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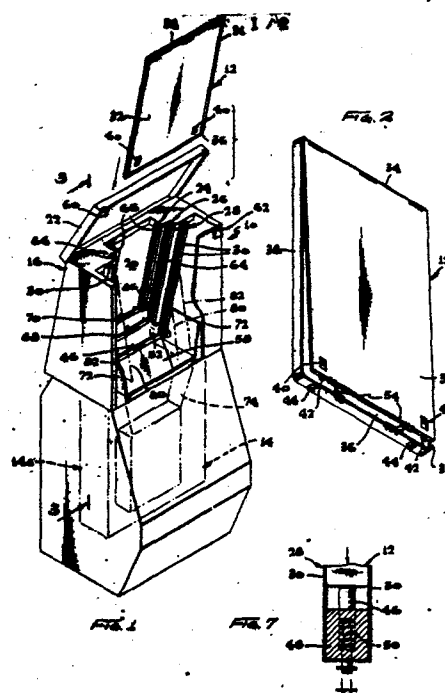
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54 Unloader for an X-ray film-holding cassette.

57 Apparat for opening a cassette, of the type which carries a sheet of X-ray film, to allow the film to move into processing equipment, without requiring a darkroom. The apparatus includes a lighttight housing containing inclined guides for receiving the cassette, and pins at the bottom of the space between the guides, that can engage latches on the cassette to open it. The cassette is forced against the pins by a cover on the housing, which pushes on the cassette as the cover approaches its fully closed position, so the pins unlatch the cassette which opens to allow the film sheet to drop out.



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Title

Cassette Unloader

DescriptionTechnical Field

5 This invention relates to apparatus
for unloading cassettes of the type that contain
X-ray film.

Background

One type of cassette, commonly used to
10 hold a large sheet of X-ray film for recording a
chest X-ray image or the like, includes a pair of
walls pivotally connected at one end and latchable
at the opposite end, which hold a film sheet
between them. Such cassettes permit an undeveloped
15 film sheet to be handled in a daylight environment,
as when bringing the film to a chest X-ray unit for
exposure or when carrying the exposed film to a
processor.

Although the use of a cassette has
20 facilitated movement of the undeveloped film, it
has usually been necessary to carry the cassette
containing the exposed film to a darkroom for
removal and placement of the film in a processing
machine which develops it. It would be possible
25 to devise complex unloader mechanisms for opening

the cassette and transferring the film to a processor while an operator of the mechanism stands in a daylight environment. However, in order for a film unloader to gain wide acceptance, it is
5 necessary that it be relatively simple, to minimize the cost and maximize the reliability of the device. It would also be desirable if any such device could accept cassettes of a plurality of different sizes without requiring it to have
10 a substantially increased size or complexity.

Disclosure of Invention

In accordance with one embodiment of the present invention, an unloader is provided for an X-ray film-holding cassette, which can
15 open the cassette to allow the film to fall into processing apparatus, utilizing a relatively simple and reliable mechanism. The unloader includes a lighttight housing with guides that slidably receive a cassette, and with release pins at the
20 end of the space between the guides for engaging corresponding latches on the cassette to open it. The guides extend at an incline from the vertical, so that the cassette tends to swing widely open when unlatched, and the film will then drop out.

25 The housing includes an upper opening, through which the cassette is received, and a cover that can be pivoted over the opening. A spring biased retainer member holds the cassette slightly above the pins, to prevent opening of the cassette
30 while the cover is open. As the cover is swung closed, it pushes down against the cassette to engage the pins, so that the cassette opens only when the housing is substantially sealed from light in the environment. A plurality of guides
35 are provided for receiving cassettes of different

sizes. The pins at the ends of the different guides are positioned so that the upper end of the cassette lies slightly above the door level when the bottom of the cassette is close to the pins, so that closing of the door will push down and cause unlatching of the cassette held by any of the guides.

Description of Drawings

Figure 1 is a perspective view of an unloader constructed in accordance with the present invention, and of a cassette which fits therein, with a portion of the unloader housing being cut away.

Figure 2 is a perspective view of the cassette of Figure 1, showing the latchable ends of the cassette in a slightly opened condition.

Figure 3 is a partial sectional view taken on the line 3-3 of Figure 1, but with the cover in an almost closed condition.

Figure 4 is a view similar to Figure 3, but showing the cover fully closed and the cassette opened.

Figure 5 is a partial view taken on the line 5-5 of Figure 4, but showing the cassette partially inserted in the unloader.

Figure 6 is a view taken on the line 6-6 of Figure 5.

Figure 7 is a view taken on the line 7-7 of Figure 5.

Description of Apparatus

Fig. 1 illustrates a cassette unloader which can receive a cassette 12, wherein the cassette is closed and contains a sheet of exposed X-ray film. The unloader can open the cassette while holding it at an incline from the vertical,

to allow the film therein to fall out, and can funnel the film to a processing apparatus 14, all without exposing the film to light in spite of the unloader lying in a daylight environment.

5 The unloader 10 includes a lighttight housing 16 with a bottom that rests on apparatus 14 and a top forming an opening 20 through which cassettes are received. After a cassette has been received, a cover 22 can be closed to make
10 the housing lighttight. A group of guide assemblies 24, 26 and 28 are provided for receiving cassettes of different sizes. The particular cassette 12 is designed to be received between a pair of guides 30 of the guide assembly 28.

15 The cassette 12 includes a pair of walls 31, 32 that are pivotally joined at one end 34 of the cassette and which are latched together at an opposite end 36 of the cassette. As shown in greater detail in Fig. 2, the base wall 31 includes
20 a peripheral lip 38 that surrounds the covering wall 32 when the cassette is closed. Wall 32 includes a pair of latches 40 that are spring biased so that their ends 42 tend to project from the wall and through corresponding holes 44 in
25 the lip 38 of the base wall, when the cassette is closed. The latches 40 can, however, be retracted to withdraw their ends 42, for opening or closing of the cassette. The unloader 10 is constructed to automatically operate the latches to open the
30 cassette after it is inserted in the unloader.

 When the cassette 12 is inserted between the guides 30, as indicated in Figs. 1 and 5, the cassette moves down until it encounters a spring-loaded retainer 46 which lies on a bar 48 at the
35 lower end of the space between the guides 30.

When downward force is applied to the cassette, it presses down the retainer 46 against the force of a spring 50, so that the cassette can approach and engage a pair of release members or
5 pins 52.

The pins 52 are located so that they will fit into the holes 44 (Fig. 2) of the cassette to push against the ends 42 of the cassette latches. Thus, as the cassette is
10 forced down, the pins 52 force the retraction of the latches to release the wall 32. A pair of leaf springs 54 are located within the cassette to initially push apart the walls to begin the opening of the cassette. The leaf springs 54
15 also lie behind the lower edge of the film, so they push out the lower film edge as the cassette opens.

As shown in Fig. 4, the guides 30 are inclined by an angle A from the vertical. As a
20 result, when the cassette latches are released and the cover wall 32 of the cassette moves slightly open, gravity pulls the cover wall 32 to a more open position. With the cassette considerably opened and oriented at an incline so
25 the film 56 faces partially downward, the film 56 (whose lower edge is pushed out by the leaf springs in the cassette) is able to fall out of the cassette and into the processor apparatus located below a funnel 58. It may be noted that
30 the cassette must be inserted so that the cover wall 32 faces downwardly. As shown in Figs. 5 and 6, the guides 30 have shallow grooves 30r so that they hold only the lip 38 of the base wall of the cassette, but not the cover wall 32. Thus, the
35 cover wall 32 is free to swing open when unlatched.

When the cassette is initially inserted through the opening 20 at the top of the unloader housing, the cassette is exposed to light entering through the opening 20. It is important that the cover 22 be closed sufficiently to keep out light, at the time when the cassette is unlatched to open, and it is desirable that the cassette then open automatically. To accomplish this, the cover 22 is utilized in the manner illustrated in Figs. 3 and 4, to push down the cassette, and to open it immediately after the door is moved to a position wherein it closes sufficiently to keep out light. As discussed above, the inserted cassette initially rests on the retainer 46. When the cassette rests on the retainer 46, as in Fig. 3, its upper end 34 projects into the path of the cover 22. With the cover 22 lying lightly on the upper end of the cassette, it is sufficiently closed to prevent the entrance of light into the unloader, but the opening 20 is not yet fully closed. The technician can fully close the opening by applying downward force to the cover, until holder members 60 on the cover engage catches 62 on the side walls of the housing to keep the cover fully closed. While the cover is being fully closed, it pushes down the cassette 12 against the biasing of retainer 46, until the cassette latches engage the pins 52 at the bottom of the space between the guides 30. The pins 52 then depress the latch ends of the cassette, to cause opening of the cassette and release of the X-ray film.

As mentioned above, the unloader includes two guide assemblies 24, 26 (Fig. 1), in addition to the guide assembly 28 with guides 30, to enable the unloading of two other sizes of cassettes.

The other two cassette sizes are of smaller length and narrower width than the cassette 12. Accordingly, the pair of guides 64 and 66 of each of the other guide assemblies are closer together, and the lower bars 68, 70 are at a greater height than the lower bar 48 which holds the retainer 46 and the pins 52. The other bars 68, 70 hold corresponding pins and retainers, at levels such that when cassettes of corresponding sizes are first inserted, and lie on their respective spring-biased retainers, their upper ends lie in the path of the cover 22. Accordingly, full closure of the cover will push down and cause opening of cassettes of any one of the three sizes provided for. The funnel 58 is made wide enough to receive films dropping from any of the three guide assemblies. It also may be noted that side funnel plates 72 are provided to engage the sides of films to enable their passage through the funnel 58, and that a processor such as 14a, designed to receive a small film sheet from a small cassette, may be provided with additional side funnel plates 74 to accurately guide these small sheets into the corresponding processor.

Although the use of release pins or members 52 fixed in position and of the housing cover 22 to press the pins into a cassette provides a simple mechanism, other arrangements can be utilized. For example, the pins can be movably mounted, and moved against the cassette by a mechanism controlled from outside the housing or by a mechanism that operates after the cover is fully closed on the housing.

As mentioned above, side funnel plates 72 (Fig. 1) can engage the sides of films dropping

towards the funnel 58. These plates prevent tumbling of large films exiting from large cassettes on the guide assembly 28. In order to prevent tumbling of films exiting from smaller
5 cassettes on the guide assemblies 24, 26, two pairs of edge guides 80, 82 are provided. The pair of edge guides 82 are pivotally mounted on the outside of grooved guides 64 of the guide assembly 26. These edge guides can guide the
10 edges of a film exiting from a cassette on the guides 64.

In order to allow the edge guides 82 to effectively guide a film, the edge guides 82 must extend through the space between the cassette
15 guides 30, as shown in Fig. 3. The edge guides 82 tend to assume this position when free to pivot thereto by gravity. When a large cassette 12 is received between the guides 30, as shown in Fig. 4, the large cassette will deflect the edge guides
20 82 out of the way of the cassette, and out of the way of a film 56 falling from the cassette. In a similar manner the edge guides 80 (Fig. 1) lying beside the smallest guide assembly 24, will be deflected by a medium cassette on guide assembly
25 26, and will be partially deflected by a large cassette on guide assembly 26. It may be noted that the edge guides 80 have slots 86 to avoid engagement with bar 68 on the guide assembly 26.

Thus, the invention provides a relatively
30 simple apparatus for removing a sheet of X-ray film from a cassette by an operator located in a daylight environment. This is accomplished by utilizing a lighttight housing with guide means for receiving the cassette in the housing and with pins, or
35 release members, positioned in the housing to

engage the latches on the cassette to release them when the cassette has been inserted into the housing. Closing of the housing to make it light-tight, and also to aid in pushing in the cassette against the release pins, is enabled by the use of a cover. The cover moves close enough to its fully closed position to keep the housing light-tight at a time when it pushes the cassette against the release pins, so that the cassette opens in a dark environment. A biased retainer holds the cassette from fully engaging the pins until pushed down by the cover. The guides hold the cover at an incline, so that once it is unlatched it swings open to allow the film to drop out therefrom and into a funnel leading to processing apparatus. A series of closely spaced guides can be utilized to hold cassettes of a plurality of different sizes in a compact unloader. The guides can be positioned so that each cassette size is pushed against its respective release pin by the cover approaching its fully closed position. Film edge guides can be provided that guide the exiting film through the space at which larger cassettes can be received, and with the edge guides being deflectable out of the way by the larger cassettes.

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Claims

1. An unloader for an X-ray film-
holding cassette which has a pair of walls .
pivotally joined at one end and held together
5 at the other end by at least one latch which can
be pushed in to release the walls so they can
pivot apart, comprising:

a lighttight housing;

means for receiving said cassette in
10 said housing; and

a release member positioned to engage
the latch on a cassette held by said receiving
means, whereby to release the walls for pivoting
apart to release the film therein.

15 2. The unloader described in Claim 1
wherein:

said housing includes a cover;

said receiving means slidably holds
said cassette in movement toward and away from
20 said release member;

said cover and release member are posi-
tioned so that when the release member initially
engages said cassette said cover is not completely
closed but can lie against the hinged end of the
25 cassette, and as the cover approaches a fully

closed position it pushes the cassette latch against said release member.

3. The unloader described in Claim 2 wherein:

5 said receiving means includes a pair of guides forming a first pair of spaced grooves for slidably holding said cassette; and including
a second pair of guides forming a second pair of grooves spaced apart by a distance
10 less than the spacing of said first grooves and extending substantially parallel thereto to hold a small cassette which is shorter and narrower than a cassette designed to fit between said first pair of grooves but which has a similar
15 latch;

 said release member lies at an end of the space between said first pair of guides; and including

 a second release member lying at an
20 end of the space between said second pair of guides and at a distance from said cover so that as said cover approaches a fully closed position it pushes the latch of a small cartridge against said second release member.

25 4. The unloader described in Claim 1 wherein:

 said receiving means includes a pair of guides forming a first pair of spaced grooves for slidably holding said cassette; and including

30 second receiving means including a second pair of guides forming a second pair of grooves spaced apart by a distance less than the spacing of said first groove and extending substantially parallel thereto to hold a smaller
35 cassette which is shorter and narrower than a

cassette designed to fit between said first pair of guides;

means defining a film-receiving region under said first and second receiving means, for receiving a film falling out of a cassette on said first or second guides; and

a pair of film edge guides lying at either side of said second guides to guide a film from a cassette therein to said film-receiving region,

said edge guides having portions movable between first positions wherein they lie between said first guides and second positions wherein said portions lie out of a position between said first guides.

5. The unloader described in Claim 1 wherein:

said receiving means holds only a first of said cassette walls, and holds said first wall at an incline from the vertical so that the second cassette wall can lie under the first one, whereby the second wall will swing open when released.

6. An unloader for an X-ray film holding cassette which has a first wall and a second wall narrower than said first wall, said walls pivotally joined at one end and held together at the other end by a pair of latches which can be moved to release the walls so they can pivot apart, comprising:

a pair of parallel guides spaced apart to receive said cassette between them, said guides oriented at an incline from the vertical so that the cassette can be installed thereon with said second wall facing downwardly, and said guides holding only said first wall of said cassette so

that the second wall is free to swing open when unlatched; and

a pair of release pin means for engaging the latches on a cassette held by said guides, whereby to unlatch the walls.

7. The unloader described in Claim 6 wherein:

said guides slidably hold said cassette; said release pins are substantially fixed in position; and including

a retainer biased to a position in the path of a cassette sliding along said guides, to hold said cassette out of unlatching engagement with said release pins; and

means for pushing said cassette toward said release pins with a force which overcomes the biasing of said retainer.

8. The unloader described in Claim 7 including:

a lighttight housing surrounding said guides, said housing having an opening providing access to said guides, and said housing having a cover for closing said opening, said cover forming said pushing means.

9. The unloader described in Claim 6 including:

a second pair of parallel guides spaced apart by less than said first-named pair of guides to receive a narrower cassette, said second guides inclined substantially parallel to said first pair of guides and lying above said first pair of guides;

funnel means positioned below said first and second parallel guides, for receiving films from cassettes on said first and second guides; and

a pair of edge guides pivotally mounted
at either side of said second guides, to guide
the edges of a film leaving a cassette on said
second guides toward said funnel means, said
5 edge guides having portions which normally lie
in the path of a cassette on said first guides
and which are moved out of the space between
said first parallel guides by a cassette moved
therealong into said housing.

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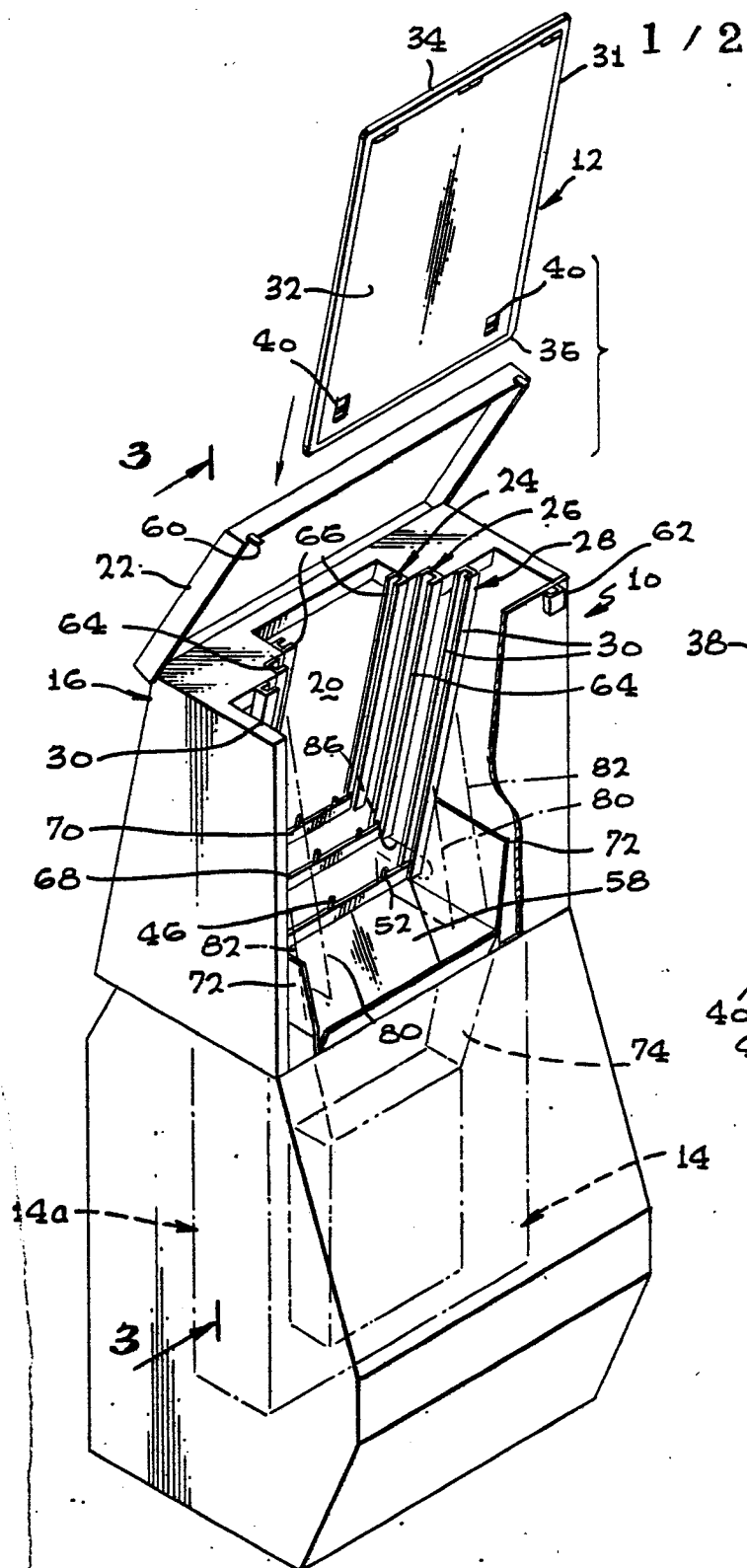


FIG. 2

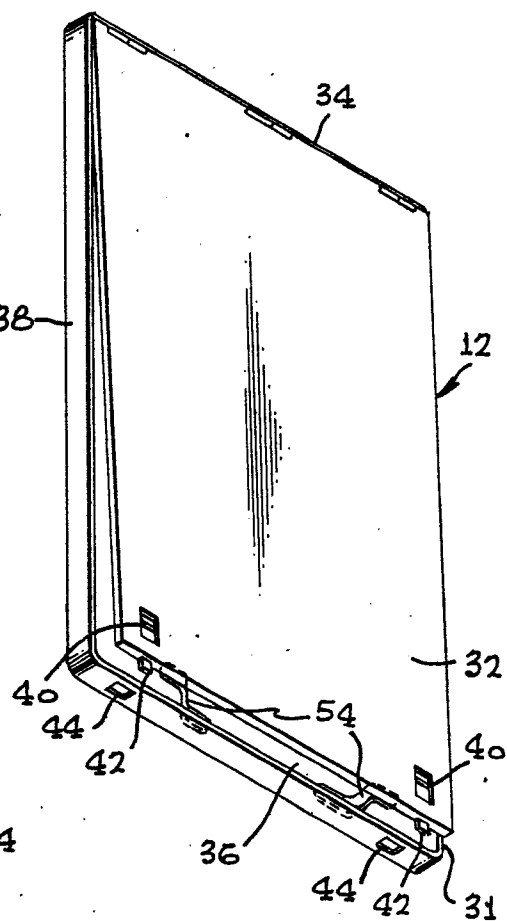
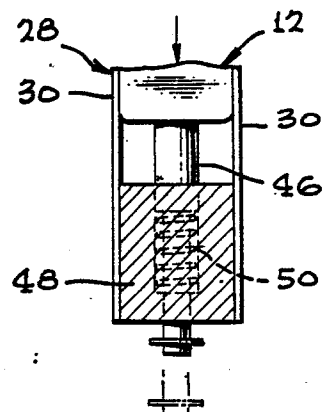


FIG. 7



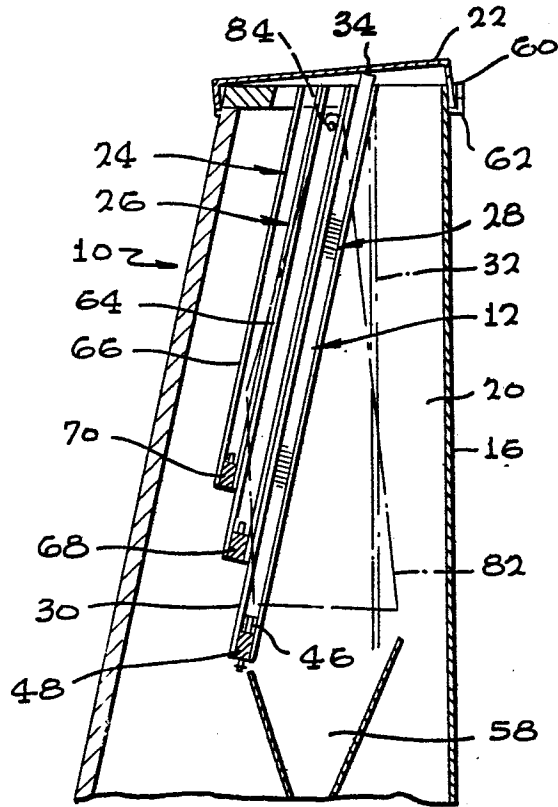


FIG. 3

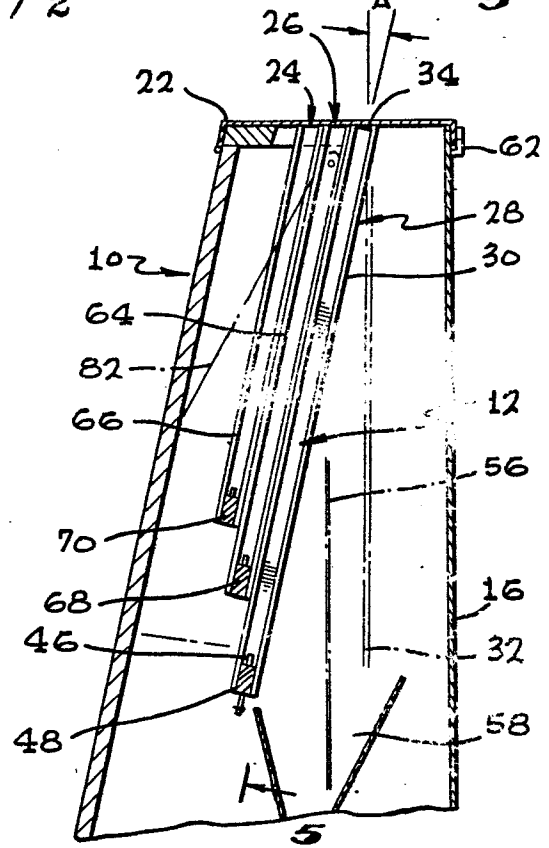


FIG. 4

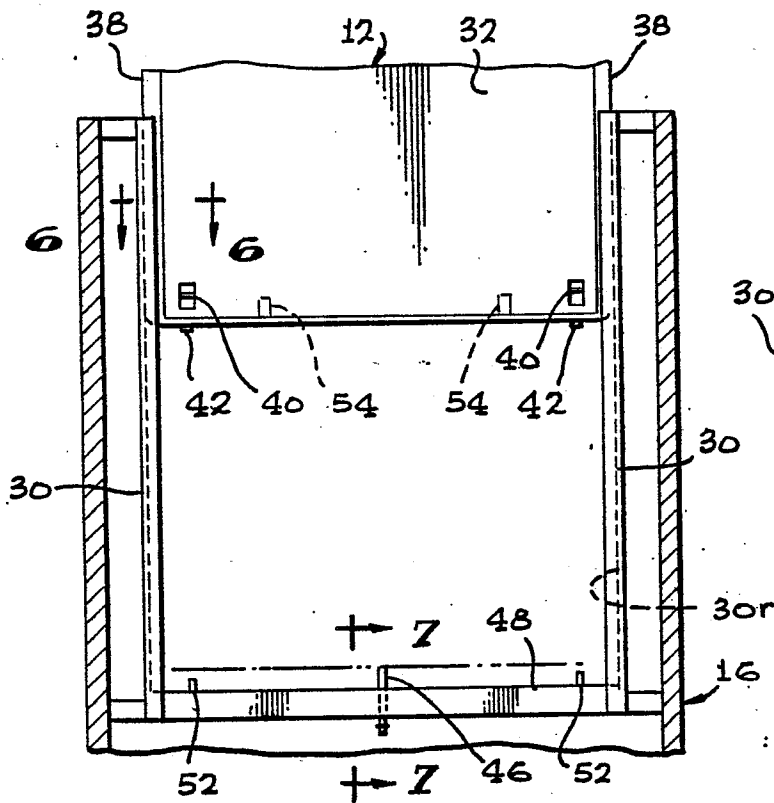


FIG. 5

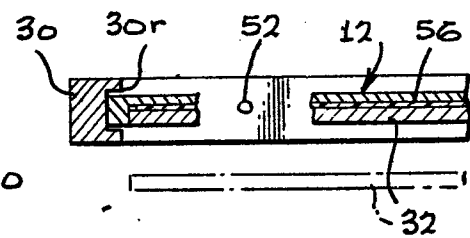


FIG. 6