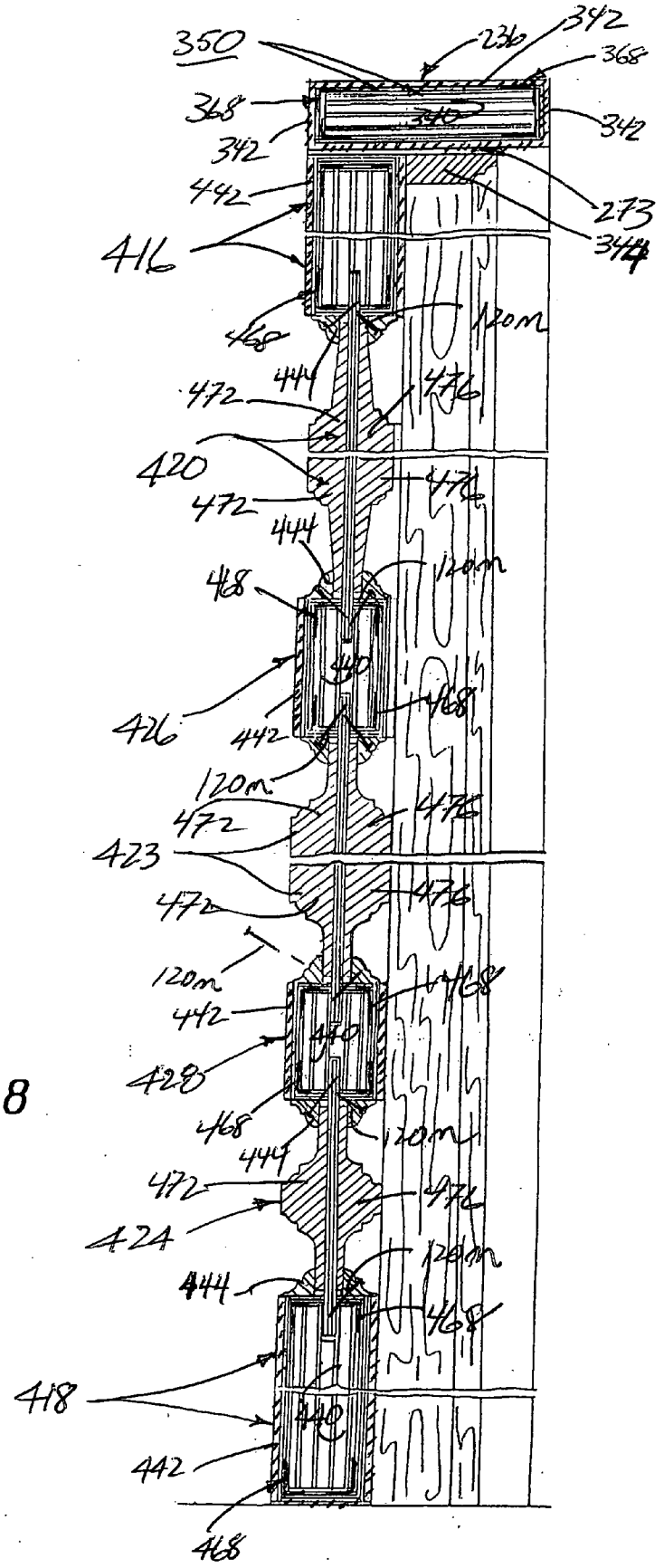

350
342
368
342
442
416
468
444
472
420
472
444
468
426
442
120m
472
423
472
120m
442
428
468
444
472
424
444
418
442
468

FIG. 18

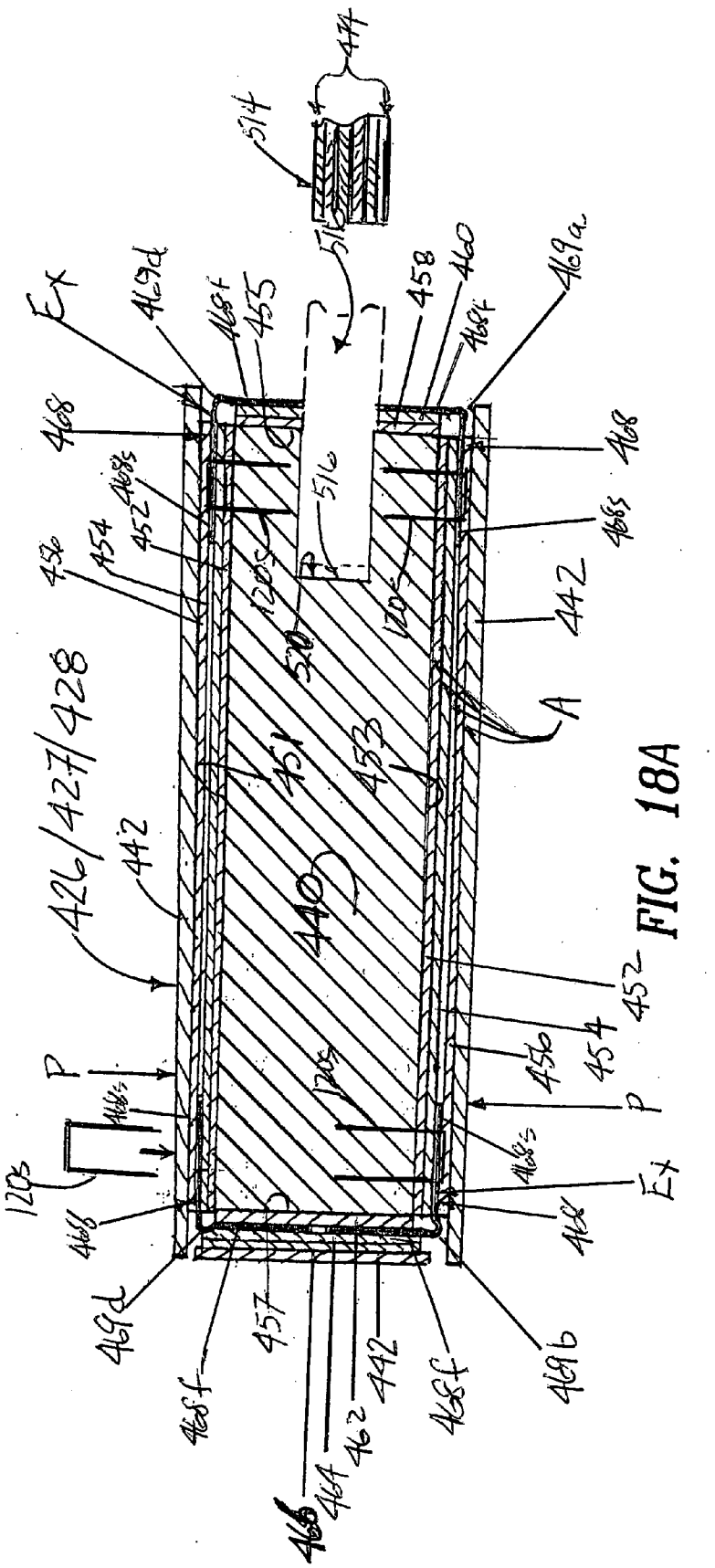

426/427/428
442
440
452
454
456
458
460
469a
469b
469d
468f
468s
457
462
464
466
514
516
474
120s
A
P
Ex

FIG. 18A

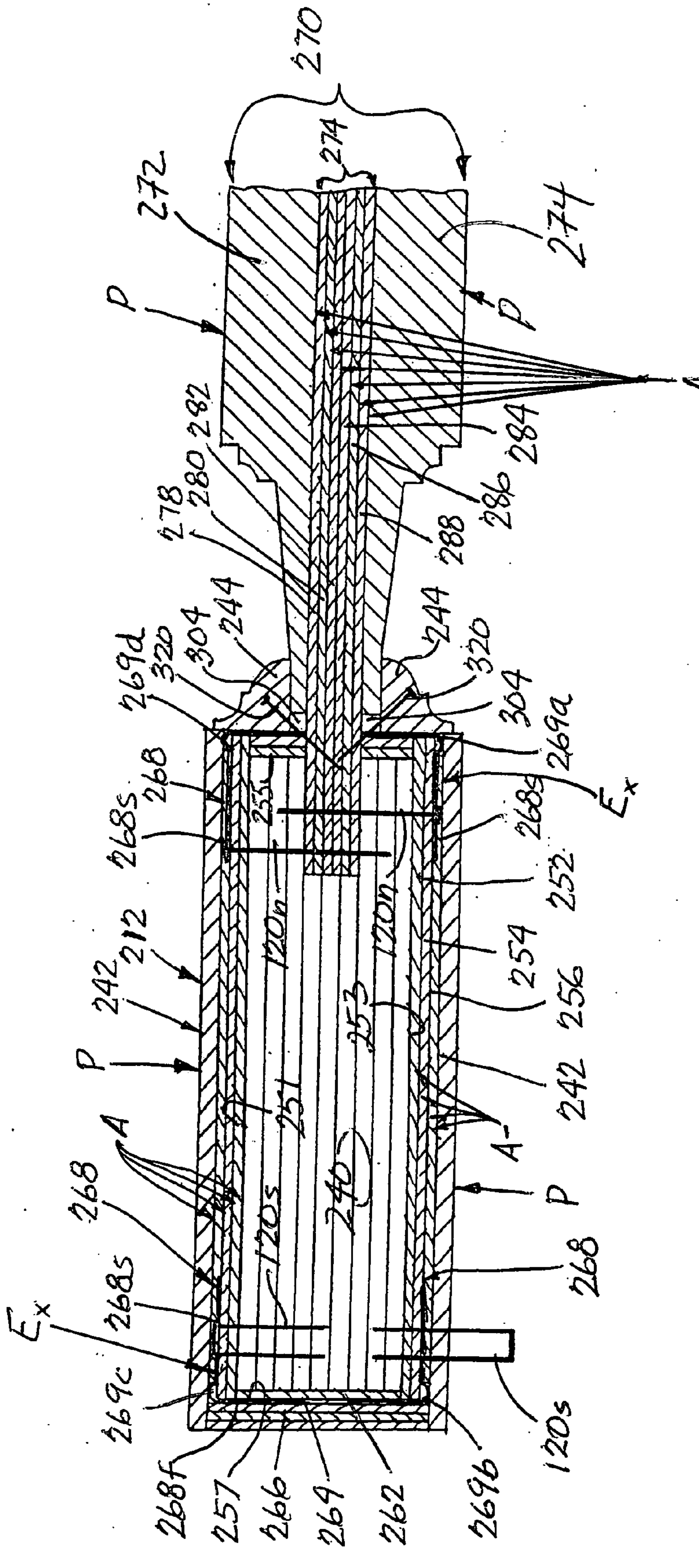

270
272
274
274
P
P
A
282
280
278
284
286
288
244
244
304
320
320
304
269d
269a
268
268s
251
Ex
268s
252
212
242
P
120n
120n
254
256
253
251
242
A
A
P
240
120s
268
268
268s
Ex
269c
120s
268f
257
266
264
262
269b
120s

FIG. 19A

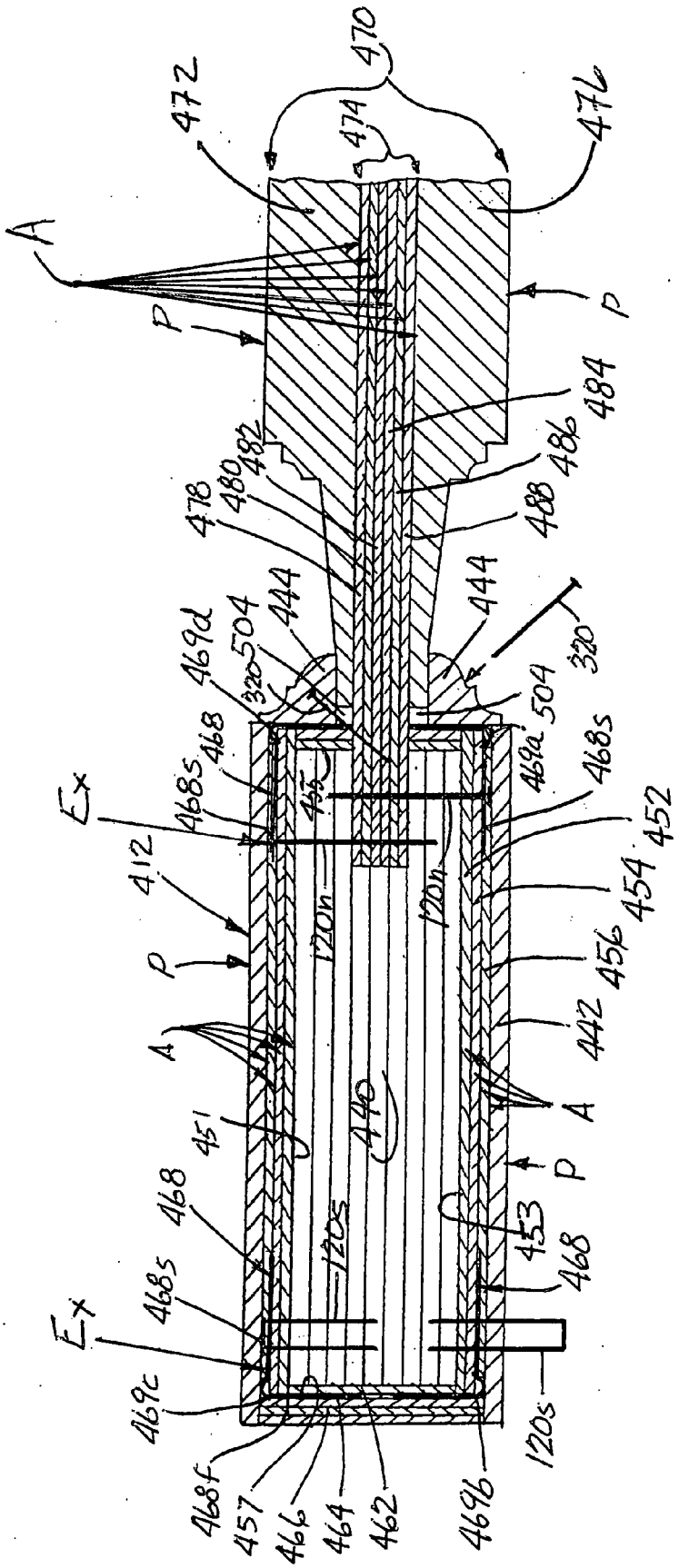

472
470
474
476
A
P
P
484
482
480
478
486
488
444
444
469d
504
320
320
504
468
468s
469a
468s
Ex
412
452
454
456
442
A
P
A
451
440
453
P
468
468
468s
Ex
469c
468f
457
466
464
462
469b
120s
120n
120n
120s

FIG. 19B

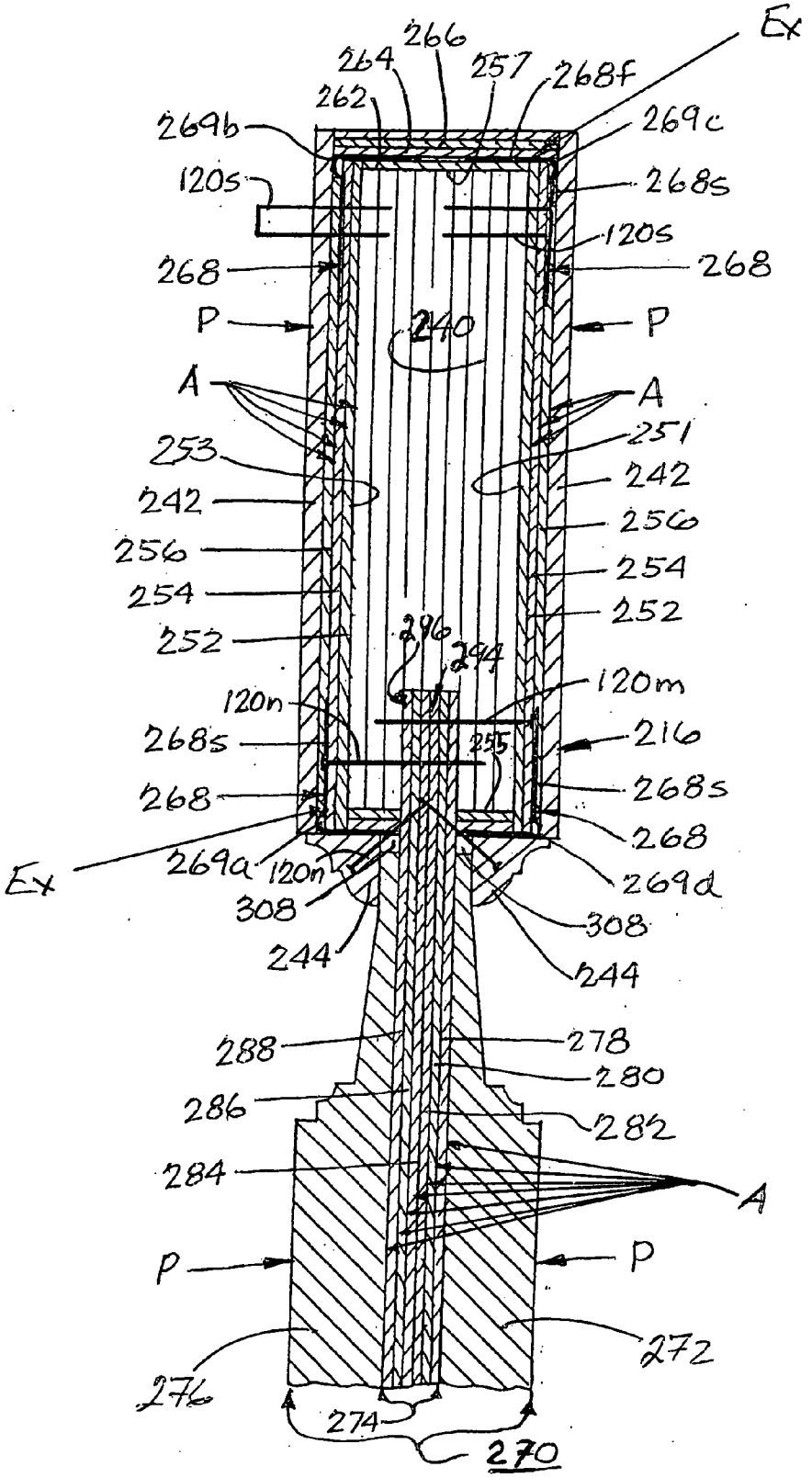

Ex
266
264
257
268f
262
269b
269c
120s
268s
120s
268
268
P
240
P
A
A
251
253
242
242
256
256
254
254
252
252
296
294
120m
120n
216
255
268s
268s
268
268
Ex
269a
120n
269d
308
308
244
244
288
278
280
286
282
284
A
P
P
272
276
274
270

FIG. 20A

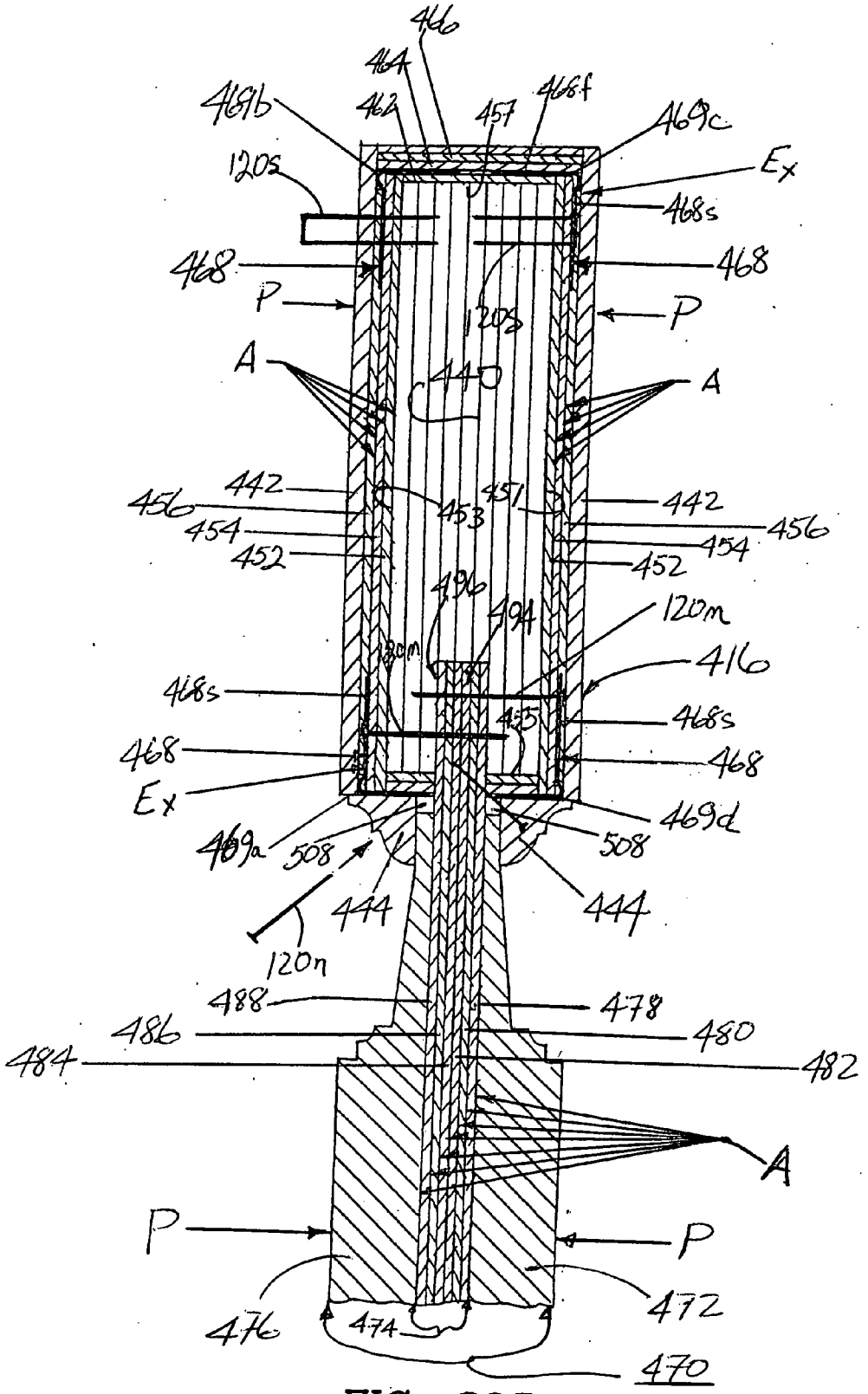

466
464
469b
462
457
468f
469c
Ex
120s
468s
468
468
P
P
120s
A
440
A
442
453
451
442
456
454
452
456
454
452
496
494
120m
416
468s
455
468s
468
468
Ex
469d
469a
508
508
444
444
120n
488
478
486
480
484
482
A
P
P
476
474
472
470

FIG. 20B

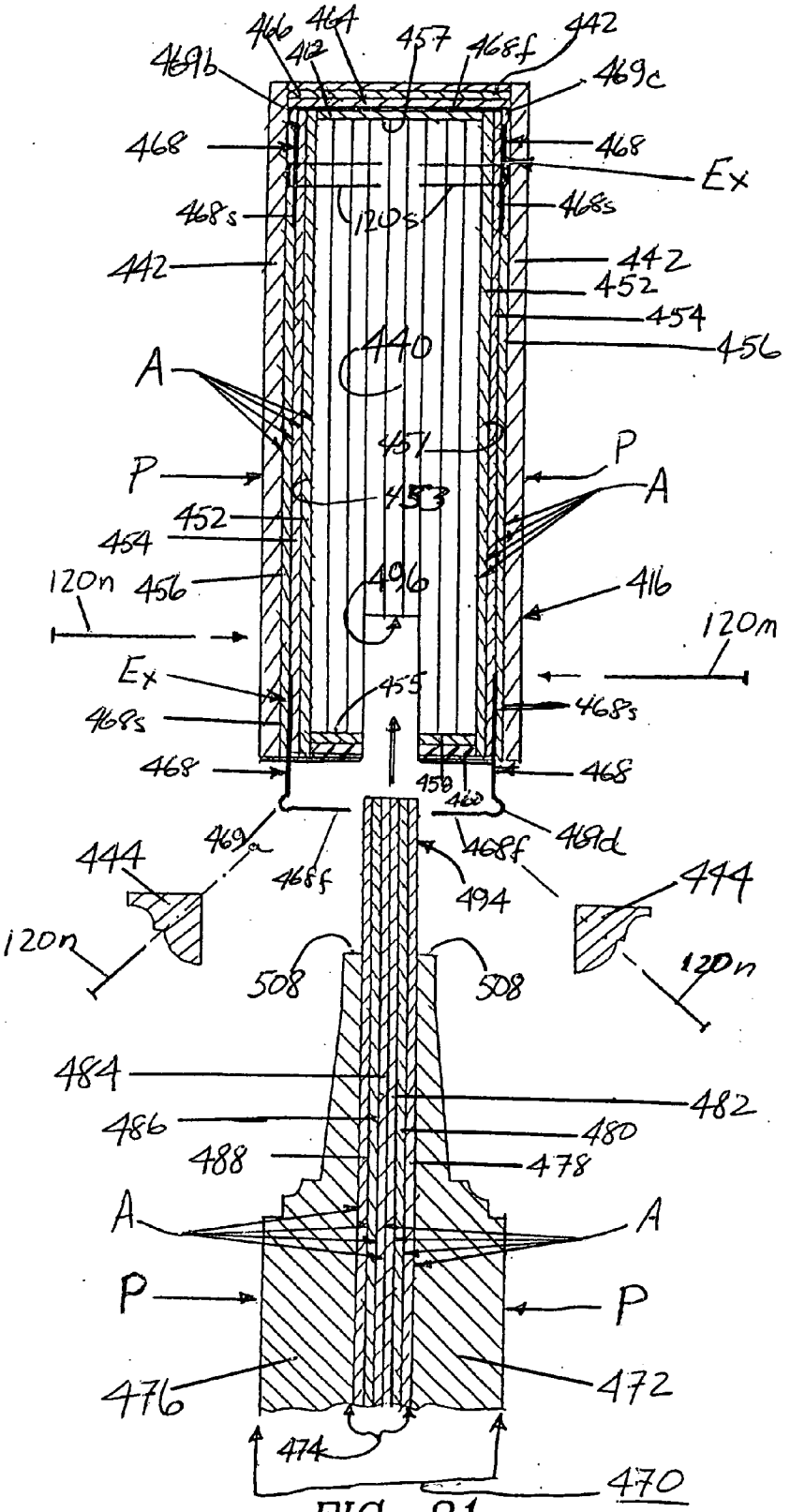

466
464
457
468f
442
469b
412
469c
468
468
Ex
468s
120s
468s
442
442
452
454
456
440
A
457
P
P
453
A
452
454
120n
456
496
416
120n
Ex
455
468s
468s
468
468
458
460
469a
468f
468f
469d
444
494
444
120n
508
508
120n
484
482
486
480
488
478
A
A
P
P
476
472
474
470

FIG. 21

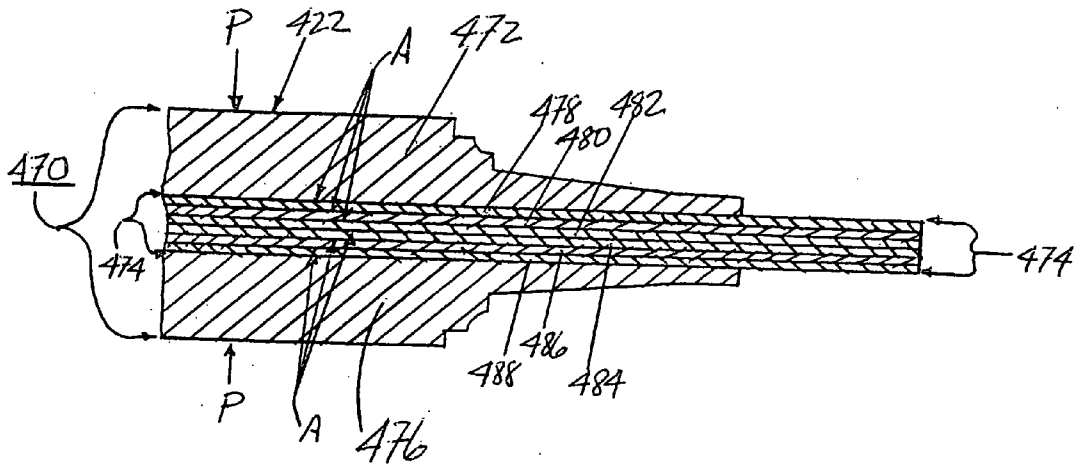

P
422
A
472
478
482
480
470
474
474
486
488
484
P
A
476

FIG. 22

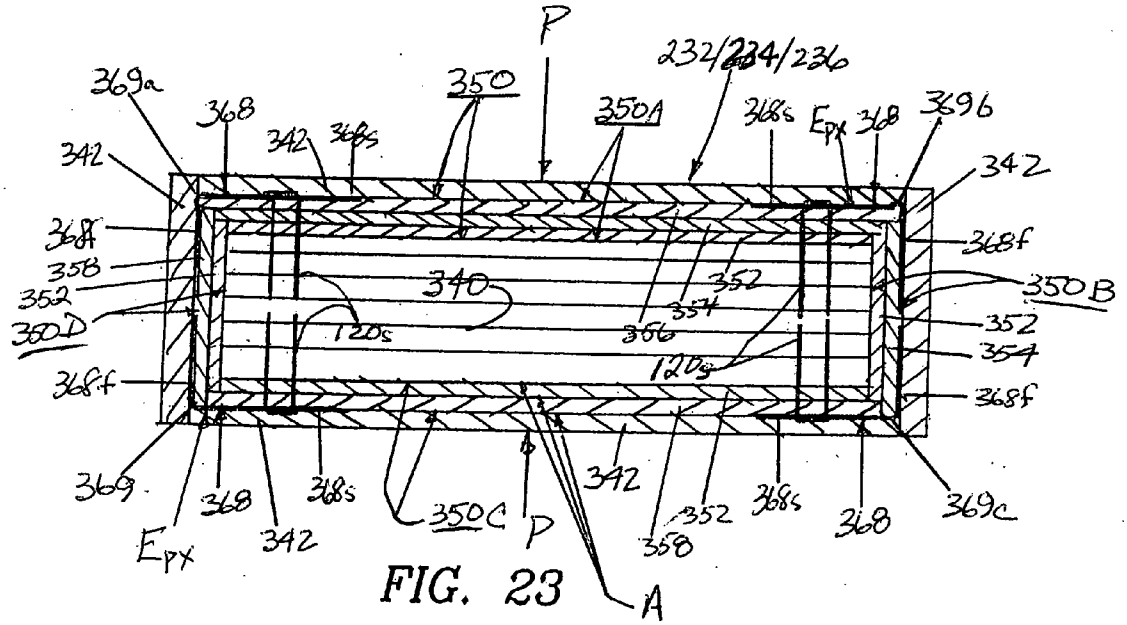

P
232/234/236
369a
368
350
350A
368s
Epx
368
369b
342
342
368s
342
368f
358
352
340
352
350B
360D
120s
356
354
352
354
120s
368f
368f
369
368
368s
350C
P
342
352
368s
368
369c
Epx
342
358
A

FIG. 23

FIRE RETARDANT PANEL DOOR AND DOOR FRAME HAVING INTUMESCENT MATERIALS THEREIN

FIELD OF INVENTION

[0001] The present invention relates to a fire retardant panel door and door frame, and more particularly to a fire retardant panel door and door frame that provides fire resistance using a plurality of intumescent and fire resistant barrier layers therein for preventing the spread of fire through the fire retardant panel door and door frame.

BACKGROUND OF THE INVENTION

[0002] A fire retardant panel door, often referred to as a "fire door," is installed in homes, commercial buildings, and industrial plants for preventing the passage or spread of fire from one part of the building to another. In the interest of public safety, standards have been set by governmental agencies; and by municipal, county and state building code authorities and insurance companies for the installation and performance of fire doors. The standards require that the fire retardant doors be installed in wall openings and that they pass industry-wide acceptance tests.

[0003] Standard test methods for fire door assemblies, such as ASTM E-152, UL 10(b) or NFPA 252, measure the ability of a door assembly to remain in an opening during a fire to retard the passage of the fire and evaluate the fire resistant properties of the door. In conducting such tests, doors are mounted in an opening of a fire proof wall. One side of the door is exposed to a predetermined range of temperatures over a predetermined period of time, followed by the application of a high pressure hose stream that causes the door to erode and provides a thermal shock to the assembly. Doors are given a fire rating based on the duration of the heat exposure of 20 minutes, 30 minutes, 45 minutes, one hour, 1½ hours or three hours. The door assembly receives the fire rating when it remains in the opening for the duration of the fire test and hose stream, within certain limitations of movement and without developing openings through the door either at the core or around the edge material.

[0004] A fire door must be made almost entirely of incombustible material. However, since a fire door is part of the interior or exterior of a personal living space or workspace, it must also be aesthetically pleasing. Usually, therefore, a core of incombustible material comprising the main structure of the fire door is overlaid with a thin wood veneer facing that provides the door with an attractive appearance. Fire door assemblies often fail, not because of the fire resistant properties of the fire door, but they fail because of inadequate placement of the fire resistance materials within the door, such that the fire door buckles. Additionally, the fire resistant blocking material of a core section of the fire door may need supplemental fire resistant materials strategically placed within the fire door to add to its fire door rating.

[0005] There remains a need for a reinforced fire retardant panel door and door frame which provides additional fire resistance using layers of intumescent and fire resistant materials in the fire retardant panel door and door frame in order to prevent buckling of the fire retardant panel door and door frame during a fire. Further, the reinforced fire retardant panel door would include supplemental layers of fire resistant materials strategically embedded within the structural components of the fire retardant panel door.

DESCRIPTION OF THE PRIOR ART

[0006] Fire retardant doors, and fire doors of various designs, configurations, structures and materials of construction have been disclosed in the prior art. For example, U.S. Pat. No. 6,115,976 to Gomez discloses an assembly for sealing a fire resistant door within a door frame during a fire event. The door edge assembly includes a plurality of door edges for receiving an intumescent strip within a slot on each door edge. The intumescent strip is constructed and designed to expand upon reaching a certain reaction temperature when exposed to a fire event or other extreme heat source. This prior art patent does not disclose or teach the particular door structure having the use of intumescent and fire resistant materials in the door panel, stiles, rails, door frame and door joints in order to provide for a fire retardant panel door that prevents buckling of the door during a fire, as well as prevent the spread of fire through the door and door frame for at least 90 minutes.

[0007] U.S. Pat. No. 5,816,017 to Hunt et al. discloses a fire retardant door and exit device for the fire retardant door. The fire retardant door includes a core of fire resistant blocking material being Tectonite™ for providing the door with a fire rating of at least 90 minutes. The fire door uses intumescent material which expands when heated to fill the void in the channel between the channel walls and the vertical extending rods within the latch stile of the door. This prior art patent does not disclose or teach the particular door structure having the use of intumescent and fire resistant materials in the door panels, stiles, rails, door frame and door joints in order to provide for a fire retardant panel door that prevents buckling of the door during a fire, as well as prevents the spread of fire through the door and door frame for at least 90 minutes.

[0008] U.S. Pat. No. 5,417,024 to San Paolo discloses a fire resistant panel door. The fire resistant panel door is constructed from panels, stiles, mullion and rails having a core of fire resistant material. The door components are joined together so that the fire resistant material extends substantially continuously from side to side and from top to bottom of the finished door. The fire resistant core of each door panel is recessed within the fire resistant core of the associated rails and stiles to reduce air infiltration through the door which can compromise the door's fire resistance. This prior art patent does not disclose or teach the particular door structure having the use of intumescent and fire resistant materials in the door panels, stiles, rails, door frame and door joints in order to provide for a fire retardant panel door that prevents buckling of the door during a fire for at least 90 minutes.

[0009] U.S. Pat. No. 4,930,276 to Bawa et al. discloses a fire door window construction. The fire door includes a trim strip having inner and outer members. The inner member is of a high density incombustible mineral material or ceramic and is nailed in position to securely and uniformly hold the pane of glass in the door opening. The outer trim member is of a fire retardant particle board and has an exposed wood veneer facing throughout. An intumescent caulking compound is applied between an inner portion of the outer trim

member and the pane of glass. This prior art patent does not disclose or teach the particular door structure having the use of intumescent and fire resistant materials in the door panels, stiles, rails, door frame and door joints in order to provide for a fire retardant panel door that prevents buckling of the door during a fire, as well as prevents the spread of fire through the door and door frame for at least 90 minutes.

[0010] U.S. Pat. No. 4,441,296 to Grabendike et al. discloses a fire resistant wood door structure designed to pass code and testing laboratories' requirements. The fire resistant wood door structure includes a door assembly having a support frame assembly with a panel assembly connected to the support frame assembly. The support frame assembly includes top, bottom, side, central and transverse frame members. The panel members include a main body connected through a peripheral edge by a double connector assembly. The double connector assembly functions to only remove about ⅓ of the door's normal 1¾ inch thickness during the burn testing procedure, thus passing the fire resistant testing of 20 minutes. This prior art patent does not disclose or teach the particular door structure having the use of intumescent and fire resistant materials in the door panels, stiles, rails, door frame and door joints in order to provide for a fire retardant panel door that prevents buckling of the door during a fire, as well as prevents the spread of fire through the door and door frame for at least 90 minutes.

[0011] U.S. Pat. Nos. 4,529,742; 6,031,040; and 6,153,674 all disclose the use of intumescent compounds/fire barrier materials within door construction to reduce or eliminate the passage of smoke and fire through the door and door frame. These prior art patents do not disclose or teach the particular door structure having the use of intumescent and fire resistant materials in the door panels, stiles, rails, door frame and door joints in order to provide for a fire retardant panel door that prevents buckling of the door during a fire, as well as prevents the spread of fire through the door and door frame for at least 90 minutes.

[0012] In addition, the aforementioned prior art patents do not disclose or teach the particular structure and configuration of the reinforced fire retardant panel door and door frame of the present invention that provides additional fire resistance to the door in order to prevent the buckling of the door during a fire.

[0013] Accordingly, it is an object of the present invention to provide a reinforced fire retardant panel door and door frame that prevents buckling of the door during a fire.

[0014] Another object of the present invention is to provide a reinforced fire retardant panel door and door frame that has supplemental fire resistant materials strategically embedded and placed within the tongue and groove joints of the fire resistant panel door, as well as supplemental fire resistant materials placed on the perimeter edges of the fire resistant panel door for preventing the spread of fire through the door and door frame.

[0015] Another object of the present invention is to provide a reinforced fire retardant panel door and door frame that has intumescent and fire resistant material layers within the panel door and door frame for preventing the spread of fire through the door and door frame.

[0016] Another object of the present invention is to provide a reinforced fire retardant panel door and door frame that has fire resistant materials being multiple layers of intumescent material that expands in the presence of fire such that the intumescent material closes and seals the component tongue and groove joints, as well as the perimeter edges of the fire retardant panel door for preventing the spread of fire through the door and door frame.

[0017] Another object of the present invention is to provide a reinforced fire retardant panel door and door frame that is used as part of an interior or exterior personal living space, or workspace being installed within home dwellings, commercial buildings or industrial plants.

[0018] Another object of the present invention is to provide a reinforced fire retardant panel door and door frame that has stiles and rails having metal L-shaped beads therein in order to form an exoskeleton for further strengthening and tying together the stiles and rails within the panel door in order to keep the panel door from buckling during a fire.

[0019] Another object of the present invention is to provide a reinforced panel door and door frame that has improved aesthetic qualities by having a maximum panel core thickness of ⅜ of an inch allowing for a minimum thickness of 1¾ inches of the fire resistant and reinforced panel door which allows for greater profiling (depth) of the exterior wood molding between the center panel and the stiles and rails.

[0020] Another object of the present invention is to provide a reinforced panel door and door frame that includes a heat activated door pin or door hook assembly for preventing the active (free) panel door from buckling during a fire.

[0021] Another object of the present invention is to provide a reinforced fire retardant panel door and door frame that is aesthetically pleasing having the appearance of natural wood, and has achieved a successful fire rating of at least 90 minutes and passes a positive pressure test, and is easily installed in a building.

[0022] A further object of the present invention is to provide a reinforced fire retardant panel door and door frame that can be mass produced in an automated and economical matter and is readily affordable to the builder or consumer.

SUMMARY OF THE INVENTION

[0023] In accordance with the present invention, there is provided a fire retardant panel door and door frame that prevents the spread of fire through the door during a fire. The fire retardant panel door has at least one door panel and stiles and rails. The door panel includes an interior center composite section formed of a first plurality of layers of intumescent materials and a first plurality of layers of fire resistant materials disposed between and connected to a pair of outer sections formed of wood for enclosing the interior center composite section to form a composite laminate door panel. Each of the stiles includes a first center core formed of wood enclosed by a second plurality of layers of intumescent materials and a second plurality of layers of fire resistant materials; and the second layers of intumescent and fire resistant materials materials are enclosed by a first applique layer formed of wood to form a composite laminate stile. Each of the rails includes a second center core formed of wood enclosed by a third plurality of layers of intumescent materials and a third plurality of layers of fire resistant materials; and the third layers of intumescent and fire

resistant materials are enclosed by a second applique layer formed of wood to form a composite laminate rail. The first, second, and third plurality of layers of intumescent materials are activated to expand upon exposure to heat and/or fire to prevent the heat and/or fire from passing through the at least one door panel, the stiles and the rails of the panel door during a fire for at least 90 minutes. The at least one door panel is connected to the panel door by tongue and groove joints; and the tongue and groove joints have a fourth plurality of layers of intumescent materials and a fourth plurality of layers of fire resistant materials in the tongue and groove joints; and wherein the fourth plurality of layers of intumescent materials in the tongue and grove joints are activated to expand upon exposure to heat and/or fire to seal said joints in order to prevent the heat and/or fire from passing through the panel door during a fire for at least 90 minutes.

BRIEF DESCRIPTION OF THE DRAWINGS

[0024] Further objects, features and advantages of the present invention will become apparent upon the consideration of the following detailed description of the presently-preferred embodiment when taken in conjunction with the accompanying drawings, wherein:

[0025] **FIG. 1** is a front perspective view of the fire retardant panel door and door frame of the first embodiment of the present invention showing a single door and a door frame and its major component parts thereof;

[0026] **FIG. 2** is a cross-sectional view of the fire retardant panel door and door frame of the first embodiment of the present invention taken along lines **2-2** of **FIG. 1** in the direction of the arrows showing intumescent materials within tongue and groove joints of a center panel, stiles and rails, and intumescent materials within a door frame;

[0027] **FIG. 2A** is a sectional view of the fire retardant panel door and door frame of the present invention showing an upper corner of a stile and upper header having a heat activated door pin assembly therein in an unexpanded configuration;

[0028] **FIG. 2B** is a sectional view of the fire retardant panel door and door frame of the present invention showing the upper corner of the stile and upper header having the heat activated door pin assembly therein in an expanded configuration;

[0029] **FIG. 3** is a cross-sectional view of the fire retardant panel door and door frame of the present invention taken along lines **3-3** of **FIG. 1** in the direction of the arrows showing the panel connected to opposing stiles within the door frame;

[0030] **FIG. 4** is a cross-sectional view of the fire retardant panel door and door frame of the present invention taken along line **4-4** of **FIG. 1** in the direction of the arrows showing the lower rail connected to opposing stiles within the door frame;

[0031] **FIG. 4A** is an enlarged sectional detailed view of the fire retardant panel door and door frame of the present invention showing the tongue and groove joint and a pair of dowel pins for joining the lower rail to the opposing stile;

[0032] **FIG. 5** is a cross-sectional view of the fire retardant panel door and door frame of the present invention taken along lines **5-5** of **FIG. 1** in the direction of the arrows showing the center panel connecting the upper rail and the lower rail within the door frame;

[0033] **FIG. 6** is an enlarged sectional detailed view of the fire retardant panel door of the present invention showing the stile having a plurality of intumescent layers surrounding a wood core, and the center panel having an interior center composite section of intumescent layers;

[0034] **FIG. 7** is an enlarged sectional detailed view of the fire retardant panel door of the present invention showing the rail having a plurality of intumescent layers surrounding a wood core, and the center panel having an interior center composite section of intumescent layers;

[0035] **FIG. 8** is an enlarged exploded sectional detailed view of the fire retardant panel door of the present invention showing the tongue and groove joint for joining the center panel to the rail;

[0036] **FIG. 9** is an enlarged sectional detailed view of the fire retardant panel door of the present invention showing a tongue section of the center panel having the interior center composite section with a plurality of intumescent layers therein;

[0037] **FIG. 10** is an enlarged sectional detailed view of the fire retardant door frame of the present invention showing a doorjamb or an upper header having a plurality of intumescent layers surrounding a wood core;

[0038] **FIG. 11** is a front perspective view of the fire retardant panel doors and door frame of the second embodiment of the present invention showing a double door assembly within a double door frame and their major component parts thereof;

[0039] **FIG. 12** is a cross-sectional view of the fire retardant panel doors and door frame of the second embodiment of the present invention taken along lines **12-12** of **FIG. 11** in the direction of the arrows showing intumescent materials within tongue and groove joints of a plurality of panels, stiles, rails, and mullions within each of the doors of the double door assembly and intumescent materials within a double door frame;

[0040] **FIG. 12A** is a sectional view of the fire retardant panel door and door frame of the present invention showing a dead bolt assembly within one of the upper corners of a stile and upper jamb header of a first panel door;

[0041] **FIG. 12B** is a sectional view of the fire retardant panel door and door frame of the present invention showing one of the upper corners of a stile and upper header having a heat activated door pin assembly therein of a second panel door in an unexpanded configuration;

[0042] **FIG. 12C** is a sectional view of the fire retardant panel door and door frame of the present invention showing one of the upper corners of the stile and upper header having the heat activated door pin assembly therein of the second panel door in an expanded configuration;

[0043] **FIG. 12D** is a perspective view of the fire retardant panel door and door frame of the present invention showing the heat activated door pin assembly in an unexpended configuration and tensioned state;

[0044] **FIG. 12E** is a sectional view of the fire retardant panel door and door frame of the present invention showing one of the upper corners of the stile and upper header having a heat activated door hook assembly therein of the second panel door in an unexpanded configuration and tensioned state;

[0045] **FIG. 12F** is a sectional view of the fire retardant panel door and door frame of the present invention showing one of the upper corners of the stile and upper header having the heat activated door hook assembly therein of the second panel door in an expanded configuration and untensional state;

[0046] **FIG. 12G** is a perspective view of the heat activated door hook assembly of the present invention showing the door hook assembly in its untensioned state;

[0047] **FIG. 12H** is a top plan view of the heat activated door hook assembly of the present invention showing a strike plate, a movable door hook member, and a fusible solder link;

[0048] **FIG. 12I** is a bottom plan view of the heat activated door hook assembly of the present invention showing a door hook housing member having an opening for accessing the door hook member and the strike plate;

[0049] **FIG. 12J** is a side elevational view of the heat activated door hook assembly of the present invention showing the strike plate, the movable door hook member and the door hook housing member and the door hook housing member in an expanded configuration and untensioned state;

[0050] **FIG. 13** is a cross-sectional view of the fire retardant panel doors and door frame of the present invention taken along lines **13-13** of **FIG. 11** in the direction of the arrows showing each of the panels connected to opposing stiles for each door within the double door frame;

[0051] **FIG. 14** is a cross-sectional view of the fire retardant panel doors and door frame of the present invention taken along lines **14-14** of **FIG. 11** in the direction of the arrows showing each of the lower rails connected to opposing stiles for each door within the double door frame;

[0052] **FIG. 15** is a cross-sectional view of the fire retardant panel doors and door frame of the present invention taken along lines **15-15** of **FIG. 11** in the direction of the arrows showing a first mullion connected to opposing stiles for the second door within the double door frame;

[0053] **FIG. 16** is a cross-sectional view of the fire retardant panel door and door frame of the present invention taken along lines **16-16** of **FIG. 11** in the direction of the arrows showing the panel, an interior raised panel, an interior stile, and the opposing stiles of one of the doors being set within the door frame;

[0054] **FIG. 17** is a cross-sectional view of the fire retardant panel door and door frame of the present invention taken along lines **17-17** of **FIG. 11** in the direction of the arrows showing the panel connected to opposing rails of the first door within the double door frame;

[0055] **FIG. 18** is a cross-sectional view of the fire retardant panel door and door frame of the present invention taken along lines **18-18** of **FIG. 11** in the direction of the arrows showing the panels connecting the opposite rail and the mullions within the double door frame;

[0056] **FIG. 18A** is an enlarged sectional detailed view of the fire retardant panel door of the present invention showing a stile within the second panel door;

[0057] **FIG. 19A** is an enlarged sectional detailed view of the fire retardant panel door of the present invention showing the stile having a plurality of intumescent layers surrounding a wood core, and the panel having an interior center composite section of intumescent layers for the first door panel;

[0058] **FIG. 19B** is an enlarged sectional detailed view of the fire retardant panel door of the present invention showing the stile having a plurality of intumescent layers surrounding a wood core, and the panel having an interior center composite section of intumescent layers for the second panel door;

[0059] **FIG. 20A** is an enlarged sectional detailed view of the fire retardant panel door of the present invention showing the rail having a plurality of intumescent layers surrounding a wood core, and the panel having an interior center composite section of intumescent layers for the first door panel;

[0060] **FIG. 20B** is an enlarged sectional detailed view of the fire retardant panel door of the present invention showing the rail having a plurality of intumescent layers surrounding a wood core, and the panel having an interior center composite section of intumescent layers for the second panel door;

[0061] **FIG. 21** is an enlarged exploded sectional detailed view of the fire retardant panel door of the present invention showing the tongue and groove joint for joining the upper panel to the upper rail for the second panel door;

[0062] **FIG. 22** is an enlarged sectional detailed view of the fire retardant panel door of the present invention showing a tongue section of the panel having the interior center composite section with a plurality of intumescent layers therein; and

[0063] **FIG. 23** is an enlarged sectional detailed view of the fire retardant door frame of the present invention showing a door jamb or an upper header having a plurality of intumescent layers surrounding a wood core.

DETAILED DESCRIPTION OF THE EMBODIMENTS

First Embodiment 10

[0064] The fire retardant panel door **10** and door frame **30** of the first embodiment of the present invention is represented in detail by **FIGS. 1 through 10** of the patent drawings. The fire retardant panel door **10** and door frame **30** is used to fireproof an area and to prevent fire from spreading to other areas within a home dwelling, a commercial building, or an industrial plant.

[0065] Fire retardant panel door **10** includes stiles **12** and **14**, rails **16** and **18**, and a center panel **20**, as shown in **FIGS. 1 and 3** to **5**. The fire retardant panel door **10** is hingedly connected to the door frame **30**, as depicted in **FIG. 1**, such that the panel door **10** is hingedly connected between a left

or right door jamb **32** or **34** and positioned below an upper header **36**, as depicted in **FIGS. 3 and 4** of the drawings. Jambs **32** and **34** include an interior wall surface **33** and **35**, respectfully, and upper header **36** includes an interior wall surface **37**.

[**0066**] As shown in **FIGS. 3, 4**, and **5**, the stiles **12** and **14** and rails **16** and **18** have a solid core section **40** formed of a yellow poplar microllam wood material. A composite intumescent and fire resistant layer section **50** partially surrounds and encloses the solid wood core section **40** on sides **51** and **53**, respectively. A wood applique **42** (i.e., oak, maple, walnut, etc.) encloses the composite intumescent and fire resistant layer sections **50** of sides **51** and **53**, respectively. The composite intumescent and fire resistant layer section **50** includes a first inner intumescent layer **52** being adjacent to and in contact with the solid wood core section **40**, a second middle fire resistant barrier layer **54** being adjacent to and in contact with the first inner intumescent layer **52**, and a third outer intumescent layer **56** being adjacent to and in contact with the second middle fire resistant barrier layer **54**, as shown in **FIGS. 6 and 7**.

[**0067**] The inner and outer intumescent layers **52** and **56** of sides **51** and **53** are made of PALUSOL P-210™ product being manufactured by the BASF Corporation of the USA. PALUSOL P-210™ is an intumescent panel consisting essentially of a core having sodium silicate, and a small portion of organic binder reinforced by glass fibers and having the addition of wire mesh therein. A coating of epoxy resin is applied to each side of the core which protects the intumescent panel from atmospheric influences of carbon dioxide, water, and/or steam. The mass per unit area of the intumescent laminate (panel) layer **52** or **56** is in the range of 0.46 to 0.77 pounds per foot^2. The thickness of the intumescent laminate layer **52** or **56** is in the range 0.0590 inches to 0.0906 inches.

[**0068**] The second middle layer **54** of sides **51** and **53** is made of a FYRE ROC™ (FR-1001) product being manufactured by the Goodrich Corporation, Engineered Polymer Products Division, of Jacksonville, Fla., U.S.A. The FYRE ROC™ panel is a laminate sheet consisting of a fire resistant metallo alumino silicate and stainless steel screen layers for forming a reinforced composite laminate sheet that has the ability to maintain excellent mechanical and physical properties at elevated temperatures up to 2000 degrees Fahrenheit, without significant smoke or toxicity emissions. The density of the laminate fire resistant barrier (sheet) layer **54** is 2.5±0.5 grams per cubic centimeter. The thickness of the laminate fire resistant barrier layer **54** is in the range of 0.020 to 0.050 inches (due to reinforcement thickness variability).

[**0069**] The wood applique **42** is adjacent to and in contact with the third outer intumescent layer **56**. Wood molding **44** is applied to the exterior surface of stiles **12** and **14**, rails **16** and **18**, and center panel **20**, as shown in **FIG. 1** of the drawings. The aforementioned wood applique **42**, intumescent layers **52**, **54**, and **56**, and the solid wood core section **40** are laminated together under pressure P using an adhesive system consisting of a Simpson ISR 70-07 isocyanate adhesive A or an equivalent adhesive in order to form the laminated stiles **12** and **14** and rails **16** and **18**, respectively, as depicted in **FIGS. 6 and 7** of the drawings.

[**0070**] As shown in **FIGS. 3, 4** and **5**, the stiles **12** and **14** and rails **16** and **18** also include inner and outer ends **55** and **57**, respectively. The inner end **55** includes a first inner intumescent end layer **58** being adjacent to and in contact with the solid wood core section **40**, and a second middle intumescent end layer **64** being adjacent to and in contact with the first inner intumescent layer **58**. The first and second intumescent end layers **58** and **64** of inner end **55** are made of the PALUSOL™ P-210 product as previously described. The outer end **57** includes a first inner intumescent end layer **62** being adjacent to and in contact with the solid wood core section **40**, a second middle intumescent end layer **64** being adjacent to and in contact with the first inner intumescent end layer **62**, a third outer intumescent end layer **66** being adjacent to and in contact with the second middle intumescent end layer **64** and the wood applique (veneer) **42** being adjacent to and in contact with the third outer intumescent end layer **66**. The first inner intumescent end layer **62** is made of the PALUSOL™ P-210 product as previously described. The second and third intumescent end layers **64** and **66** are made of a TECHNOFIRE 2000™ product manufactured by the TECHNICAL FIBRE PRODUCTS SUBSIDIARY in Newburgh, N.Y., U.S.A. The TECHNOFIRE 2000™ rigid sheet panel is a composite laminate sheet consisting of a core having rockwool fibers with chopped strand glass fibre reinforcement and a small portion of organic binder. A coating of epoxy resin is applied to each side of the core which protect the composite intumescent panel from atmospheric influences of carbon dioxide, water and/or steam. The density of the composite intumescent laminate sheet end layers **64** or **66** is in the range of 78.0 to 90.5 5 lbs/ft^3 (1250 to 1450 kg/m^3). The intumescent laminate end layers **64** or **66** has a maximum thickness of 1.3 mm (0.0512 inches). The mass per unit area of the intumescent laminate end layers **64** or **66** is in the range of 0.333 to 0.386 pounds per foot^2. The intumescent laminate end layers **64** or **66** upon exposure to heat and/or fire has expansion ratio of 22:1 for imparting linear gap seals between the fire retardant panel door **10** and door frame **30** in order to prevent the spread of excessive heat and/or fire through the fire retardant panel door **10** and door frame **30**.

[**0071**] Additionally, as shown in **FIGS. 3, 4** and **5**, the stiles **12** and **14** and rails **16** and **18** further include a plurability of metal L-shaped beads **68** made from 16 gauge galvanized steel being positioned at the corners **69***a*, **69***b*, **69***c* and **69***d* of the stiles **12** and **14**, and rails **16** and **18**. The metal L-shaped beads **68** each include a first end section **68***f* and a second end section **68***s*. Each of the second end sections **68***s* of metal L-shaped beads **68** are further positioned and placed between the second middle fire resistant barrier layer **54** and the third outer intumescent layer **56**, as shown in **FIGS. 3, 4** and **5** of the drawings. One pair of the first end sections **68***f* at the inner end **55** are further positioned and placed in contact with and adjacent to the second middle end layer **60**. The other pair of the first end sections **68***f* at the outer end **57** are further positioned and placed between the first inner intumescent end layer **62** and the second middle intumescent end layer **64**. The aforementioned metal L-shaped beads **68** are used for rigidity and retention of the second middle fire resistant barrier layers **54** and the third outer intumescent layers **56** together and in conjunction with each other to form an exoskeleton layer E_x, as shown in **FIGS. 3, 4** and **5** of the drawings, in order to further strengthen and tie together stiles **12** and **14** and rails **16** and **18**, respectively. Each of the metal L-shaped beads **68** are fastened at the inner and outer ends **55** and **57** of the

stiles **12**, **14** and rails **16**, **18** by brads **120***n* and staples **120***s*, respectively, as shown in **FIGS. 7 and 8**.

[**0072**] Center panel **20** has edges **61**, **63**, **65** and **67**. The center panel **20** is formed from a composite laminate structure **70**, as shown in **FIG. 9**. The composite laminate structure **70** includes outer wood sections **72** and **76** and an interior center intumescent and fire resistant barrier section **74** sandwiched between outer wood sections **72** and **76**. The interior center intumescent and fire resistant barrier composite section **74** includes a first outer intumescent layer **78**, a second inner fire resistant barrier layer **80**, a third middle intumescent layer **82**, a fourth middle intumescent layer **84**, a fifth inner fire resistant barrier layer **86**, and a sixth outer intumescent layer **88**. The first outer, third middle fourth middle, and sixth outer intumescent layers **78**, **82**, **84**, and **88** are made of the PALUSOL™ P-210 product. The second inner and fifth inner fire resistant barrier layers **80** and **86** are made of the FYRE ROC™ fire resistant laminate sheet, as previously described. The aforementioned outer wood sections **72**, **76** and the intumescent layers **78** to **88** are laminated together under pressure P using an adhesive system consisting of a Simpson ISR 70-07 isocyante adhesive A or an equivalent adhesive in order to form the laminated center panel **20**.

[**0073**] Tongue and groove joints **90** and **92** are used to connect center panel **20** to stiles **12** or **14**, respectively, and tongue and groove joints **94** and **96** are used to connect center panel **20** to rails **16** or **18**, respectively, as depicted in **FIGS. 3, 4**, and **5** of the drawings. Tongue and groove joints **98** and **100** are used to connect rails **16** or **18** to stiles **12** or **14**, respectively, as shown in **FIGS. 6 and 7** of the drawings. As shown in **FIG. 6**, the tongue and groove joints **90** and **92** include air gaps **104** for expansion of the intumescent material layers **78**, **82**, **84** and **88** in the presence of excessive heat and/or fire, such that the intumescent material layers **78**, **82**, **84** and **88** close and seal the air gaps **104** within the fire retardant panel door **10** in order to prevent the spread of excessive heat and/or fire through the fire retardant panel door **10** and door frame **30**. Further, the tongue and groove joints **94** and **96** also include air gaps **108**, as shown in **FIG. 8**, for expansion of the intumescent material layers **78**, **82**, **84** and **88** in the presence of excessive heat and/or fire, such that the intumescent material layers **78**, **82**, **84** and **88** close and seal the air gaps **108** within the fire retardant panel door **10** in order to prevent the spread of excessive heat and/or fire through the fire retardant panel door **10** and door frame **30**. Additionally, the tongue and groove joints **98** and **100**, as shown in **FIGS. 4 and 4**A, include air gaps **112** for expansion of the intumescent end layers **58** and **60** in the presence of excessive heat and/or fire, such that the intumescent end layers **58** and **60** close and seal the air gaps **112** within the fire retardant panel door **10** in order to prevent the spread of excessive heat and/or fire through the fire retardant panel **10** and door frame **30**. Also, the tongue and groove joints **90** and **92**, and **94** and **96** are attached to each other using a staple **120***s* or nail **120***n*, respectively, as shown in **FIGS. 6 and 7** of the drawings. Further, each of the rails **16**, **18**, and stiles **12**, **14** include a dowel groove **122**, **123**, **124** and **125**, respectively, for receiving a wooden dowel **126** therein, for additionally joining together the rails **16** and **18** to the stiles **12** and **14**, respectively, as shown in **FIGS. 4 and 4**A. The dowels **126** are held in place within dowel grooves **122**, **123**, **124** and **125** with appropriate wood glue G, as depicted in **FIG. 4**.

[**0074**] As shown in **FIGS. 3, 4**, and **10**, the jambs **32** and **34**, and upper head **36** of door frame **30** include a core section **140** formed of wood materials, such as oak, maple, walnut, pine, poplar and the like. Wood applique **142** (i.e., oak, maple, walnut, etc.) is applied to a composite intumescent and/or fire resistant barrier layer sections **150**A, **150**B, **150**C and **150**D which surrounds the solid wood core section **140**. The composite intumescent and fire resistant barrier layer section **150**A includes a first inner intumescent layer **152** being adjacent to and in contact with the solid wood core section **140**, a second middle fire resistant barrier layer **154** being adjacent to and in contact with the first inner intumescent layer **152**, a third outer intumescent layer **156** being adjacent to and in contact with the second middle fire resistant barrier layer **154** and a wood applique (veneer) **142** being adjacent and in contact with the third outer intumescent layer **156**. The composite intumescent and fire resistant barrier layer section **150**B includes a first inner intumescent layer **152** being adjacent to and in contact with the solid wood core section **140**, a second middle fire resistant barrier layer **154** being adjacent to and in contact with the first inner intumescent layer **152**, a wood applique (veneer) **142** being adjacent to and in contact with the second middle fire resistant barrier layer **154**. The composite intumescent layer section **150**C includes a first inner intumescent layer **152** being adjacent to and in contact with the solid wood core section **140**, a second middle intumescent layer **158** being adjacent to and in contact with the first inner intumescent layer **152**, and a wood applique (veneer) **142** being adjacent to and in contact with the second middle intumescent layer **158**. The composite intumescent layer section **150**D includes a first inner intumescent layer **152** being adjacent to and in contact with the solid wood core section **140**, a second middle intumescent layer **158** being adjacent to and in contact with the first inner intumescent layer **152**, and a wood applique (veneer) **142** being adjacent to and in contact with the second middle intumescent layer **158**. The inner and middle intumescent layers **152** and **158** are made of PALUSOL P-210™ product being manufactured by the BASF Corporation of the USA. PALUSOL P-210™ is an intumescent panel consisting essentially of a core having sodium silicate, and a small portion of organic binder reinforced by glass fibers and wire mesh. A coating of epoxy resin is applied to each side of the core which protects the intumescent panel from atmospheric influences of carbon dioxide, water, and/or steam. The mass per unit area of the intumescent laminate (panel) layer **152** or **158** is in the range of 0.46 to 0.77 pounds per foot^2. The thickness of the intumescent laminate layer **152** or **156** is in the range 0.0590 inches to 0.906 inches. The second middle fire resistant barrier layer **154** is made of a FYRE ROC™ product being manufactured by the Goodrich Corporation, Engineered Polymer Products Division, of Jacksonville, Fla., U.S.A. The FYRE ROC™ panel is a laminate sheet consisting of a fire resistant metallo alumino silicate and stainless steel screen for forming a reinforced composite laminate sheet that has the ability to maintain excellent mechanical and physical properties at elevated temperatures up to 2000 degrees Fahrenheit, without significant smoke or toxicity emissions. The density of the fire resistant barrier laminate (sheet) layer **154** is 2.5±0.5 grams per cubic centimeter. The thickness of the fire resistant barrier laminate layer **154** is in the range of 0.020 to 0.050 inches (due to reinforcement thickness variability). The third outer intumescent layer **156** of the composite layer

section **150**A is made of a TECHNOFIRE 2000™ product manufactured by the TECHNICAL FIBRE PRODUCTS SUBSIDIARY in Newburgh, N.Y., U.S.A. The TECHNOFIRE 2000™ rigid sheet panel is a composite laminate sheet consisting of a core having rockwool fibers with chopped strand glass fibre reinforcement and a small portion of organic binder. A coating of epoxy resin is applied to each side of the core which protects the composite intumescent panel atmospheric influences of carbon dioxide, water and/or steam. The density of the composite intumescent laminate sheet layer **156** is in the range of 78.0 to 90.5 lbs/ft^3. The mass per unit area of the intumescent laminate layer **156** is in the range of 0.333 to 0.386 pounds per foot^2. The intumescent laminate layer **156** has a maximum thickness of 1.3 mm (0.0512 inches). The intumescent laminate layer **156** upon exposure to heat and/or fire has an expansion ratio of 22 to 1 for importing linear gap seals between the fire retardant panel door **10** and door frame **30** in order to prevent the spread of excessive heat and/or fire through the fire retardant panel door **10** and door frame **30**. Wood molding **144** is applied to the exterior surface of the upper header **36**, as shown in **FIG. 1** of the drawings. The aforementioned wood applique **142**, the composite layer sections **150**A, **105**B, **150**C and **150**D, and the solid wood core section **140** are laminated together under pressure P using an dual adhesive system consisting of a Simpson ISR 70-07 isocyanate adhesive A or an equivalent adhesive in order to form the jambs **32** and **34** and the upper header **36** of door frame **30**.

[**0075**] The composite layer sections **150**A, **150**B, **150**C and **150**D of the jambs **32** and **34** and the upper header **36** expands in the presence of excessive heat and/or fire, such that the intumescent and fire resistant barrier material layer sections **150**A, **150**B, **150**C and **150**D closes and seals the perimeter of the fire retardant panel door **10** within the jambs **32** and **34** and upper header **36** of the door frame **30** to also prevent the spread of the excessive heat and/or fire through the fire retardant panel door **10** and door frame **30**, as shown in **FIG. 1**.

[**0076**] Additionally, as shown in **FIGS. 3, 4** and **5**, the jambs **32** and **34** further include a pair of metal L-shaped beads **168** made from 16 gauge galvanized steel being positioned at the corners **169***a* and **169***b* of jambs **32** and **34**, respectively. The metal L-shaped beads **168** each include a first end section **168***f* and a second end section **168***s*. Each of the second end sections **168***s* of metal L-shaped beads **168** are further positioned and placed between the second middle fire resistant barrier layer **154** and the third outer intumescent layer **156**, as shown in **FIGS. 3, 4** and **5** of the drawings. Each of the first end sections **168***f* of metal L-shaped beads **168** are further positioned and placed between such that they are in contact with and adjacent to the second middle intumescent layer **158** and the wood applique (veneer) **142** of composite layer end sections **150**C and **150**D of jambs **32** and **34**, respectively. The aforementioned metal L-shaped beads **168** are used for rigidity and retention of the second middle fire resistant barrier layer **154** and the third outer intumescent layer **156** together and in conjunction with each other to form a partial exoskeleton layer Epx, as shown in **FIGS. 3, 4** and **5** of the drawings, in order to further strengthened jambs **32** and **34**, respectively. Each of the metal L-shaped beads **168** are fastened to the composite end sections **150**C and **150**D of jambs **32** and **34**, respectively, by brads **120***n* or staples **120***s*, as shown in **FIGS. 5 and 10**.

[**0077**] The fire retardant panel door **10** and door frame **30** of the first embodiment of the present invention further includes a heat activated door pin assembly **170**, as shown in **FIGS. 2, 2A** and **2**B, for securing and holding a free corner C_F of the stile **14** of the fire retardant panel door **10** in place while the intumescent layers of the stiles **12, 14** and rails **16, 18** react from excessive heat and/or fire. The heat activated door pin assembly **170** includes a substantially cylindrically-shaped housing member **172** having a pin opening **174** for receiving a movable and hollow door pin **180** therein. The housing member **172** further includes a curved outer wall **176** and a bottom wall **177** for forming an interior compartment **178**. The hollow pin **180** includes an internal compressible spring **182** coiled about a threaded rod **184**. The compressible spring **182** includes a first lower end **182***f* and a second upper end **182***s*. Threaded rod **184** includes a proximal end **184***p* and a distal end **184***d*. The proximal end **184***p* of threaded rod **184** is connected to the first lower end **182***f* of compressible spring **182** and is held in place by washer **186** and hex nut **188**. The distal end **184***d* of threaded rod **184** includes a fusible solder link **190**. The fusible solder link **190** melts at 117° F. allowing the internal compressible spring **182** to eject the movable door bolt pin **180** within a strike plate opening **192** of a strike plate **194**, such that the movable door bolt pin **180** resides within an upper header bolt opening **36***h* of upper header **36**. The strike plate **194** also includes mounting openings **195** for receiving mounting screws **196** therein for attaching the strike plate **194** to the upper header **36**, as shown in **FIGS. 2A and 2B** of the drawings. Further, the bottom wall **177** of interior compartment **178** of the housing member **172** includes a pair of circular intumescent pads **198***a* and **198***b*. The intumescent pads **198***a* and **198***b* upon exposure to excessive heat and/or fire expands rapidly (22 times the original thickness) and locks the movable door bolt pin **180** permanently within the upper header bolt opening **36***h*. Thus, preventing any movement or buckling of the free corner C_F of the fire retardant panel door **10** relative to the door frame **30**. Intumescent pads **198***a* and **198***b* are made form TECHNOFIRE 2000™ composite laminate sheets as previously described in the above preferred embodiment. Housing member **172** is made of copper metal and the movable hollow door bolt pin **180** is made of brass metal.

Second Embodiment 200

[**0078**] A double door assembly **200** and door frame **230** of the second embodiment of the present invention is represented in detail by **FIGS. 11 through 23** of the patent drawings. The double door assembly **200** includes a first fire retardant panel door **210**, and a second fire retardant panel door **410** being hingedly connected to a double door frame **230**. The first and second fire retardant panel doors **210** and **410**, and double door frame **230** are used to fireproof an area and to prevent fire from spreading to other areas within a home dwelling, a commercial building, or an industrial plant. Fire retardant panel doors **210** and **410** are hingedly connected between a left and right door jambs **232** and **234** and positioned below an upper header **236**, as depicted in **FIG. 11** of the drawings. Jambs **232** and **234** include an interior wall surface **233** and **235**, respectfully and upper header **236** includes an interior wall surface **237**.

[**0079**] Fire retardant panel door **210** includes stiles **212** and **214**, rails **216** and **218**, and a center panel **220**, as shown in **FIGS. 11 and 13** through **18** of the drawings. The fire

retardant panel door **210** is hingedly connected to one section **230**A of the door frame **230**, as depicted in **FIGS. 11, 13**, and **14**, such that the panel door **210** is hingedly connected to the left door jamb **232** and positioned below section **230**A of the upper header **236**, as depicted in **FIGS. 8 and 9** of the drawings. As shown in **FIGS. 12 and 19** through **21**, the stiles **212** and **214** and rails **216** and **218** have a solid core section **240** formed of a yellow poplar microllam of wood material, and the like. Wood applique **242** (i.e., oak, maple, walnut, etc.) is applied to a composite intumescent and fire resistant layer section **250** which partially surrounds the solid wood core section **240** on sides **251** and **253**, respectively. The composite intumescent and fire resistant layer section **250** includes a first inner intumescent layer **252** being adjacent to and in contact with the solid wood core section **240**, a second middle fire resistant barrier layer **254** being adjacent to and in contact with the first inner intumescent layer **252**, and a third outer intumescent layer **256** being adjacent to and in contact with the second middle fire resistant barrier layer **254**. The inner and outer intumescent layers **252** and **256** of sides **251** and **253** are made of PALUSOL P-210™ product being manufactured by the BASF Corporation of the USA. PALUSOL P-210™ is an intumescent panel consisting essentially of a core having sodium silicate, and a small portion of organic binder reinforced by glass fibers and having the addition of wire mesh therein. A coating of epoxy resin is applied to each side of the core which protects the intumescent panel from atmospheric influences of carbon dioxide, water, and/or steam. The mass per unit area of the intumescent laminate (panel) layers **252** or **256** is in the range of 0.46 to 0.77 pounds per foot^2. The thickness of the intumescent laminate layers **252** or **256** is in the range 0.0590 inches to 0.0906 inches. The second middle layer fire resistant barrier **254** is made of a FYRE ROC™ (FR-1001) product being manufactured by the Goodrich Corporation, Engineered Polymer Products Division, of Jacksonville, Fla., U.S.A. The FYRE ROC™ panel is a laminate sheet consisting of a fire resistant metallo alumino silicate and stainless steel screen layers for forming a reinforced composite laminate sheet that has the ability to maintain excellent mechanical and physical properties at elevated temperatures up to 2000 degrees Fahrenheit, without significant smoke or toxicity emissions. The density of the laminate fire resistant barrier (sheet) layer **254** is 2.5±0.5 grams per cubic centimeter. The thickness of the laminate fire resistant barrier layer **254** is in the range of 0.020 to 0.050 inches (due to reinforcement thickness variability).

[**0080**] The wood applique **242** is adjacent to and in contact with the third outer intumescent layer **256**. Wood molding **244** is applied to the exterior surface of stiles **212** and **214**, rails **216** and **218**, and center panel **220**, as shown in **FIG. 11** of the drawings. The aforementioned wood applique **242**, intumescent layers **252**, **254**, and **256**, and the solid wood core section **240** are laminated together under pressure P using a dual adhesive system consisting of a Simpson ISR 70-07 isocyonate adhesive A or an equivalent adhesive in order to form the laminated stiles **212** and **214** and rails **216** and **218**, respectively.

[**0081**] As shown in **FIGS. 11**, and **13** through **18**, the stiles **212** and **214** and rails **216** and **218** also include inner and outer ends **255** and **257**, respectively. The inner end **255** includes a first inner intumescent end layer **258** being adjacent to and in contact with the solid wood core section **240**, and a second middle intumescent end layer **260** being adjacent to and in contact with the first inner intumescent layer **258**. The first and second intumescent end layers **258** and **260** of inner end **255** are made of the PALUSOL™ P-210 product as previously described. The outer end **257** includes a first inner intumescent end layer **262** being adjacent to and in contact with the solid wood core section **240**, a second middle intumescent end layer **264** being adjacent to and in contact with the first inner intumescent end layer **262**, a third outer intumescent end layer **266** being adjacent to and in contact with the second middle intumescent end layer **264** and the wood applique (veneer) **242** being adjacent to and in contact with the third outer intumescent end layer **266**. The first inner intumescent end layer **262** is made of the PALUSOL™ P-210 product as previously described. The second and third intumescent end layers **264** and **266** are made of a TECHNOFIRE 2000™ product manufactured by the TECHNICAL FIBRE PRODUCTS SUBSIDIARY in Newburgh, N.Y., U.S.A. The TECHNOFIRE 2000™ rigid sheet panel is a composite laminate sheet consisting of a core having rockwool fibers with chopped strand glass fibre reinforcement and a small portion of organic binder. A coating of epoxy resin is applied to each side of the core which protect the composite intumescent panel from atmospheric influences of carbon dioxide, water and/or steam. The density of the composite intumescent laminate sheet end layers **264** or **266** is in the range of 78.0 to 90.5 5 lbs/ft^3 (1250 to 1450 kg/m^3). The intumescent laminate end layers **264** or **266** has a maximum thickness of 1.3 mm (0.0512 inches). The mass per unit area of the intumescent laminate end layers **264** or **266** is in the range of 0.333 to 0.386 pounds per foot^2. The intumescent laminate end layers **264** or **266** upon exposure to heat and/or fire has expansion ratio of 22:1 for imparting linear gap seals between the fire retardant panel door **10** and door frame **30** in order to prevent the spread of excessive heat and/or fire through the fire retardant panel door **10** and door frame **30**.

[**0082**] Additionally, as shown in **FIGS. 11 and 13** through **18**, the stiles **212** and **214** and rails **216** and **218** further include a plurability of metal L-shaped beads **268** made from 16 gauge galvanized steel being positioned at the corners **269***a*, **269***b*, **269***c* and **269***d* of the stiles **212** and **214**, and rails **216** and **218**. The metal L-shaped beads **268** each include a first end section **268***f* and a second end section **268***s*. Each of the second end sections **268***s* of metal L-shaped beads **268** are further positioned and placed between the second middle fire resistant barrier layer **254** and the third outer intumescent layer **256**, as shown in **FIGS. 11 and 13** through **18** of the drawings. One pair of the first end sections **268***f* at the inner end **255** are further positioned and placed in contact with and adjacent to the second middle end layer **260**. The other pair of the first end sections **268***f* at the outer end **257** are further positioned and placed between the first inner intumescent end layer **262** and the second middle intumescent end layer **264**. The aforementioned metal L-shaped beads **268** are used for rigidity and retention of the second middle fire resistant barrier layers **254** and the third outer intumescent layers **256** together and in conjunction with each other to form an exoskeleton layer E_x, as shown in **FIGS. 11 and 13** through **18** of the drawings, in order to further strengthen and tie together stiles **212** and **214** and rails **216** and **218**, respectively. Each of the metal L-shaped beads **268** are fastened at the inner and

outer ends **255** and **257** of the stiles **212**, **214** and rails **216**, **218** by brads **120***n* and staples **120***s*, respectively, as shown in **FIGS. 7 and 8**.

[**0083**] Center panel **220** has edges **261**, **263**, **265** and **267**. The center panel **220** is formed from a composite laminate structure **270**. The composite laminate structure **270** includes outer wood sections **272** and **276** and sandwiched there between is an interior center intumescent section **274**, as depicted in **FIGS. 19 and 20**. The interior center composite intumescent section **274** includes a first outer intumescent layer **278**, a second inner fire resistant barrier intumescent layer **280**, a third middle intumescent layer **282**, a fourth middle intumescent layer **284**, a fifth inner fire resistant barrier layer **286**, and a sixth outer intumescent layer **288**. The first outer, third middle, fourth middle, and sixth outer intumescent layers **278**, **282**, **284**, and **288** are made of the PALUSOL™ P-210 product, as previously described. The second and fifth inner fire resistant barrier layers **280** and **286**, are made of the FYRE ROC™ fire resistant barrier intumescent laminate sheet, as previously described. The aforementioned outer wood sections **272**, **276** and the intumescent and fire resistant barrier layers **278**, **280**, **282**, **284**, **286** and **288** are laminated together under pressure P using an adhesive system consisting of a Simpson ISR 70-07 isocyante adhesive A or an equivalent adhesive in order to form the laminated center panel **220**.

[**0084**] Tongue and groove joints **290** and **292** are used to connect center panel **220** to stiles **212** or **214**, respectively, and tongue and groove joints **294** and **296** are used to connect center panel **220** to rails **216** or **218**, respectively, as depicted in FIGS. **19** to **21** of the drawings. Tongue and groove joints **298** and **300** are used to connect rails **216** or **218** to stiles **212** or **214**, respectively, as shown in **FIG. 10A** of the drawings. As shown in **FIG. 19**, the tongue and groove joints **290** and **292** include air gaps **302** and **304** for expansion of the intumescent material layers **278**, **282**, **284** and **288** in the presence of excessive heat and/or fire, such that the intumescent material layers **278**, **282**, **284** and **288** close and seal the air gaps **304** within the fire retardant panel door **210** in order to prevent the spread of excessive heat and/or fire through the fire retardant panel door **210** and door frame **230**. Further, the tongue and groove joints **294** and **296**, as depicted in **FIG. 20**, also include air gaps **308** for expansion of the intumescent material layers **278**, **282**,**284** and **288** in the presence of excessive heat and/or fire, such that the intumescent material layers **278**, **282**, **284** and **288** close and seal the air gaps **308** within the fire retardant panel door **210** in order to prevent the spread of excessive heat and/or fire through the fire retardant panel door **210** and door frame **230**. Additionally, the tongue and groove joints **298** and **300**, as shown in **FIGS. 12 and 13**, include air gaps **312** for expansion of the intumescent end layers **258** and **260** in the presence of excessive heat and/or fire, such that the intumescent end layers **258** and **260** close and seal the air gaps **312** within the fire retardant panel door **210** in order to prevent the spread of excessive heat and/or fire through the fire retardant panel **210** and door frame **230**. Also, the tongue and groove joints **290** and **292** and **294** and **296**, are attached to each other using a staple **120***s* or nail **120***n*, respectfully, as shown in **FIGS. 19 and 20** of the drawings. Further, each of the rails **216** and **218** and stiles **212** and **214** include a dowel groove **322**, **323**, **324** and **325**, respectfully, for receiving a wooden dowel **326** therein, for additionally joining together the rails **216** and **218** to the stiles **212** and **214**, respectfully, as shown in **FIGS. 14 and 15** of the drawings. The dowels **326** are held in place within dowel grooves **322**, **323**, **324** and **325** with appropriate wood glue G, as depicted in **FIGS. 14 and 15**.

[**0085**] As shown in **FIGS. 13 through 18** and **23**, the jambs **232** and **234**, and upper head **236** of door frame **230** include a core section **340** formed of wood materials, such as oak, maple, walnut, pine, poplar and the like. Wood applique **342** (i.e., oak, maple, walnut, etc.) is applied to a composite intumescent and/ layer section **350** which surrounds the solid wood core section **340**. The composite intumescent layer section **350**A includes a first inner intumescent layer **352** being adjacent to and in contact with the solid wood core section **340**, a second middle intumescent layer **354** being adjacent to and in contact with the first inner intumescent layer **352**, and a third outer intumescent layer **356** being adjacent to and in contact with the second middle intumescent layer **354** and a wood applique (veneer) **342** being adjacent and in contact with the third outer intumescent layer **356**. The composite intumescent and fire resistant barrier layer section **350**B includes a first inner intumescent layer **352** being adjacent to and in contact with the solid wood core section **340**, a second middle fire resistant barrier layer **354** being adjacent to and in contact with the first inner intumescent layer **352**, a wood applique (veneer) **342** being adjacent to and in contact with the second middle fire resistant barrier layer **354**. The composite intumescent layer section **350**C includes a first inner intumescent layer **352** being adjacent to and in contact with the solid wood core section **340**, a second middle intumescent layer **358** being adjacent to and in contact with the first inner intumescent layer **352**, and a wood applique (veneer) **342** being adjacent to and in contact with the second middle intumescent layer **358**. The composite intumescent layer section **350**D includes a first inner intumescent layer **352** being adjacent to and in contact with the solid wood core section **340**, a second middle intumescent layer **358** being adjacent to and in contact with the first inner intumescent layer **352**, and a wood applique (veneer) **342** being adjacent to and in contact with the second middle intumescent layer **358**. The inner and outer intumescent layer **352** and **358** are made of PALUSOL P-210™ product being manufactured by the BASF Corporation of the USA. PALUSOL P-210™ is an intumescent panel consisting essentially of a core having sodium silicate, and a small portion of organic binder reinforced by glass fibers and wire mesh. A coating of epoxy resin is applied to each side of the core which protects the intumescent panel from atmospheric influences of carbon dioxide, water, and/ or steam. The mass per unit area of the intumescent laminate (panel) layer **352** or **358** is in the range of 0.46 to 0.77 pounds per foot^2. The thickness of the intumescent laminate layer **352** or **356** is in the range 0.0590 inches to 0.906 inches. The second middle fire resistant barrier layer **354** is made of a FYRE ROC™ product being manufactured by the Goodrich Corporation, Engineered Polymer Products Division, of Jacksonville, Fla., U.S.A. The FYRE ROC™ panel is a laminate sheet consisting of a fire resistant metallo silicate and stainless steel screen for forming a reinforced composite laminate sheet that has the ability to maintain excellent mechanical and physical properties at elevated temperatures up to 2000 degrees Fahrenheit, without significant smoke or toxicity emissions. The density of the fire resistant barrier laminate (sheet) layer **354** is 2.5±0.5 grams per cubic centimeter. The thickness of the laminate intumes-

cent layer **354** is in the range of 0.020 to 0.050 inches (due to reinforcement thickness variability). The third outer intumescent layer **356** of the composite layer section **350**A is made of a TECHNOFIRE 2000™ product manufactured by the TECHNICAL FIBRE PRODUCTS SUBSIDIARY in Newburgh, N.Y., U.S.A. The TECHNOFIRE 2000™ rigid sheet panel is a composite laminate sheet consisting of a core having rockwool fibers with chopped strand glass fibre reinforcement and a small portion of organic binder. A coating of epoxy resin is applied to each side of the core which protects the composite intumescent panel atmospheric influences of carbon dioxide, water and/or steam. The density of the composite intumescent laminate sheet layer **356** is in the range of 78.0 to 90.5 lbs/ft^3. The mass per unit area of the intumescent laminate layer **356** is in the range of 0.333 to 0.386 pounds per foot^2. The intumescent laminate layer **356** has a maximum thickness of 1.3 mm (0.0512 inches). The intumescent laminate layer **356** upon exposure to heat and/or fire has an expansion ratio of 22 to 1 for importing linear gap seals between the fire retardant panel door **210** and door frame **230** in order to prevent the spread of excessive heat and/or fire through the fire retardant panel door **210** and door frame **230**. Wood molding **344** is applied to the exterior surface of the upper header **236**, as shown in **FIGS. 8 and 9** of the drawings. The aforementioned wood applique **342**, the composite layer sections **350**A, **350**B, **350**C and **350**D, and the solid wood core section **340** are laminated together under pressure P using an dual adhesive system consisting of a Simpson ISR 70-07 isocyanate adhesive A or an equivalent adhesive in order to form the jambs **232**, **234** and the upper header **236** of door frame **230**, as depicted in **FIG. 23**.

[**0086**] The composite layer sections **350**A, **350**B, **350**C and **350**D of the jambs **232** and **234** and upper header **236** expand in the presence of excessive heat and/or fire, such that the intumescent and fire resistant barrier material layer sections **350**A, **350**B, **350**C and **350**D closes and seals the perimeter of the fire retardant panel door **210** within the jambs **232** and **234** and upper header **236** of the door frame **230** to also prevent the spread of the excessive heat and/or fire through the fire retardant panel door **210** and door frame **230**.

[**0087**] Additionally, as shown in **FIGS. 11, 13** through **18**, the jambs **232** and **234** further include a pair of metal L-shaped beads **368** made from 6 gauge galvanized steel being positioned at the corners **369***a* to **369***d* of jambs **232** and **234**, respectively. The metal L-shaped beads **368** each include a first end section **368***f* and a second end section **368***s*. Each of the second end sections **368***s* of metal L-shaped beads **368** are further positioned and placed between the second middle fire resistant barrier layer **356** and the third outer intumescent layer **356**, as shown in **FIGS. 11 and 13** through **18** of the drawings. Each of the first end sections **368***f* of metal L-shaped beads **368** are further positioned in contact with and adjacent to the second middle intumescent layer **358** and the wood applique (veneer) **342** of composite layer end sections **350**C and **350**D of jambs **232** and **234**, respectively. The aforementioned metal L-shaped beads **368** are used for rigidity and retention of the second middle fire resistant barrier layer **354** and the third outer intumescent layer **356** together and in conjunction with each other to form a partial exoskeleton layer Epx, as shown in **FIGS. 11 and 13** through **18** of the drawings, in order to further strengthened jambs **232** and **234**, respectively. Each of the metal L-shaped beads **368** are fastened to the composite end sections **350**C and **350**D of jambs **232** and **234**, respectively, by brads **120***n* or staples **120***s*, as shown in **FIGS. 13, 14** and **23**.

[**0088**] The fire retardant panel door **210** and door frame section **230**A of door frame **230** of the second embodiment of the present invention further includes a standard mechanical flush or dead bolt assembly **370**, as shown in **FIGS. 12 and 12**A, for securing and holding a first free corner C_{F1} of the fire retardant panel door **21** in place while the intumescent layers of the stiles **212**, **214** and rails **16**, **18** react from excessive heat and/or fire. The flush or dead bolt assembly **370** is positioned within stile **214** as shown in **FIGS. 12 and 12**A of the drawings. The dead bolt assembly **370** includes a housing member **372** for receiving a dead bolt **374**. Dead bolt **374** is received within a dead bolt receiving member **376** positioned within the upper header **236** of the door frame section **230**A. The aforementioned dead bolt assembly **370** presents any movement or buckling of the first free corner C_{F1} of the fire retardant panel door **210** relative to the door frame section **230**A of door frame **230**.

[**0089**] Fire retardant panel door **410** includes stiles **412** and **414**, rails **416** and **418**, an upper panel **420**, a lower panel **422**, a first raised panel **423**, and a second raised panel **424**, as shown in **FIGS. 11 and 13** through **18** of the drawings. The fire retardant panel door **410** also includes a first mullion **426** separating the upper panel **420** from the lower panel **422**, a second mullion **427** separating the lower panel **422** from the first raised panel **423**, and a third mullion **428** separating the first raised panel **423** from the second raised panel **424**. The fire retardant panel door **410** is hingedly connected to the other section **230**B of the door frame **430**, as depicted in **FIG. 11**, such that the panel door **410** is hingedly connected to the right door jamb **234** and positioned below a section **230**B of the upper header **236**, as depicted in **FIGS. 11 and 12** of the drawings.

[**0090**] As shown in **FIGS. 11, 12** and **19** through **21**, the stiles **412** and **414**, rails **416** and **418**, and mullions **426**, **427**, and **428** have a solid core section **440** formed of a yellow poplar microllam wood material, and the like. Wood applique **442** (i.e., oak, maple, walnut, etc.) is applied to a composite intumescent and fire resistant layer section **450** which partially surrounds the solid wood core section **440** on sides **451** and **453**, respectively. The composite intumescent and fire resistant layer section **450** includes a first inner intumescent layer **452** being adjacent to and in contact with the solid wood core section **440**, a second middle fire resistant barrier layer **454** being adjacent to and in contact with the first inner intumescent layer **452**, and a third outer intumescent layer **456** to being adjacent and in contact with the second middle fire resistant barrier layer **454**. The inner and outer intumescent layers **452** and **456** of sides **451** and **453** are made of PALUSOL P-210™ product being manufactured by the BASF Corporation of the USA. PALUSOL P-210™ is an intumescent panel consisting essentially of a core having sodium silicate, and a small portion of organic binder reinforced by glass fibers and wire mesh. A coating of epoxy resin is applied to each side of the core which protects the intumescent panel from atmospheric influences of carbon dioxide, water, and/or steam. The mass per unit area of the intumescent laminate (panel) layers **452** or **456** is in the range of 0.46 to 0.77 pounds per foot^2. The thickness of the intumescent laminate layers **452** or **456** is in

the range 0.0590 inches to 0.0906 inches. The second middle fire resistant barrier layer **454** is made of a FYRE ROC™ (FR-1001) product being manufactured by the Goodrich Corporation, Engineered Polymer Products Division, of Jacksonville, Fla., U.S.A. The FYRE ROC™ panel is a laminate sheet consisting of a fire resistant metallo alumino silicate and stainless steel screen reinforced composite laminate sheet that has the ability to maintain excellent mechanical and physical properties at elevated temperatures up to 2000 degrees Fahrenheit, without significant smoke or toxicity emissions. The density of the laminate fire resistant barrier (sheet) layer **454** is 2.5±0.5 grams per cubic centimeter. The thickness of the laminate first resistant barrier layer **454** is in the range of 0.020 to 0.050 inches (due to reinforcement thickness variability).

[**0091**] The wood applique **442** is adjacent to and in contact with the third outer intumescent layer **456**. Wood molding **444** is applied to the exterior surface of stiles **412** and **414**, rails **416** and **418**, mullions **426**, **427**, and **428**, and panels **420**, **422**, **423**, and **424**, as shown in **FIGS. 8 and 9** of the drawings. The aforementioned wood applique **442**, intumescent layers **452**, **454**, and **456**, and the solid wood core section **440** are laminated together under pressure P using an adhesive system A consisting of a Simpson ISR 70-07 isocyanate adhesive A or an equivalent adhesive in order to form the laminated stiles **412** and **414**, rails **416** and **418**, and mullions **426**, **427**, and **428**, respectively, as depicted in **FIGS. 19 and 20**.

[**0092**] As shown in **FIGS. 11, 13**, through **18**, the stiles **412** and **414** rails **416** and **418** and mullions **426**, **427** and **428** also include inner and outer ends **455** and **457**, respectively. The inner end **455** includes a first inner intumescent end layer **458** being adjacent to and in contact with the solid wood core section **440**, and a second middle intumescent end layer **460** being adjacent to and in contact with the first inner intumescent layer **458**. The first and second intumescent end layers **458** and **460** of inner end **455** are made of the PALUSOL™ P-210 product as previously described. The outer end **457** includes a first inner intumescent end layer **462** being adjacent to and in contact with the solid wood core section **440**, a second middle intumescent end layer **464** being adjacent to and in contact with the first inner intumescent end layer **462**, a third outer intumescent end layer **466** being adjacent to and in contact with the second middle intumescent end layer **464** and the wood applique (veneer) **442** being adjacent to and in contact with the third outer intumescent end layer **466**. The first inner intumescent end layer **462** is made of the PALUSOL™ P-210 product as previously described. The second and third intumescent end layers **464** and **466** are made of a TECHNOFIRE 2000™ product manufactured by the TECHNICAL FIBRE PRODUCTS SUBSIDIARY in Newburgh, N.Y., U.S.A. The TECHNOFIRE 2000™ rigid sheet panel is a composite laminate sheet consisting of a core having rockwool fibers with chopped strand glass fibre reinforcement and a small portion of organic binder. A coating of epoxy resin is applied to each side of the core which protect the composite intumescent panel from atmospheric influences of carbon dioxide, water and/or steam. The density of the composite intumescent laminate sheet end layers **464** or **466** is in the range of 78.0 to 90.5 5 lbs/ft^3 (1250 to 1450 kg/m^3). The intumescent laminate end layers **464** or **466** has a maximum thickness of 1.3 mm (0.0512 inches). The mass per unit area of the intumescent laminate end layers **464** or **466** is in the range of 0.333 to 0.386 pounds per foot^2. The intumescent laminate end layers **464** or **466** upon exposure to heat and/or fire has expansion ratio of 22:1 for imparting linear gap seals between the fire retardant panel door **10** and door frame **30** in order to prevent the spread of excessive heat and/or fire through the fire retardant panel door **410** and door frame section **230**B of door frame **230**.

[**0093**] Additionally, as shown in **FIGS. 11, 13** through **18**, the stiles **412** and **414** and rails **416** and **418** further include a plurability of metal L-shaped beads **468** made from 16 gauge galvanized steel being positioned at the corners **469***a*, **469***b*, **469***c* and **469***d* of the stiles **412** and **414**, and rails **416** and **418**. The metal L-shaped beads **468** each include a first end section **468***f* and a second end section **468***s*. Each of the second end sections **468***s* of metal L-shaped beads **468** are further positioned and placed between the second middle fire resistant barrier layer **454** and the third outer intumescent layer **456**, as shown in **FIGS. 11, 13** through **18** of the drawings. One pair of the first end sections **468***f* at the inner end **455** are further positioned and placed in contact with and adjacent to the second middle end layer **460**. The other pair of the first end sections **468***f* at the outer end **457** are further positioned and placed between the first inner intumescent end layer **462** and the second middle intumescent end layer **464**. The aforementioned metal L-shaped beads **468** are used for rigidity and retention of the second middle fire resistant barrier layers **454** and the third outer intumescent layers **456** together and in conjunction with each other to form an exoskeleton layer E_x, as shown in **FIGS. 11, 13** through **18** of the drawings, in order to further strengthen stiles **412** and **414** and rails **416** and **418**, respectively. Each of the metal L-shaped beads **68** are fastened at the inner and outer ends **455** and **457** of the stiles **412**, **414** and rails **416**, **418** by brads **120***n* and staples **120***s*, respectively, as shown in **FIGS. 7 and 8**.

[**0094**] Upper panel **420** has edges **461**, **463**, **465** and **467**, and the lower panel has edges **563**, **565**, **567**, and **569**. The panels **420**, **422**, **423**, and **424** are formed from a composite laminate structure **470**, as shown in FIGS. **13** to **18** and **21** of the drawings. The composite laminate structure **470** includes outer wood sections **472** and **476** and an interior center intumescent section **474** sandwiched therebetween. The interior center intumescent section **474** includes a first outer intumescent layer **478**, a second inner fire resistant barrier layer **480**, a third middle intumescent layer **482**, a fourth middle intumescent layer **484** a fifth inner fire resistant barrier layer **486**, and a sixth outer intumescent layer **488**. The first outer, third middle, fourth middle, and sixth outer intumescent layers **478**, **482**, **484**, and **488** are made of the PALUSOL™ P-210 product as previously described. The second and fifth fire resistant barrier layers **480** and **486** are made of the FYRE ROC™ fire resistant barrier laminate sheet, as previously described. The aforementioned outer wood sections **472**, **476** and the intumescent and fire resistant barrier layer **478**, **480**, **482**, **484**, **486** and **488** are laminated together under pressure P using an adhesive system consisting of a Simpson ISR 70-07 isocyanate adhesive A or an equivalent adhesive in order to form the laminated panels **428**, **422**, **423**, and **424**, respectively, as shown in **FIGS. 19, 20**, and **22** of the drawings.

[**0095**] Tongue and groove joints **490** and **492** are used to connect upper panel **420** to stiles **412** or **414**, respectively, and tongue and groove joints **494** and **496** are used to

connect upper panel **420** to rail **416**, as depicted in **FIGS. 12 and 20** of the drawings. Tongue and groove joints **498** and **500** are used to connect rails **416** or **418** to stiles **412** or **414**, respectively, as shown in **FIG. 14** of the drawings. Additionally, tongue and groove joints **514** and **516** are used to connect the first mullion **426** to stiles **412** or **414**, as well as the first mullion **426** to upper panel **420**, as depicted in **FIG. 15**. As shown in **FIGS. 13, 19** and **19**B the tongue and groove joints **490** and **492** include air gaps **504** for expansion of the intumescent material layers **478**, **482**, **484**, and **488** in the presence of excessive heat and/or fire, such that the intumescent material layers **478**, **482**, **484**, and **488** close and seal the air gaps **504** within the fire retardant panel door **410** in order to prevent the spread of excessive heat and/or fire through the fire retardant panel door **410** and door frame **430**. Further, the tongue and groove joints **494** and **496**, as shown in **FIGS. 14, 20A**, **20**B and **20**C also include air gaps **508** for expansion of the intumescent material layers **478**, **482**, **484**, and **488** in the presence of excessive heat and/or fire, such that the intumescent material layers **478**, **482**, **484**, and **488** close and seal the air gaps **508** within the fire retardant panel door **410** in order to prevent the spread of excessive heat and/or fire through the fire retardant panel door **410** and door frame **230**. Also, the tongue and groove joints **514** and **516** include air gaps **520** for expansion of the intumescent material layers **478**, **482**, **484**, and **488** in the presence of excessive heat and/or fire, such that the intumescent material layers **478**, **482**, **484**, and **488** close and seal the air gaps **520** within the fire retardant panel door **410** in order to prevent the spread of excessive heat and/or fire through the fire retardant panel door **410** and door frame **230**. Additionally, the tongue and groove joints **498** and **500** as shown in **FIGS. 12 and 13** include air gaps **512** for expansion of the intumescent end layers **458** and **460** in the presence of excessive heat and/or fire, such that the intumescent end layers **458** and **460** close and seal the air gaps **512** within the fire retardant panel door **410** in order to prevent the spread of excessive heat and/or fire through the fire retardant panel **410** and door frame **230**. Also, the tongue and groove joints **490** and **492**, **494** and **496**, and **514** and **516** are attached to each other using a staple **120***s* or nail **120***n*, respectively, as shown in **FIGS. 11, 20**, and **21** of the drawings. Further, each of the rails **416** and **418**, and stiles **412** and **414** include a dowel groove **522**, **523**, **524** and **525**, respectfully, for receiving the wooden dowel **326**. Therein, for additionally joining together the rails **416** and **418** to the stiles **412** and **414**, respectfully, as shown in **FIGS. 14 and 15**. The dowels **526** are held in place within dowel grooves **522**, **523**, **524** and **525** with appropriate wood glue G, as shown in **FIGS. 14 and 15**.

[**0096**] The fire retardant panel door **410** and door frame **230** of the second embodiment 200 of the present invention further includes a heat activated door pin assembly **570**, as shown in **FIGS. 12, 12B**, **12**C and **12**D, for securing and holding a second free corner C_{F2} of the fire retardant panel door **410** in place (to present buckling of free corner C_{F2}) while the intumescent layers of the stiles **412**, **414** and rails **416**, **418** react from excessive heat and/or fire. The heat activated door pin assembly **570** includes a substantially cylindrically-shaped housing member **572** having a pin opening **574** for receiving a movable and hollow door pin **580** therein. The housing member **572** further includes a curved outer wall **576** and a bottom wall **577** for forming an interior compartment **578**. The hollow pin **580** includes an internal compressible spring **582** coiled about a threaded rod **584**. The compressible spring **582** includes a first lower end **582***f* and a second upper end **582***s*. Threaded rod **584** includes a proximal end **584***p* and a distal end **584***d*. The proximal end **584***p* of threaded rod **584** is connected to the first lower end **582***f* of compressible spring **582** and is held in place by washer **586** and hex nut **588**. The distal end **584***d* of threaded rod **584** includes a fusible solder link **590**. The fusible solder link **590** melts at 117° F. allowing the internal compressible spring **582** to eject the movable door bolt pin **580** withing a strike plate opening **592** of a strike plate **594**, such that the movable door bolt pin **580** resides within an upper header bolt opening **236***h* of upper header **236**. The strike plate **594** also includes mounting openings **595** for receiving mounting screws **596** therein for attaching the strike plate **594** to the upper header **236**, as shown in **FIGS. 12B and 12C** of the drawings. Further, the bottom wall **577** of interior compartment **578** of the housing member **572** includes a pair of circular intumescent pads **598***a* and **598***b*. The intumescent pads **598***a* and **598***b* upon exposure to excessive heat and/or fire expands rapidly (23 times the original thickness) and locks the movable door bolt pin **580** permanently within the upper header bolt opening **236***h*. Thus, preventing any movement or buckling of the second free corner C_{F2} of the fire retardant panel door **410** relative to the door frame **230**. Intumescent pads **598***a* and **598***b* are made form TECHNOFIRE 2000™ composite laminate sheets as previously described in the above preferred embodiment. Housing member **572** is made of copper metal and the movable hollow door bolt pin **580** is made of brass metal.

[**0097**] It is understood that the heat activated door pin assembly **570'** and **570"** can also be positioned at other locations, such as along the vertical axis of stile **412**, as shown in **FIG. 12**. In this manner, when the heat activated door pin assemblies (**570'** and **570"**) react to excessive heat and/or fire, they cause the door panels **210** and **410** to lock together to prevent any movement or buckling of the door panels **210** and **410** relative to the door frame **230**.

[**0098**] The fire retardant panel door **410** and door frame **230** of the second embodiment 200 of the present invention also includes a heat activated door hook or door latch assembly **610**, as shown in **FIGS. 12, 12E**, **12**F, **12**G, **12**H, **12**I and **12**J for securing and holding a second free corner C_{F2} of the fire retardant panel door **410** in place (to prevent buckling of the free corner C_{F2}) while the intumescent layers of the stiles **412**, **414** and rails **416**, **418** react from excessive heat and/or fire. The heat activated door hook assembly **610** includes a substantially rectangular-shaped housing member **612** having a top wall **614** in the form of a strike plate, a bottom wall **616**, a front wall **618**, a rear wall **620**, a left side wall **622**, a right side wall **624** for forming an interior compartment **626**. Strike plate **614** includes a hook/latch opening **628** for receiving a movable door hook or door latch member **630** therethrough. Strike plate **614** further includes opposing ends **632***a* and **632***b* having mounting openings **634***a* and **634***b* therethrough for receiving mounting screws **636** therein. The strike plate **614** also includes a solder link opening **638** for receiving a fusible solder link **640** therethrough. The front and rear walls **618** and **620** include shaft openings **642** and **644** therethrough for receiving a shaft member **646** therein. The bottom wall **616** includes a rectangular opening **648** for accessing the door hook member **630**. The door hook member **630** includes a hook or latch

section **650**, a shaft hook opening **645** for receiving the shaft member **646** therethrough, a round end section **652**, a front wall **654** and a rear wall **656**. The door hook member **630** further includes an internal compressible spring **658** having a first spring end **660** and a second spring end **662** being integrally attached to the front wall **654** of the hook member **630** and adjacent to the shaft hook opening **652**, as depicted in **FIGS. 12D and 12E** of the drawings. The fusible solder link **640** includes a first solder link end **664** and a second solder link end **666**. Side wall **624** includes a pin opening **668** for receiving the first spring end **660** therethrough in order to hold the compressible spring **658** in place on side wall **624**, as shown in **FIG. 12D**. The hook member **630**, the attached compressible spring **658** and the fixed shaft member **646** are all positioned within the interior compartment **626** of the housing member **612**. The first solder link end **664** of the fusible solder link **640** is detachably connected to the solder link opening **638** and the second solder link end **666** of the fusible solder link **640** is connected to the second spring end **662** of compressible spring **658** such that the heat activated door hook assembly **610** is an unexpanded configuration and tensioned state C_1, as shown in **FIG. 12D**, and is readied for activation by heat or fire. In an alternate design configuration, the second solder link end **666** of the fusible solder link **640** is connected to the front wall **654** of the round end section **652** of door hook member **630** such that the heat activated door hook assembly **610** is also in the tensioned state C_1. The fusible solder link **640** melts at 117° F. allowing the second spring end **662** of compressible spring **658** to rotatably move in a clockwise motion R_{C_2} such that the hook section **650** of the door hook member **630** is then moved to an untensioned state C_2. The shaft hook opening **652** of the door hook member **630** pivots on the fixed shaft member **646**, where then the hook section **650** rotatably moves within an upper strike plate opening **672** of an upper strike plate **670**. The upper strike plate **670** includes mounting openings **674***a* and **674***b* for receiving mounting screws **636** therethrough for attaching permanently to the upper strike plate **670** to the upper header **236**, as shown in **FIGS. 12D and 12E** of the drawings. The housing member **612** is made from brass or copper materials.

OPERATION OF THE PRESENT INVENTION

[0099] In operation, when fire or excessive heat occurs, the intumescent materials expand and provide closing and sealing of all the tongue and groove joints within panel doors **10**, **210**, and **410**, respectively, of the first and second embodiments. This includes also the closing and sealing of the panels, stiles, rails, and/or mullions, as well as perimeter edges of the fire retardant panel doors **10**, **210**, and **410** within the door frames **30** and **230**, respectively, thus preventing the spread of the fire through the fire retardant panel door **10**, **210**, and **410** and door frames **30** and **230**, respectively.

[0100] The fire retardant panel doors **10**, **210**, and **410** and the door frames **30** and **230**, respectively, of this invention have undergone special testing by I.T.S. Warnock Hersey Laboratory for fire resistance and have passed the fire burn test known as ANSI/U.L. 10B1978 including the hose stream test. By passing this fire burn test, the doors **10**, **210**, and **410** and the door frames **30** and **230**, respectively, can be specified by architects for many building uses where metal doors and wood flush doors would have been previously used.

[0101] The I.T.S. test under ANSI/U.L. 10B1978 includes the following steps:

[0102] 1. The door structure to be tested is placed within a brick retaining wall.

[0103] 2. One side of the door is subjected to an intense fire on a time temperature curve from 0 to 90 minutes and room temperature to 1,462° F. temperature. More specifically, the time-temperature is as follows:

Start: Room temperature
5 minutes: 1000° F.
10 minutes: 1300° F.
20 minutes: 1462° F.
30 minutes: 1550° F.
40 minutes: 1620° F.
50 minutes: 1650° F.
60 minutes: 1700° F.
70 minutes: 1750° F.
80 minutes: 1785° F.
90 minutes: 1785° F.

[0104] 3. Immediately after the 90 minute burn period, the burned side of the door is subjected to a hose stream test from: a) a 2½ inch water supply hose; b) discharged through a tapered nozzle with a one (1) inch outlet opening; c) regulated to a 30 PSI discharge pressure; d) applied a distance of 20 feet from the door structure; and e) the time period of application of the water stream against the middle and all exposed parts of the door structure is controlled at a rate of 1.5 seconds per square foot.

[0105] The door being tested passes this testing procedure if no door panel or door members are disengaged from the supporting door frame assembly and if no openings are created.

[0106] In summary, the fire retardant panel doors **10**, **210**, and **410** and the door frames **30** and **230**, respectively, of the present invention have passed a ninety (90) minute burn test performed by a I.T.S. testing laboratory to obtain and meet the fire resistant specification known as the ANSI/U.L. 10B fire burn test for doors.

ADVANTAGES OF THE PRESENT INVENTION

[0107] Accordingly, it is an advantage of the present invention that it provides a reinforced fire retardant panel door and door frame that prevents buckling of the door during a fire.

[0108] Another advantage of the present invention is that it provides for a reinforced fire retardant panel door and door frame that has supplemental fire resistant materials strategically embedded and placed within the tongue and groove joints of the fire resistant panel door, as well as supplemental fire resistant materials placed on the perimeter edges of the fire resistant panel door for preventing the spread of fire through the door and door frame

[0109] Another advantage of the present invention is that is provides for a reinforced fire retardant panel door and door frame that has intumescent and fire resistant material layers within the panel door and door frame for preventing the spread of fire through the door and door frame.

[0110] Another advantage of the present invention is that it provides for a reinforced fire retardant panel door and door frame that has fire resistant materials being multiple layers of intumescent material that expands in the presence of fire such that the intumescent material closes and seals the component tongue and groove joints, as well as the perimeter edges of the fire retardant panel door for preventing the spread of fire through the door and door frame.

[0111] Another advantage of the present invention is that it provides for a reinforced fire retardant panel door and door frame that is used as part of an interior or exterior personal living space, or workspace being installed within home dwellings, commercial buildings or industrial plants.

[0112] Another advantage of the present invention is that it provides for a reinforced fire retardant panel door and door frame that has stiles and rails having metal L-shaped beads therein in order to form an exoskeleton for further strengthening and tying together the stiles and rails within the panel door in order to keep the panel door from buckling during a fire.

[0113] Another advantage of the present invention is that it provides for a reinforced panel door and door frame that has improved aesthetic qualities by having a maxium panel core thickness of ⅜ of an inch allowing for a minimum thickness of 1¾ inches of the fire resistant and reinforced panel door which allows for greater profiling (depth) of the exterior wood molding between the center panel and the stiles and rails.

[0114] Another advantage of the present invention is that it provides for a reinforced panel door and door frame that includes a heat activated door pin or door hook assembly for preventing the active (free) panel door from buckling during a fire.

[0115] Another advantage of the present invention is that it provides for a reinforced fire retardant panel door and door frame that is aesthetically pleasing having the appearance of natural wood, and has achieved a successful fire rating of at least 90 minutes and passes a positive pressure test, and is easily installed in a building.

[0116] A further advantage of the present invention is that it provides for a reinforced fire retardant panel door and door frame that can be mass produced in an automated and economical matter and is readily affordable to the builder or consumer.

[0117] A latitude of modification, change, and substitution is intended in the foregoing disclosure, and in some instances, some features of the invention will be employed without a corresponding use of other features. Accordingly, it is appropriate that the appended claims be construed broadly and in a manner consistent with the spirit and scope of the invention herein.

What is claimed is:

1. A fire retardant panel door, comprising:

a) a panel door having at least one door panel and stiles and rails;

b) said door panel including an interior composite section formed by a first plurality of layers of intumescent materials and a first plurality of layers of fire resistant materials disposed between and laminated to a pair of outer sections formed of wood for enclosing said interior composite section to form a composite laminated door panel;

c) each of said stiles including a first core formed of wood enclosed by a second plurality of layers of intumescent materials and a second plurality of layers of fire resistant materials; said second layers of intumescent and fire resistant materials enclosed by a first layer formed of wood to form a composite laminated stile;

d) each of said rails including a second core formed of wood enclosed by a third plurality of layers of intumescent materials and a third plurality of layers of fire resistant materials; said third layers of intumescent and fire resistant materials enclosed by a second layer formed of wood to form a composite laminated rail;

e) said first, second, and third plurality of layers of intumescent materials being activated to expand upon exposure to heat and/or fire to prevent the heat and/or fire from passing through said at least one door panel, said stiles and said rails of said panel door during a fire for at least 90 minutes; and

f) said at least one door panel being connected to said panel door by joints; and said joints having a fourth plurality of layers of intumescent materials and a fourth plurality of layers of fire resistant materials; wherein said fourth plurality of layers of intumescent materials in said joints being activated to expand upon exposure to heat and/or fire to seal said joints in order to prevent the heat and/or fire from passing through said panel door during a fire for at least 90 minutes.

2. A fire retardant panel door in accordance with claim 1, wherein said first plurality of layers of intumescent materials includes four intumescent layers and said first plurality of layers of fire resistant materials includes two fire resistant barrier layers for forming said interior composite section of said at least one door panel.

3. A fire retardant panel door in accordance with claim 2, wherein at least one of said four intumescent layers includes sodium silicate; and wherein at least one of said two fire resistant barrier layers includes a fire resistant metallo alumino silicate resin of said interior composite section.

4. A fire retardant panel door in accordance with claim 1, wherein said second plurality of layers of intumescent materials includes at least two intumescent layers and said second plurality of layers of fire resistant materials includes two fire resistant barrier layers for forming a first composite of said two intumescent layers and said two fire resistant barrier layers within said composite laminated stile.

5. A fire retardant panel door in accordance with claim 4, wherein at least one of said at least two intumescent layers includes sodium silicate and wherein at least one of said at least two intumescent layers includes rockwool silicates; and wherein at least one of said two fire resistant barrier layers includes a fire resistant metallo alumino silicate resin of said composite laminated stile.

6. A fire retardant panel door in accordance with claim 1, wherein said third plurality of layers of intumescent materials includes at least two intumescent layers and said third plurality of layers of fire resistant materials includes two fire resistant barrier layers for forming a second composite of said two intumescent layers and said two fire resistant barrier layers within said composite laminated rail.

7. A fire retardant panel door in accordance with claim 6, wherein at least one of said at least two intumescent layers includes sodium silicate and wherein at least one of said at least two intumescent layers include rockwool silicates; and wherein at least one of said two fire resistant barrier layers includes a fire resistant metallo alumino silicate resin of said composite laminated rail.

8. A fire retardant panel door in accordance with claim 1, wherein said fourth plurality of layers of intumescent materials includes four intumescent layers and wherein said fourth plurality of layers of fire resistant materials includes two fire resistant barrier layers for forming a third composite of said four intumescent layers and said two fire resistant barrier layers within a tongue section of said joints of said door panel.

9. A fire retardant panel door in accordance with claim 8, wherein at least one of said four intumescent layers includes sodium silicate; and wherein at least one of said two fire resistant barrier layers includes a fire resistant metallo alumino silicate resin of said tongue section.

10. A fire retardant panel door in accordance with claim 1, wherein at least one layer of each of said first, second, third, and fourth plurality of layers of intumescent materials is made from a sodium silicate; wherein at least one layer of each of said second and third plurality of layers of intumescent materials is made from rockwool silicates; and wherein at least one layer of each of said first, second, third and fourth plurality of layers of fire resistant materials is made from a fire resistant metallo alumino silicate resin.

11. A fire retardant panel door in accordance with claim 1, wherein said wood of said pair of outer sections is selected from the group consisting of oak, maple, walnut, poplar, and pine.

12. A fire retardant panel door in accordance with claim 1, wherein said first plurality of layers of intumescent materials, said first plurality of layers of fire resistant materials, and said pair of outer sections of wood are laminated together using adhesive and pressure to form said composite laminated door panel.

13. A fire retardant panel door in accordance with claim 1, wherein said first wood core of said stile is a yellow poplar microllem wood material.

14. A fire retardant panel door in accordance with claim 1, wherein said first wood layer of said stile is selected from the group consisting of oak, maple, walnut, poplar and pine.

15. A fire retardant panel door in accordance with claim 13, wherein said first wood core, said second plurality of layers of intumescent materials, said second plurality of layers of fire resistant materials and said first wood layer are laminated together using adhesive and pressure to form said composite laminated stile.

16. A fire retardant panel door in accordance with claim 1, wherein said second wood core of said rail is a yellow poplar microllem wood material.

17. A fire retardant panel door in accordance with claim 1, wherein said second wood layer of said rail is selected from the group consisting of oak, maple, walnut, poplar and pine.

18. A fire retardant panel door in accordance with claim 17, wherein said second wood core, said third plurality of layers of intumescent materials, said third plurality of layers of fire resistant materials and said second wood layer are laminated together using adhesive and pressure to form said composite laminated rail.

19. A fire retardant panel door in accordance with claim 1, wherein said joints are tongue and groove joints.

20. A fire retardant panel door in accordance with claim 19, wherein said tongue and groove joints each include a tongue section and a groove section.

21. A fire retardant panel door in accordance with claim 20, wherein each of said tongue sections and groove sections are held together by attachment means.

22. A fire retardant panel door in accordance with claim 21, wherein said attachment means includes a staple and/or a nail through said tongue section and a groove section of said tongue and groove joints.

23. A fire retardant panel door in accordance with claim 1, wherein said panel door includes perimeter edging having said third and fourth plurality of layers of intumescent materials therein which expand upon exposure to heat and/or fire to seal said perimeter edging relative to a door frame in order to prevent the heat and/or fire from passing through said panel door and said door frame during a fire.

24. A fire retardant panel door in accordance with claim 1, wherein said at least one door panel includes one or more mullions for separating two or more door panels of said panel door.

25. A fire retardant panel door in accordance with claim 24, wherein each of said mullions includes a third core formed of wood enclosed by a fifth plurality of layers of intumescent materials; a fifth plurality of layers of fire resistant materials; said fifth layers of intumescent materials and said fifth layers of fire resistant materials being enclosed by a third layer formed of wood to form a composite laminated mullion.

26. A fire retardant panel door in accordance with claim 24, wherein said fifth plurality of layers of intumescent materials includes at least two intumescent layers and wherein said fifth plurality of layers of fire resistant materials includes two fire resistant barrier layers for forming a fourth composite of said two intumescent layers and said two fire resistant barrier layers within said composite laminated mullion.

27. A fire retardant panel door in accordance with claim 26, wherein at least one of said at least two intumescent layers includes sodium silicate and wherein at least one of said at least two intumescent layers include rockwool silicates; and wherein at least one of said two fire resistant barrier layers includes a fire resistant metallo alumino silicate resin of said composite laminated mullion.

28. A fire retardant panel door in accordance with claim 24, wherein said third wood core of said mullion is a yellow poplar microllom wood material.

29. A fire retardant panel door in accordance with claim 24, wherein said third wood layer of said mullion is selected from the group consisting of oak, maple, walnut, poplar and pine.

30. A fire retardant panel door in accordance with claim 24, wherein said third wood core, said fifth plurality of layers of intumescent materials, said fifth plurality of layers of fire resistant materials and said third wood layer are laminated together using adhesive and pressure to form said composite laminated mullion.

31. A fire retardant panel door in accordance with claim 23, wherein said door frame includes jambs and an upper header.

32. A fire retardant panel door in accordance with claim 31, wherein each of said jambs includes a fourth core formed

of wood enclosed by a sixth plurality of layers of intumescent materials and a sixth plurality of layers of fire resistant materials; said sixth layers of intumescent materials and said sixth plurality of layers of fire resistant materials are enclosed by a fourth layer formed of wood to form a composite laminated jamb.

33. A fire retardant panel door in accordance with claim 32, wherein said sixth plurality of layers of intumescent materials includes at least one intumescent layer and wherein said sixth plurality of layers of fire resistant material includes one fire resistant barrier layer for forming a fifth composite of said one intumescent layer and said one fire resistant barrier layer within said composite laminated jamb.

34. A fire retardant panel door in accordance with claim 33, wherein at least one of said intumescent layers includes sodium silicate; wherein at least one of said intumescent layers include rockwool silicates; and wherein said fire resistant barrier layer includes a fire resistant metallo alumino silicate resin.

35. A fire retardant panel door in accordance with claim 32, wherein said fourth wood core of said jamb is selected from the group consisting of oak, maple, walnut, poplar and pine.

36. A fire retardant panel door in accordance with claim 32, wherein said fourth wood layer of said jamb is selected from the group consisting of oak, maple, walnut, poplar and pine.

37. A fire retardant panel door in accordance with claim 32, wherein said fourth wood core, said sixth plurality of layers of intumescent materials, said sixth plurality of layers of fire resistant materials and said fourth wood layer are laminated together using adhesive and pressure to form said composite laminated jamb.

38. A fire retardant panel door in accordance with claim 31, wherein said upper header includes a fifth core formed of wood enclosed by a seventh plurality of layers of intumescent materials and a seventh plurality of layers of fire resistant materials; said seventh layers of intumescent materials and said seventh plurality of layers of fire resistant materials are enclosed by a fifth layer formed of wood to form a composite laminated upper header on said door frame.

39. A fire retardant panel door in accordance with claim 38, wherein said seventh plurality of layers of intumescent materials includes two intumescent layers and wherein said seventh plurality of layers of fire resistant materials includes at least one layer of fire resistant barrier layer for forming a sixth composite of said two intumescent layers and said one fire resistant barrier layer within said composite laminated upper header.

40. A fire retardant panel door in accordance with claim 39, wherein at least one of said two intumescent layers includes sodium silicate; and wherein at least one of said two intumescent layers includes rockwool silicates; and wherein at least one of said fire resistant barrier layers includes a fire resistant metallo alumino silicate resin.

41. A fire retardant panel door in accordance with claim 38, wherein said fifth wood core of said upper header is selected from the group consisting of oak, maple, walnut, poplar and pine.

42. A fire retardant panel door in accordance with claim 38, wherein said fifth wood layer of said upper header is selected from the group consisting of oak, maple, walnut, poplar and pine.

43. A fire retardant panel door in accordance with claim 38, wherein said fifth wood core, said seventh plurality of layers of intumescent materials, said seventh plurality of layers of fire resistant materials and said fifth wood applique layer are laminated together using adhesive and pressure to form said composite laminated upper header.

44. A fire retardant panel door in accordance with claim 38, wherein said door frame includes perimeter surface walls having said sixth and seventh plurality of layers of intumescent materials therein which expand upon exposure to heat and/or fire to seal said perimeter surface walls within said door frame in order to prevent the heat and/or fire from passing through said panel door and said door frame during a fire.

45. A fire retardant panel door in accordance with claim 1, further including a double door assembly having a first panel door with one or more door panels, stiles, and rails, and having a second panel door with one or more door panels, stiles, rails, and mullions within a double door frame.

46. A fire retardant panel door in accordance with claim 19, wherein said tongue and groove joints include first air gaps between said first plurality of layers of intumescent materials of said door panel and said second plurality of layers of intumescent materials of said stile for expansion of said first and second plurality of layers of intumescent materials within said first air gaps upon exposure to heat and/or fire to seal said tongue and groove joints in order to prevent the heat and/or fire from passing through said door panel and said stile during a fire.

47. A fire retardant panel door in accordance with claim 19, wherein said tongue and groove joints include second air gaps between said first plurality of layers of intumescent materials of said door panel and said third plurality of layers of intumescent materials of said rail for expansion of said first and third plurality of layers of intumescent materials within said second air gaps upon exposure to heat and/or fire to seal said tongue and groove joints in order to prevent the heat and/or fire from passing through said door panel and said rail during a fire.

48. A fire retardant panel door in accordance with claim 19, wherein said tongue and groove joints include third air gaps between said second plurality of layers of intumescent materials of said stile and said third plurality of layers of intumescent materials of said rail for expansion of said second and third plurality of layers of intumescent materials within said third air gaps upon exposure to heat and/or fire to seal said tongue and groove joints in order to prevent the heat and/or fire from passing through said stile and said rail during a fire.

49. A fire retardant panel door in accordance with claim 1, wherein said first plurality of layers of intumescent materials includes five intumescent layers and wherein said first plurality of layers of fire resistant materials includes at least one fire resistant barrier layer for forming said interior composite section.

50. A fire retardant panel door in accordance with claim 1, wherein said composite laminated style further includes a plurality of metal L-shaped beads being positioned between one of said second plurality of layers of intumescent materials and one of said second plurality of layers of fire resistant materials in conjunction with said intumescent and fire resistant material layers together to form an exoskeleton layer in order to further strengthen said composite laminated stile.

51. A fire retardant panel door in accordance with claim 1, wherein said composite laminated rail further includes a plurality of metal L-shaped beads being positioned between one of said third plurality of layers of intumescent materials and one of said third plurality of layers of fire resistant materials in conjunction with said intumescent and fire resistant material layers together to form an exoskeleton layer in order to further strengthen said composite laminated rail.

52. A fire retardant panel door in accordance with claim 32, wherein said composite laminated jamb further includes a pair of metal L-shaped beads being positioned between one of said sixth plurality of intumescent materials and one of said sixth plurality of layers of fire resistant materials in conjunction with said intumescent and fire resistant material layers together to form a partial exoskeleton layer in order to further strengthen said composite laminated jamb.

53. A fire retardant panel door in accordance with claim 1, wherein one of said composite laminated stiles includes an upper corner having a heat activated door pin assembly therein.

54. A fire retardant panel door in accordance with claim 53, wherein said heat activated door pin assembly includes a housing member and a hollow door bolt pin having an internal compressive spring and a rod member therein.

55. A fire retardant panel door in accordance with claim 54, wherein said door bolt pin being movable from an unexpanded first position to an expanded second position.

56. A fire retardant panel door in accordance with claim 55, wherein said compressible spring and said rod member together include an upper rod end having a fusible solder link therein which melts at least at 117° F. allowing said combined compressible spring and fusible solder link to eject said door bolt pin through a strike plate opening of a strike plate located within a bolt opening of said upper header to said expanded second position in order to prevent any movement of said upper corner of said stile of said fire retardant panel door relative to said door frame.

57. A fire retardant panel door in accordance with claim 54, wherein said housing member includes a pin opening for receiving said door bolt pin therein and having a proximal end and a distal end.

58. A fire retardant panel door in accordance with claim 57, wherein said proximal end of said housing member of said heat activated door pin assembly includes a pair of intumescent pads which upon exposure to excessive heat and/or fire expands rapidly to at least 22 times its original thickness in order to permanently lock said door bolt pin in said expanded second position within said upper-bolt opening of said upper header of said door frame.

59. A fire retardant panel door in accordance with claim 1, wherein on of said composite laminated stiles includes an upper corner having a heat activated door hook assembly therein.

60. A fire retardant panel door in accordance with claim 59, wherein said heat activated door hook assembly includes a housing member having an internal compressible spring having a first spring end and a second spring end attached to a hook member having a hook section fusible solder link therein.

61. A fire retardant panel door in accordance with claim 60, wherein said compressible spring and hook member being movable from a tensioned first position to an untensioned second position.

62. A fire retardant panel door in accordance with claim 61, wherein said first spring end of said compressible spring is detachably connected to a first end of said fusible solder link and said second spring end of said compressible spring is attached to a second end of said fusible solder link which melts at least at 117° F. allowing said combined compressible spring and hook member to rotatably move in a clockwise motion such that said hook section of said hook member moves through a strike plate opening of an upper strike plate located within an opening of said upper header to said untensioned second position in order to prevent any movement and buckling of said upper corner of said stile of said fire retardant panel door relative to said door frame when exposed to heat and/or fire.

63. A fire retardant panel door, comprising:

a) a panel door having a door panel;

b) said door panel including an interior composite section formed of a first plurality of layers of intumescent materials and a first plurality of layers of fire resistant materials disposed between and laminated to a pair of outer sections formed of wood for enclosing said interior composite section to form a composite laminated door panel; and

c) said first plurality of layers of intumescent materials being activated to expand upon exposure to heat and/or fire to prevent the heat and/or fire from passing through said door panel of said panel door and a door frame during a fire.

64. A fire retardant panel door in accordance with claim 63, wherein said first plurality of layers of intumescent materials includes at least five intumescent layers for forming said interior composite section, wherein at least one of said at least five intumescent layers includes sodium silicate and wherein at least one of said at least five intumescent layers include rockwool silicates; and wherein at least one of said fire resistant layers includes a fire resistant metallo alumino silicate resin.

65. A heat activated door pin assembly for preventing the movement and buckling of an upper free corner of a panel doors comprising:

a) a housing member being substantially cylindrically-shaped having an opening and an interior compartment for receiving a hollow door bolt pin therein, said interior compartment having a proximal end and a distal end;

b) said hollow door bolt pin including an internal compressive spring and a rod member having a proximal rod end and a distal rod end therein;

c) said distal rod end of said rod member including a fusible solder link;

d) said fusible solder link melting at least at 117° F.; and

e) said door bolt pin being movable from an expanded first position to an expanded second position when activated by excessive heat and/or fire.

66. A heat activated door pin assembly in accordance with claim 65, wherein said compressible spring and said fusible solder link activates at 117° F. by excessive heat and/or fire allowing said compressible spring to eject said door bolt pin through a strike plate opening of a strike plate located within a bolt opening of said upper header to said expanded second

position in order to prevent any movement and buckling of said upper free corner of said fire retardant panel door relative to said door frame.

67. A heat activated door pin assembly in accordance with claim 65, wherein said proximal end of said housing member of said that heat activated door pin assembly includes a pair of intumescent pads which upon exposure to excessive heat and/or fire expands rapidly to at least 22 times its original thickness in order to permanently lock said door bolt pin in said expanded second position within said upper-bolt opening of said upper header of said door frame.

68. A heat activated door hook assembly for preventing the movement and buckling of an upper free corner of a panel door, comprising:

a) a housing member being substantially rectangularly-shaped housing a top wall in the form of a strike plate, a bottom wall, a front wall, a rear wall and side walls for forming an interior compartment;

b) said interior compartment of said housing member including a movable door hook member having a hook section, a shaft opening, an end section, a front wall and a rear wall; a shaft member; an internal compressible spring having a first spring end and a second spring end; and a fusible solder link having a first solder link end and a second solder link end;

c) said strike plate including a hook opening for receiving said hook section of said movable door hook member and a solder link opening for receiving said first solder link end of said fusible solder link therethrough;

d) said compressible spring being attached to said front wall of said door hook member and adjacent to said shaft opening; said shaft opening of said door hook member pivots on said shaft member;

e) said first spring end of said compressible spring is received within a pin opening of said side wall in order to hold said compressible spring in place on said side wall;

f) said second solder link end is attached to said second spring end of said compressible spring, wherein said compressible spring is in an unexpanded configuration;

g) said fusible solder link melting at least 117° F.; and

h) said hook section of said door hook member and said compressible spring being rotatable in a clockwise motion from a tensioned first position to an untensioned second position when activated by excessive heat and/or fire.

69. A heat activated door hook assembly in accordance with claim 68, wherein said compressible spring and said fusible solder link is activated at said 117° F. by excessive heat and/or fire allowing said compressive spring to rotatably move said hook section of said door hook member through an upper strike plate located within an opening of an upper header to said untensioned second position in order to prevent any movement and buckling of said upper free corner of said panel door relative to a door frame when exposed to heat and/or fire.

70. A heat activated door hook assembly in accordance with claim 68, wherein said strike plate includes opposing ends each having a mounting opening therethrough for receiving a mounting screw therein.

71. A heat activated door hook assembly in accordance with claim 68, wherein said front and rear walls include shaft openings for receiving and attaching said shaft member therein.

72. A heat activated door hook assembly in accordance with claim 68, wherein said bottom wall includes a bottom opening for accessing said door hook member.

73. A heat activated door hook assembly in accordance with claim 71, wherein shaft opening of said door hook member pivots about said attached shaft member, where then said hook section of said door hook member rotatably moves within said upper strike opening of said upper strike plate permanently such that said hook section prevents any movement and buckling of said upper free corner of said panel to said untensioned second position when activated by excessive heat and/or fire.

* * * * *