

[54] **METHOD AND APPARATUS FOR INSERTING PAPER BETWEEN PLATE-SHAPE MATERIAL**

[75] Inventors: **Nobumitsu Hegi; Takeshi Kitamura**, both of Kitakyushu; **Seishiro Saida; Tadao Kawaguchi**, both of Hikari, all of Japan

[73] Assignee: **Nippon-Steel Corporation**, Tokyo, Japan

[22] Filed: **Sept. 6, 1972**

[21] Appl. No.: **286,816**

[30] **Foreign Application Priority Data**

Oct. 29, 1971 Japan..... 46-8003
Dec. 6, 1971 Japan..... 46-114566

[52] U.S. Cl. **270/45, 270/58**

[51] Int. Cl. **B65h 39/02**

[58] Field of Search..... 156/216, 477 B; 270/2, 270/4, 32, 37, 45-53, 58; 11/3

[56] **References Cited**

UNITED STATES PATENTS

2,628,092 2/1953 Malmros et al..... 270/45

3,059,391 10/1962 Volks et al..... 270/58 X
3,083,009 3/1963 Barr et al..... 270/58
3,245,859 4/1966 Busk 156/216 X
3,645,525 2/1972 Ishihara et al..... 270/45

FOREIGN PATENTS OR APPLICATIONS

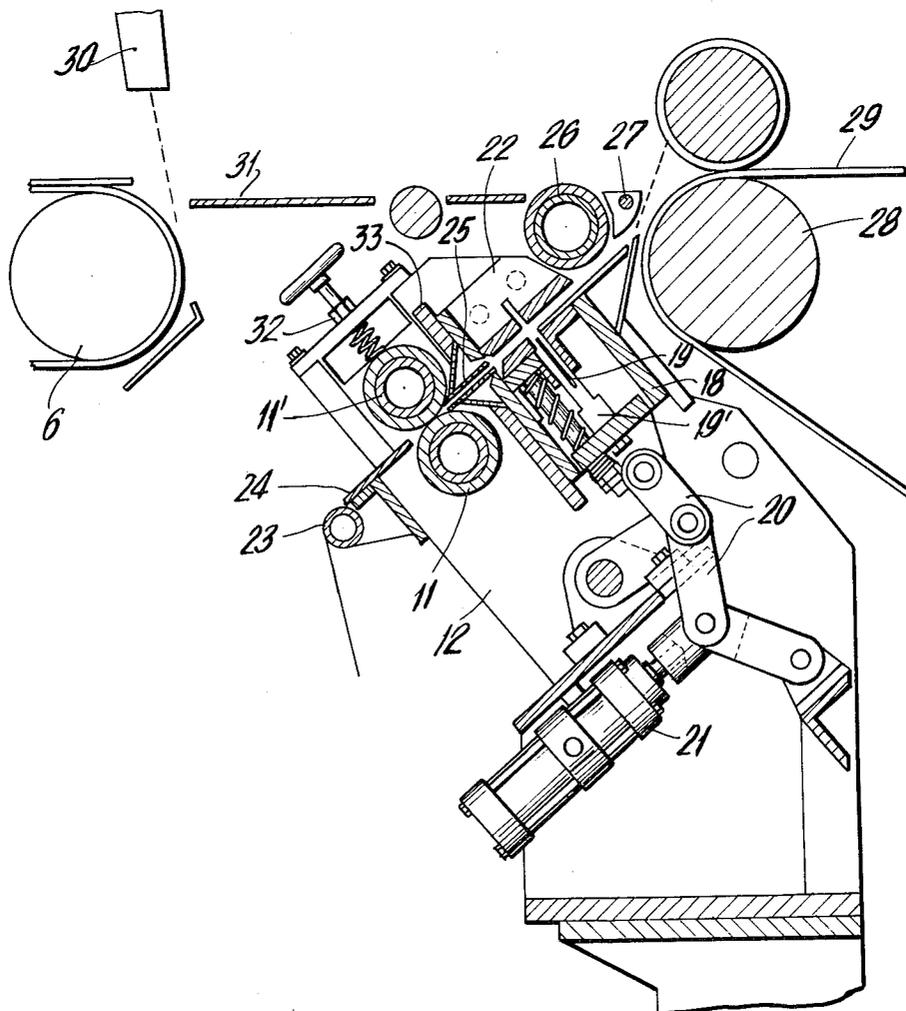
53,682 2/1967 Germany 11/3

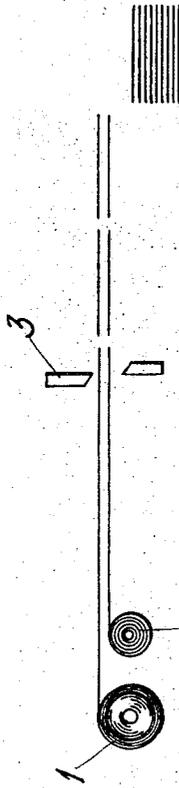
Primary Examiner—Robert W. Michell
Assistant Examiner—Vincent Millin
Attorney, Agent, or Firm—Toren, McGeady and Stanger

[57] **ABSTRACT**

A method of inserting film shape protective material as paper, and the like between plate-shape material and such as steel sheets, aluminum sheets, glass plates, and the like, which are piled in a stack, being piled up by placing the protective material on the top or bottom of the plate-shape material, and characterized in that the forward end of the protective material is positioned transversely of the path of the plate-shape material on it is moved into the stacking position and is folded back in such manner as wrapping the forward end of the plate-shape material so that the protective material is surely attached to the plate-shape material.

4 Claims, 15 Drawing Figures





(PRIOR ART)
FIG. 1

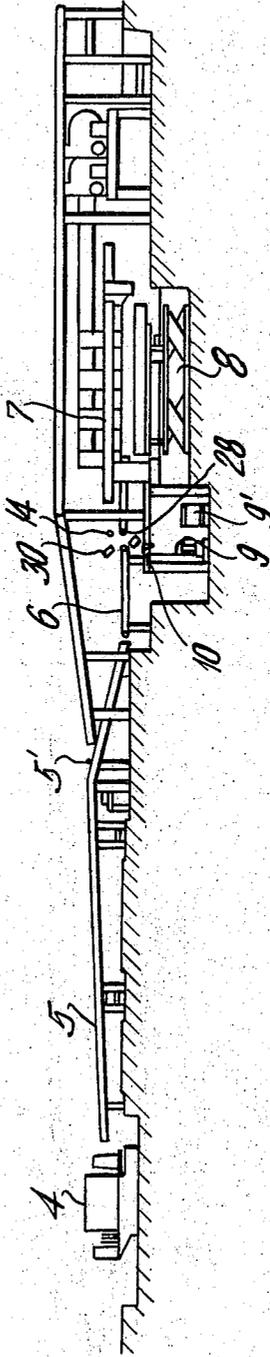


FIG. 2

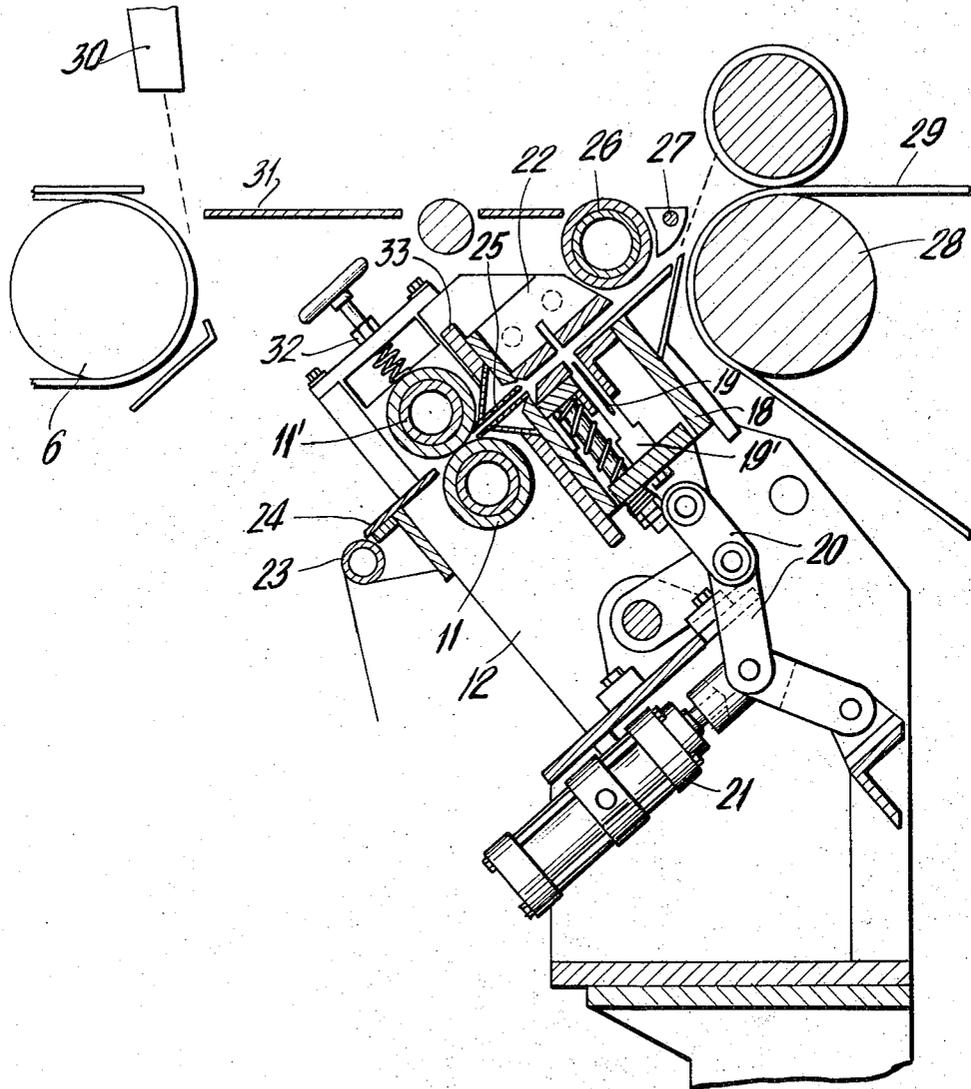


FIG.3

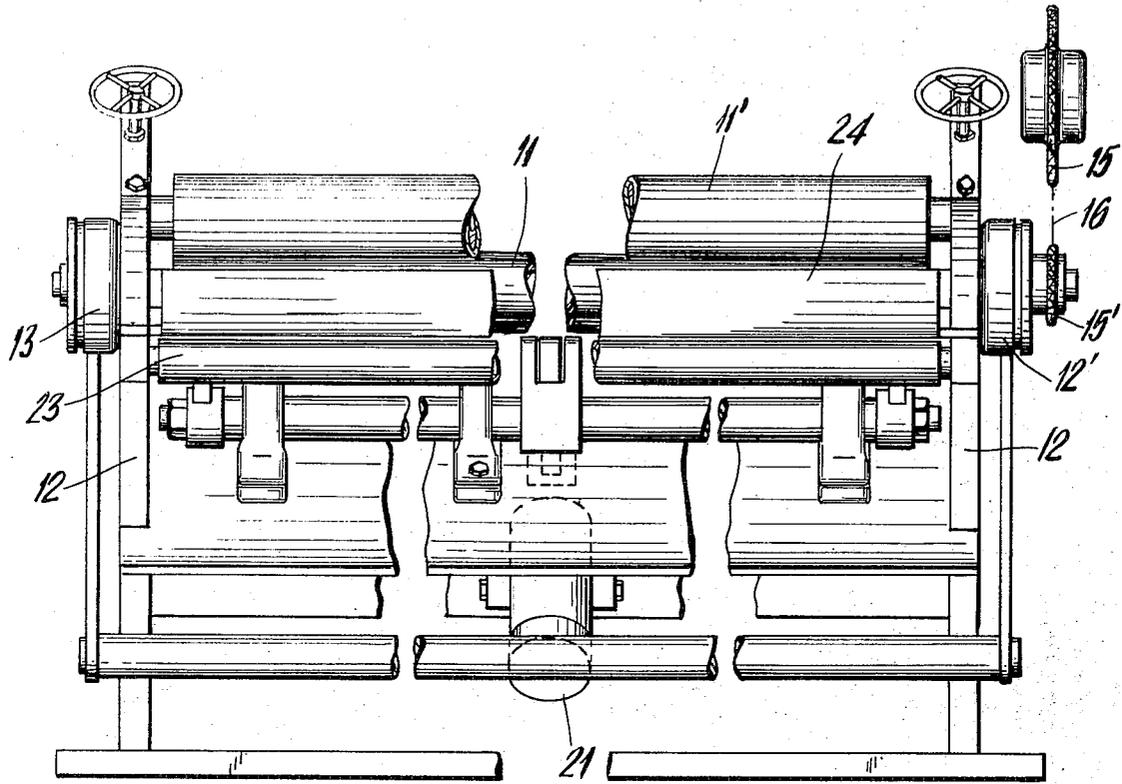


FIG. 4

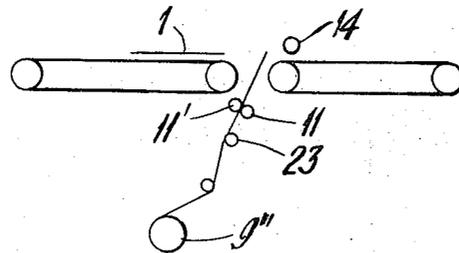


FIG. 5 A

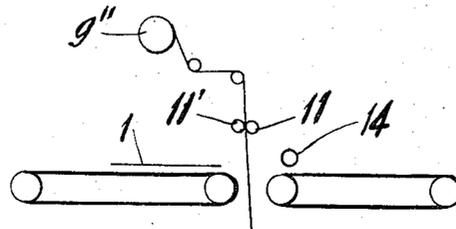


FIG. 5 B

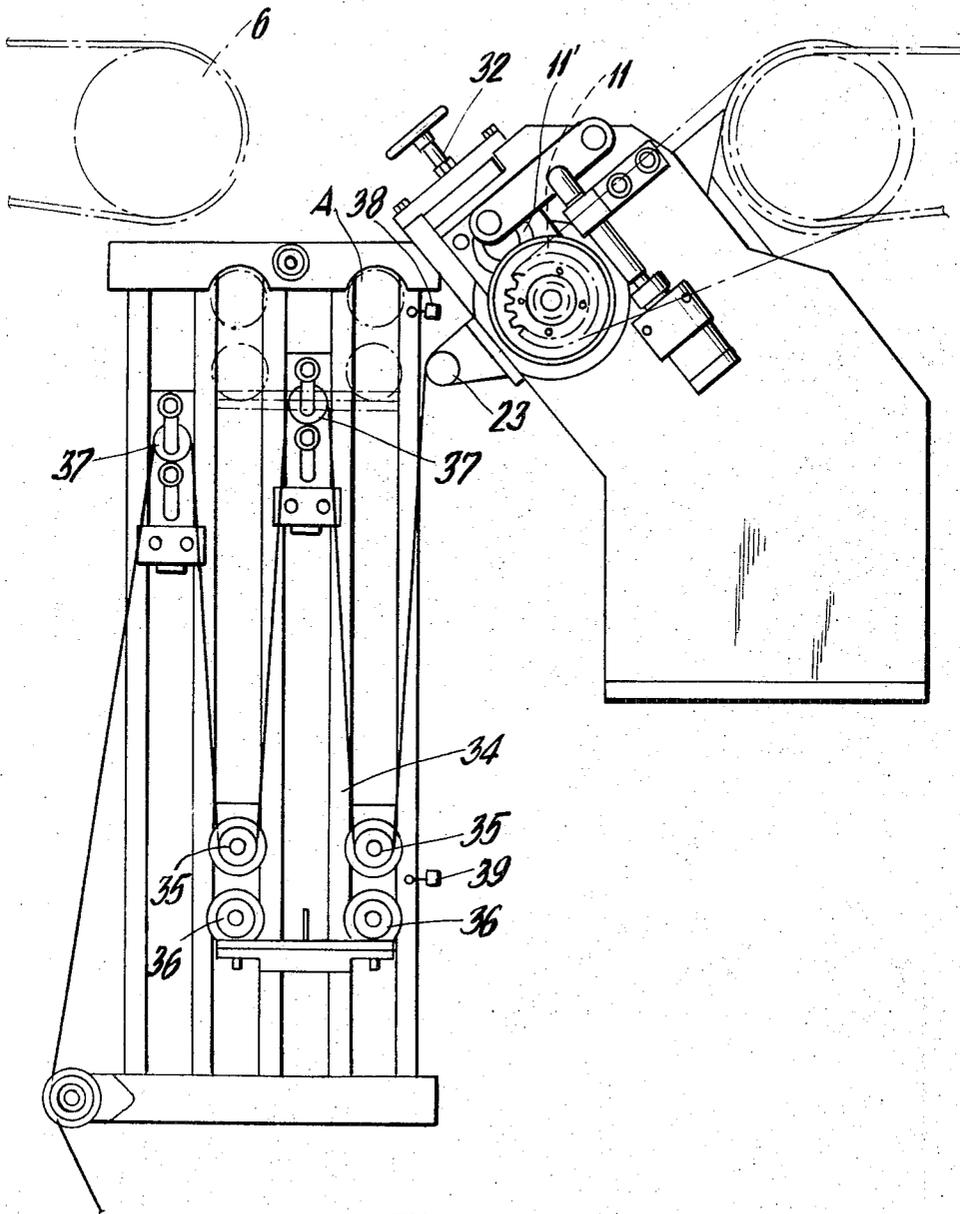


FIG. 6

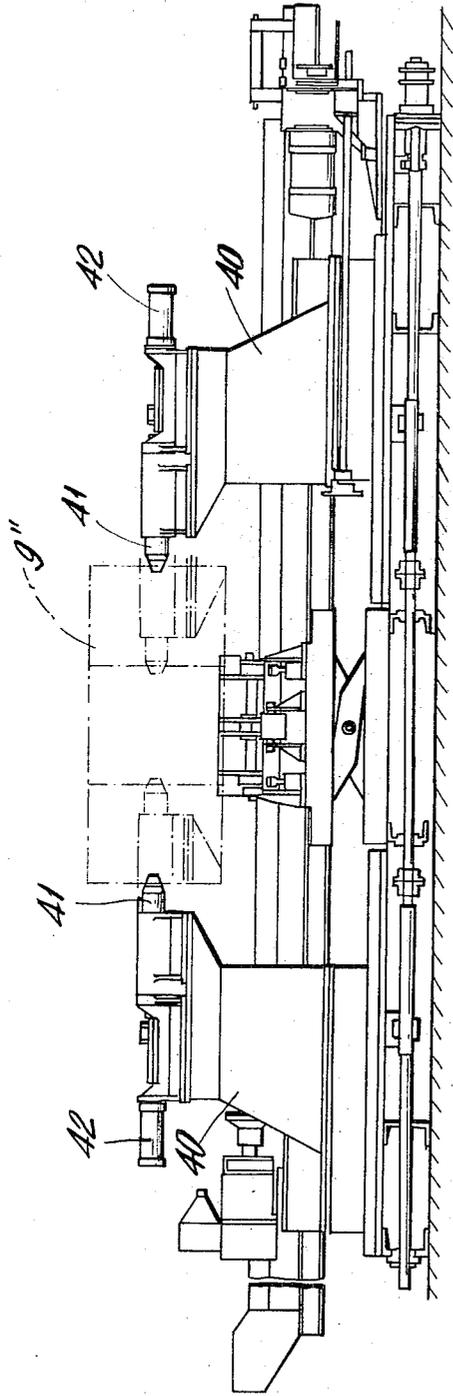


FIG. 7

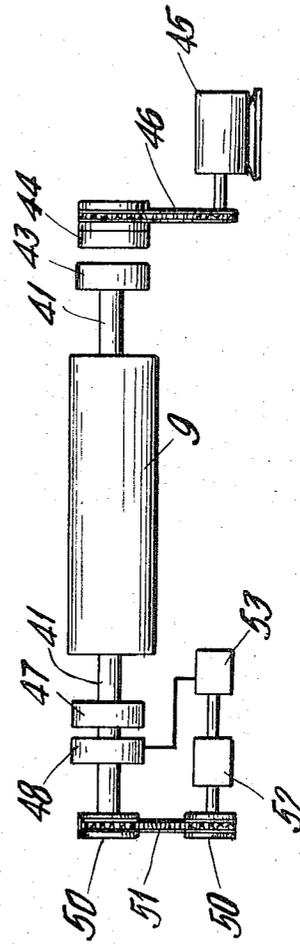


FIG. 8

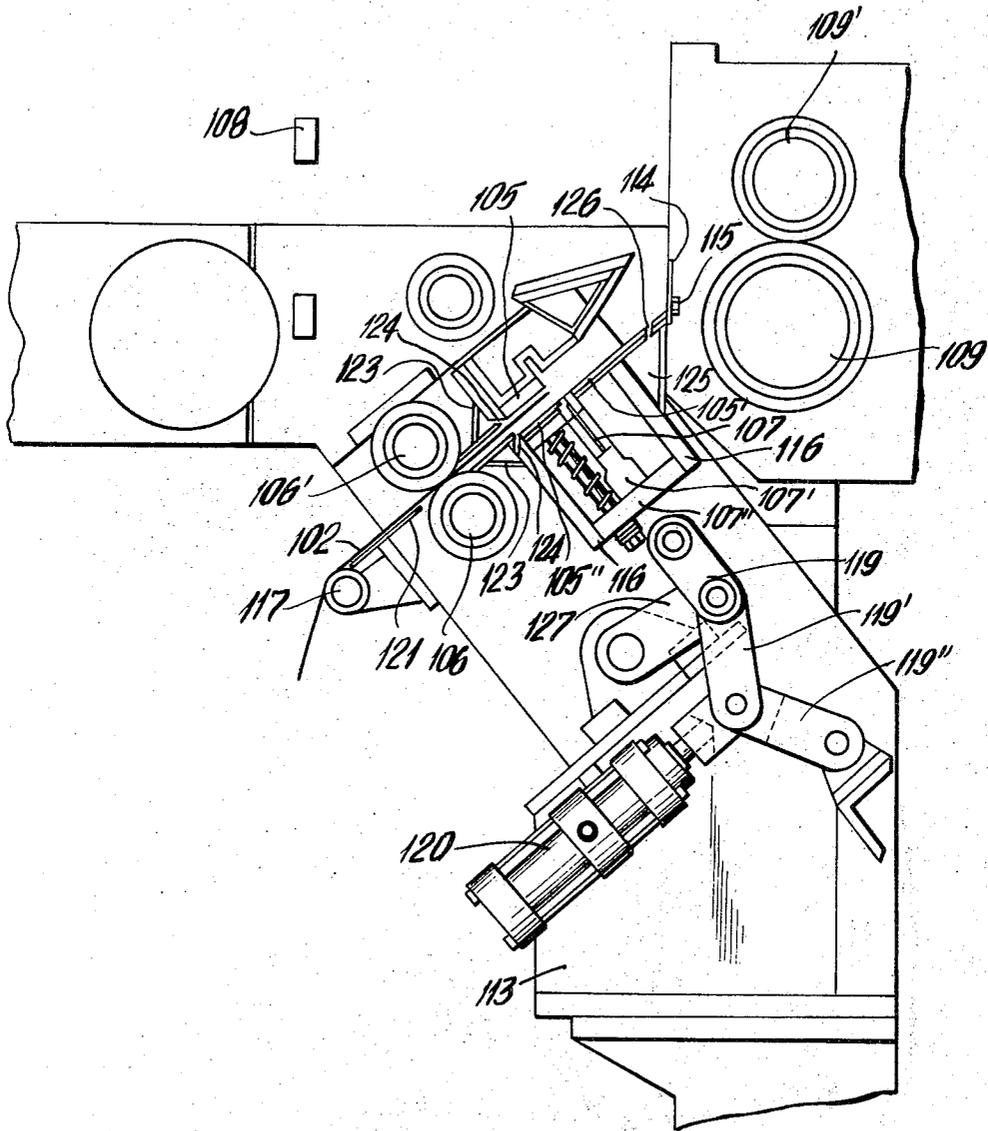


FIG. 9

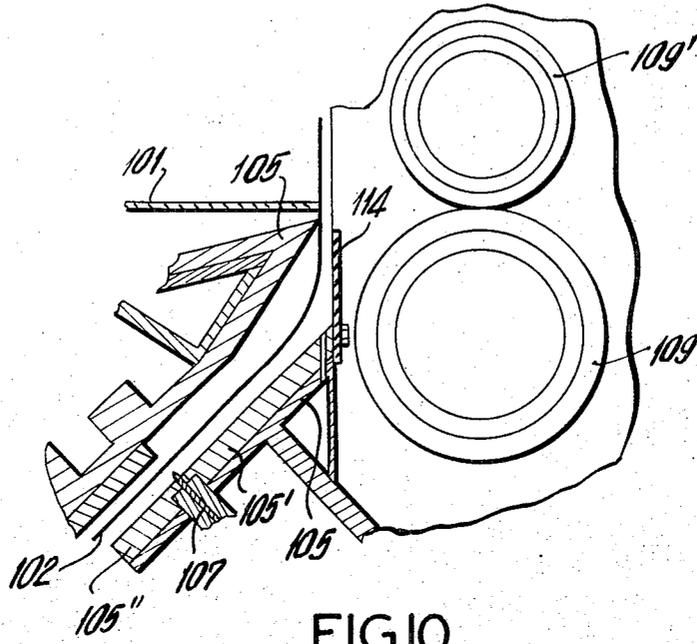


FIG. 10

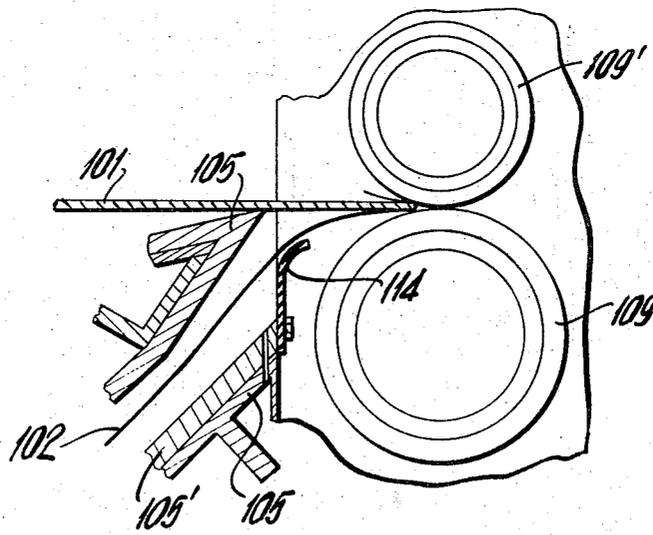


FIG. 11



FIG. 12

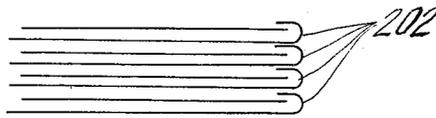


FIG. 13

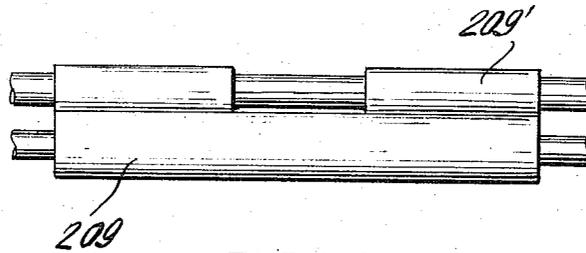


FIG. 14

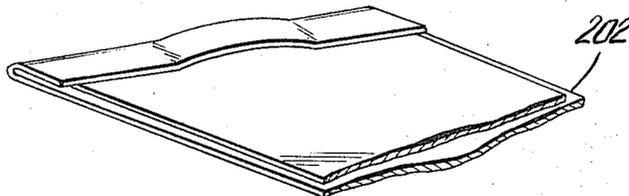


FIG. 15

METHOD AND APPARATUS FOR INSERTING PAPER BETWEEN PLATE-SHAPE MATERIAL

The present invention relates to a method and apparatus (interleaver) for inserting film shape protective material made of paper, plastics, etc. between plate-shape material such as a stainless steel sheet or plate, a color coated steel sheet, a galvanized steel sheet, a thin aluminium sheet, a glass plate, etc. for preventing scratches and damages to the surfaces and ends of said plate-shape material.

For a product in which scratches or damages on its surface should not take place such as a stainless steel sheet, a color coated steel sheet, a galvanized steel sheet, a thin aluminium sheet or a glass plate, etc., such operation is necessary as inserting protective paper between each of the plate-shape material during the production process or at the time of shipping.

Conventionally for such operation a method has been employed in which in the case of cut sheet or plate, paper is cut beforehand into a suitable plate length and piled up then the paper is taken out sheet by sheet by hand and placed between the plate-shape material as it is piled.

Therefore, in a process such as a shear line, cutting speed is determined by the speed of plate surface inspection and of the operation to place the protective paper. That is, ordinarily in such a series of operations the speed is determined by the processing capacity of the surface inspection and the piling up operation of the plate and paper which follow the cutting operation, instead of the effect of the cutting operation.

However, mechanization of the piling up operation of plate and paper had not been realized, thus the operation must be done manually and actual operation has had to rely on man power.

But recently there has been some tendency to mechanize such an operation, and an example thereof is as shown in FIG. 1 which a steel sheet coil 2 is stretched into a flat sheet, and protective paper 1 is placed upon the steel sheet before cutting operation, and the steel sheet 2 and the protective paper 1 are together and are cut together by a shear 3. But in this case, it is necessary to keep the steel sheet 2 and the protective paper 1 together not to let them separate from each other. While static electricity has been used as an example of bonding them, but in such method the bonding effect is affected by humidity in the air, and such method has the shortcoming that when humidity is high the protective paper is separated from the steel sheet at the time of piling after cutting.

There is another method of using adhesives such as glue, etc., but this method results in impairing the gloss of steel sheet, or lowering the commercial value of coloured or galvanized steel sheet.

Further another big disadvantage in said conventional methods lies in that even if piling up of the steel sheet and the protective paper is done with proper alignment, since the size of the steel sheet is the same as that of the protective paper, no protection is afforded to the edges of the sheet during the piling operation when the edges contact the surface of the already piled sheet or plate so that if only a slight sliding of the edge on the already piled plate takes place, the surface of the already piled plate is damaged by the edge.

The present invention is to eliminate such shortcomings and disadvantages and is characterized by a

method in which protective material in film shape, such as paper, is placed on the top surface or bottom surface of plate-shape material such as steel sheet, aluminium sheet, glass plate, etc. so that the protective material is inserted between plate-shape material as it is piled up, wherein the forward end portion of the protective material is folded back at the forward end of the plate shape material so that the protective material is surely attached to the plate-shape material by gravity or vacuum method, etc.

And as a method of folding back the forward end of protective material onto the forward end of the plate like material so that the protective material is stuck to upper surface or bottom surface of the plate shape material, the forward end of the protective material is made to protrude a little out of pass line of the plate-shape material in such manner as blocking the pass line of the plate-shape material, and the forward end of the protective material is placed onto and hooked by the forward end of the plate-shape material and the protruded part is bent and folded by bending pinch rolls, etc.

Further the present invention is characterized in that when the forward end of protective material protruding out of said pass line is folded by the folding pinch rolls, etc., in the above method, only a portion of said forward end is folded thereby the folded back part of the protective material is opened up again at the time of piling up of the plate-shape material for preventing the collapse of the pile.

The present invention is further characterized in:

1. An interleaver for inserting paper between plate-shape material which is characterized by at a plate-shape material transfer apparatus having a conveyor roller with pinch rollers provided on its upper part, and a sheet detecting device being provided near a feeding conveyor roller located adjacent to the above mentioned conveyor roller, pinch rollers are oppositely provided in the middle between the above mentioned pinch rollers and the conveyor, and also there is provided a paper feeding device having a clutch and a brake connected with said sheet detecting device at both sides of the driving pinch rollers, the paper feeding device also has a shearing blade coupled with a cutter cylinder which is connected with the sheet detecting device positioned in front of the paper send out end of the pinch rollers oppositely positioned, wherein the position where the paper transfer device is provided is such that the distance from the position of shearing blade for protective paper to the point where the protective paper sent out comes across the forward end of the plate-shape material is shorter than the distance from the point of crossing to the detecting position by the sheet detecting device, and

2. an interleaver for inserting paper in the piling of plate-shape material which is characterized by folding pinch rollers are provided in front of the piling device and at the transporting plane on a pass line of the plate-shape material, further there is provided, facing the folding pinch roller and along the paper supply and transfer line, paper transferring rollers, a paper cutting device and a paper transferring guide device which has a gas blow out opening and a forward end guide in a paper transferring direction and is connected with the paper transferring rollers and the paper cutting device, and

3. a tuck-in (insertion) apparatus for paper-like material in an apparatus for inserting paper between plate-shape materials in which paper folding pinch rollers are oppositely provided up and down on a transporting pass line of conveyor rollers, and a paper feeding device is provided at a suitable location between the adjacently placed positions, wherein a concave part is formed at about center of the upper roller of the above mentioned pinch rollers.

The object of the present invention lies in composing the paper inserting apparatus so that arrival of the forward end of the steel sheet is detected by the detecting device, then its signal is sent to the paper feeding device, wherein by the device the protective paper arrives at the crossing position on the steel sheet transferring pass line earlier than the arrival of the forward end of the steel sheet, and by sending out more of the protective paper by the paper transferring device the protective paper is hooked around the forward end of the steel sheet and is made to pass between the pinch roller and the conveyor roller thus the forward end of paper is folded to two with the steel sheet being held therebetween, and the paper and the steel sheet are fed into a piler with both of them so closely put together so as not to separate and the edge of the plate is protected by the protecting paper, so that surface scratch and damage and particularly, damages by the non-protected edge of the sheet on the surface of the already-piled sheet are effectively prevented.

The present invention can also be composed as required so that a loop device is provided between a paper supply device and the paper feeding device whereby the invention can be fitted to speeding up of the operating line or a large diameter paper coil can be used, reducing the number of stops of operation due to breaking of paper.

Now examples of the present invention shall be explained in detail referring to drawings.

FIG. 1 is a schematic drawing of an existing apparatus for inserting paper between plate-shape material.

FIG. 2 is a schematic drawing of a shear line having the apparatus of the present invention.

FIG. 3 is a detailed schematic drawing of a protective paper supply device.

FIG. 4 is a schematic drawing of FIG. 3 with a portion thereof shown in detail.

FIGS. 5-A and 5-B are schematic drawings for paper send out part.

FIG. 6 is a schematic drawing to show its mechanism.

FIGS. 7 and 8 are detailed schematic drawings of a paper supply device.

FIG. 9 is a side elevation to show a modification of a paper transferring device of the present invention.

FIGS. 10, and 11 are schematic drawings in cross sectional view of important parts of FIG. 9.

FIGS. 12, and 13 are drawings to show the state of inserting paper like material by the apparatus of the present invention.

FIG. 14 is a front elevation of a modification of the pinch rollers of the apparatus of the present invention.

FIG. 15 is an oblique three dimensional drawing to show the state of tucking in (folding-in) by the apparatus of the present invention.

EXAMPLE 1

FIG. 2 is an overall drawing to explain the positional arrangement showing an example wherein the present invention is applied to the shear line, wherein 4 shows a shear to cut steel sheet, 5 is an inspection conveyor, 5' shows a switching conveyor for steel sheets, wherein steel sheets are sorted into upper and lower conveyors dividing them by feeding order by said switching conveyor 5'. 6 is a feed in conveyor and detection of forward end and rear end of a steel sheet and measuring of plate length are done by a detecting device 30, which is to be described later, near the last end of the conveyor 6.

7 is a vacuum conveyor to suck the steel sheets fed in and carry the same to prescribed position, 8 shows a piler to receive said steel sheets, and 9 is a protective paper supply device by which paper coil is unwound according to the plate length and speed.

10 is a loop device used to correspond with high speed, and 11, 11' are pinch rollers. 12 is a paper feeding device which receives supply of protective paper by the above mentioned supply device 9 and conducts transferring of paper, and 9' shows a feed in conveyor for paper coil.

FIG. 3 shows a main body of the paper feed out device, wherein 30 shows the detecting device to detect the forward end and rear end of steel sheet, 11, 11' show the pinch rollers which send out paper corresponding to the length and speed of the steel sheet measured by the above mentioned sheet detecting device 30.

19 shows a cutter to cut the protective paper 1, and 19' shows a blade receiving stand of the cutter 19. 22 shows a paper support stand, 20 shows a toggle link, and 21 shows a cutter cylinder, wherein the signal of the above mentioned steel sheet detecting device 30 is transmitted to the cutter cylinder 21 to let the toggle link 20, the blade edge stand 19', and the blade edge 19 work upward, so that the protective paper 1 is cut thereby and by the paper support stand 22.

23 shows an inlet roll for the paper 1. 24 shows a paper spanning board, 25 shows a paper guide, 26 shows a steel sheet receiving roll, 27 shows a guide, 28 shows conveyor roller and, 29 shows a conveyor for feeding into the piler, 31 is a spanning board to feed steel sheet, 32 shows a screw down device of the pinch roll 11', and 33 shows an air tube to send air to the paper guide 25 to facilitate feeding of the paper.

The present invention is composed so that the distance from the crossing point, of the proceeding direction of the protective paper being transferred to the transferring pass line of the plate shape material being transferred and the plate shape material transferring pass line, to the edge position of the cutting blade 19 is shorter than the distance from said crossing point to the detecting position of the plate shape material by the detector 30.

Now important parts of the above arrangements shall be explained. The feeding conveyor 6 and the paper send out roll 11 are made to have same speed by having the driving diverted from the conveyor 6, and 11 rotates always under same condition as that for the conveyor 6, and one rotation per sheet of steel sheet will be made by an in and out of the clutch to be explained later.

Now, when steel sheet 2 proceeds to the state shown in FIG. 3, the paper send out device cuts the paper in the shape shown in the drawing during its proceeding, into such length as required for sending out.

The steel sheet 2 hooks a forward end of paper and enters between next pinch roll and conveyor and is sent to the piler 8 in the form shown in the drawing. The piler 8 sucks the steel sheet with the vacuum conveyor 7 and drops the same at a predetermined position thus performing the piling.

Next, the paper send out device shall be explained in detail by FIG. 4.

11 is a driving pinch roll having a clutch 12' and a brake 13 on both sides. 11' is a reduction pinch roll, and the driving is diverted from the conveyor 6 (it could be the other one if it is of same speed conveyor) to a sprocket 15, and the sprocket 15' and a clutch 12' rotate simultaneously on an axle of the pinch roll 11 on which they are rotatably placed. The clutch 12' becomes in and the brake 13 is cut by steel sheet forward end detecting signal of the steel sheet detecting device 30 to rotate the pinch rolls 11 11', then the clutch is cut and the brake becomes to work by the sheet rear end detecting device, while paper of such length as required for the length of steel sheet is sent out. The sheet rear end detecting signal works on the cutter cylinder 21 to have the toggle link 20, a blade receiving stand 19' and the blade 19 work upward to perform cutting of paper together with paper stand 22.

Therefore, the pinch rolls 11 11' stop in such form as tucking paper as much as the separation between the center of the pinch roll and the center of cutter.

Next, the arrangement of the paper loop device 10 shown in FIG. 2 shall be explained. Ordinary paper is fed in such manner as shown in FIG. 5-A. That is, a small loop is provided between paper send out pinch rolls 11 11' and the paper coil 9'' to brake slightly the paper coil 9'' during the sending out of the pinch rolls 11 11' for unwinding the same with back tension, and this method can be applied with speed of 50 to 75 meters per minute. In this method the diameter of paper coil can not be made large as paper will be cut. Therefore it has such shortcoming that the operation must be stopped while the paper coil is being replaced, impairing production.

FIG. 5-B shows a case wherein the protective paper is placed on upper face of the steel sheet and its principle is same as that for FIG. 5-A.

While this example shows a case of 4 loops in FIG. 6, the amount of loop increases as the number of loops increase. In FIG. 6 34 is a loop guide, 35 is an up and down roll, 36 is a rack gear for the up and down roll (to retain the roll 35 in horizontal position), and 37 is a fixing roll for the loop. A limit switch 38 is attached to upper part of the loop guide 34 and a limit switch 39 is attached to lower part of the same. FIG. 7 shows a paper supply device. 9'' is a paper coil, note FIGS. 5-A and 5-B 40 is a coil receiving stand, 41 is a coil center and 42 is a cylinder for moving the center 41 in and out. Thus the drawing is an over all view but as details are not shown this mechanism shall be explained in FIG. 8.

In FIG. 8, 43 is an over-run clutch, 44 is a clutch for driving the center 41, and 45 is an electric motor being driven at the same speed as that of plate speed. 46 is a driving chain, 47 is an emergency stop brake, 48 is a brake for back tension, 50 is a timing pulley, 51 is a

transmitting chain, 52 is a pulse generator, and 53 is a converter to adjust the braking power of the back tension brake based on the figure detected from the pulse generator 52.

The relationship between the paper supply and the loop device shall be explained by FIG. 6 and FIG. 8. When the paper sending signal is received while the up and down roll 35 is located at position "A" in FIG. 6, the clutch 12' (FIG. 4) of the pinch roll 11 and the clutch 44 for center driving become in, effecting sending of or feeding the paper.

As the clutch 44 is intended to assist starting up the paper coil (for preventing the cutting of paper), the clutch 44 is placed in off state by a timer and takes the paper out while giving tension with the back tension brake 48. Next when the clutch 12' is cut, the brake 13 is in and the emergency stop brake 47 is in by the stop signal, the paper coil proceeds with inertia then stops and the up and down roll stops above the limit switch 39 in FIG. 6. When from this state next paper is fed, that is the in and cut of the clutch 12' is done with regular intervals the emergency stop brake 47 does not function and the up and down roll 35 sends out paper maintaining almost same distance.

When distance between plates is wide, that is when there is rejected plate the clutch will be delayed to be in thus the paper coil continues to be unwound and the up and down roll 35 continues descending.

At this time when the limit switch 39 is passed, the emergency stop brake 47 becomes in by the signal 39 stopping the paper coil.

While the above shows the relationship between the paper supply device and the loop device, the system shown in FIGS. 5-A and 5-B will have cutting of paper and can have only small diameter paper coil. Thus it has such shortcoming as having suspension of operation during processing, but the method shown above has such advantage that it has no paper cutting with short loop. Thus paper insertion can be done using a large diameter paper coil.

Next explanations shall be made of the function.

The arrival of the forward end of plate-shape material is detected by the sheet detecting device 30 provided near the conveyor 6, and by transmitting the signal to the clutch 12' which diverts the driving from the above mentioned conveyor 6 and making simultaneous rotation, the pinch rollers 11 11' are rotated with the clutch 12' being coupled to the pinch roller 11, thereby sending the protective paper out to the transferring pass line of the plate-shape material, then the rear end of the plate-shape material is detected by the detector 30 and at a same time when the coupling of the clutch 12' and the pinch roller 11 is released by the signal the sending of the protective paper is stopped by having the pinch roller 11 coupled with the brake 13, and the above mentioned signal for passing of the rear end of plate shape material is also transmitted to the cutter cylinder 21 to activate the cutter cylinder 21 to perform cutting of protective paper.

Therefore the apparatus is stopped in such a state that the paper is inserted as much as the separation from the point between the pinch rollers 11 11' and the cutting blade.

And in the present invention the apparatus is so arranged that the distance from the crossing point of the proceeding direction of the protective paper being sent out toward the transferring pass line of the plate-shape

material and the transferring pass line of the plate-shape material to the edge position of the cutting blade 19 is shorter than the distance from same crossing point to the detecting position of the plate-shape material by the detecting device 30, and the protective paper is made to arrive at the above mentioned crossing point always earlier than the forward end of the plate-shape material thus the protective paper is sent out more, and it is hooked by the forward end of the plate and is fed into between the pin roller 14 and the conveyor roller 28.

EXAMPLE 2

Example 2 of the present invention shall be explained referring to the side elevation shown in FIG. 9. In the drawing 113 is a frame of a paper sending device according to the present invention, 114 is a paper erecting guide to erect the protective paper 102 into the vertical direction, 115 is a tightening bolt for fixing the paper erecting stand to an end part of a guide device to screw the lower part of the paper erecting forwardend guide 114 to the guide device 105', note FIG. 10, which guides a protective paper 102.

The paper erecting forwardend guide 114 is made of elastic material in the present invention, and guides the protective paper 102 to erect the same vertically, and the protective paper 102 is hooked by the passing steel sheet 101, note FIG. 10, then as the protective paper 102 is pulled to the direction of the pinch rollers 109 109', the protective paper 102 is guided vertically while preventing the protective paper 102 from creasing by the paper erecting forward end guide 114 which is of elastic material, then the guide 114 bends itself following the proceeding of the protective paper 102 and the paper can be inserted between steel sheet without going against the proceeding of the paper. The forward end guide 114 can be of such mechanism as can follow the proceeding of the protective paper 102 after guiding the protective paper 102 to vertical direction, for example, rigid material can be axially placed at its lower part to an end part of the guide device and is placed on a spring thereby providing the same in a freely rotatable manner. And it can be positioned by any suitable methods and not limited to the above mentioned axial positioning with bolt.

116 is a cutter guide, and 107 shows blade edge of a cutter to cut the protective paper 102. 107' is a blade stand of the cutter 107, and 107'' shows its fixing stand. 119, 119', 119'' show, respectively, link parts of a toggle link which are axially supported in such manner as freely rotatable to each other, and the lower part 119' of the toggle link is provided in a freely rotatable manner to the paper sending device frame 113 by suitable member, and the upper toggle link part 119 is axially placed to the lower end of the fixing stand 107''. 127 is a guide frame to guide the toggle link parts 119, 119', 119'' to in the vertical direction, and one end thereof is provided at the paper sending device frame 113 by a suitable member, and the other end is axially placed to the above mentioned toggle links 119, 119' in a freely rotatable manner. 120 shows an actuating device, being engaged at one of its ends to the toggle links 119', 119'', and in this example a cutter cylinder, and it is arranged so that the forward end and rear end of a steel sheet are detected by the detecting device 108 and their signals are transmitted to the cutter cylinder 120 thus activating the cutter cylinder 120, pushing the

toggle link, and being guided by the guide frame 127, then the toggle link is pushed upward making the fixing stand 107'', the blade edge 107' and the blade edge 107 ascend performing the cutting of the protective paper 102 by the blade stand 105'' and the blade edge 107, then after cutting descending will be done in the order reverse to the above mentioned order.

The above mentioned cutting device is not limited to the use of the toggle links 119, 119', 119'', but may naturally be other actuating mechanism for example such mechanism as directly ascending and descending by fluid pressure cylinder.

The blade receiving stand 105'' should be as shown in FIG. 9, only at rear of the blade edge 107 that is at paper sending side or at left side of FIG. 9 but preferably not at front of the same. The reason therefore is that when an upward blade 105'' is provided at front end, bending of the forward end of the protective paper 102 at the time of cutting which causes enfolding is prevented.

Of course for advantages in cutting protective paper 102 it can be provided also in front of the blade edge 107, but in such case a pressurized gas blowing member or other suitable member may be provided to prevent enfolding of the protective paper 102.

117 is a paper receiving roller to receive the protective paper 102 from supply side and send the same out, and 106 106' show paper transferring pinch rollers, which are connected to the above mentioned detecting device 108, and passing of the forward end of the steel sheet 101 is detected by the detecting device 108, then the protective paper 102 is made to arrive at the crossing point of the steel sheet 101 always earlier than the arrival of the forward end of steel sheet, wherein passing of the rear end is detected to stop sending of paper.

121 is a paper spanning board between the paper receiving roller 117 and the pinch rollers 106 106', and 123 is a pressurized gas supply pipe provided near the pinch rollers 106, 106' that is in this example in front position of the cutter guide 116, and 124 shows a blow out nozzle provided at the pressurized gas supply-pipe 123, and said nozzle is provided in necessary numbers in the crosswise direction of the plate having their blow out openings facing obliquely to the proceeding direction of the protective paper 102 from both upper and lower positions. 125 is a pressurized gas supply pipe at a suitable distance from the above mentioned pressurized gas supply pipe 123 and in this example at rear of the cutter guide 116 at the right side in the drawing. 126 shows a nozzle provided at said pressurized gas supply pipe, and the blow out opening of the nozzle is provided to vertical direction as along the forward end guide 114 described before.

Now an example of function of the apparatus of this example shall be explained. As shown in FIG. 9 the protective paper 102 is seized by stationary pinch rollers 106, 106' and is floating within the guide in such state as being pulled by the gaseous pressure from the blow out nozzles 124 provided at cross-wise direction at upper and lower direction of the pressurized gas supply pipe 123.

Now as shown in FIG. 9 the steel sheet is transferred by a sending conveyor and the forward end of the steel sheet is detected by a detecting device (refer to FIG. 3). Said the detecting device is connected to actuating mechanism of the paper transferring pinch rollers 106,

106' and the cutter 107, and the detecting signal for arrival of the steel sheet is transmitted to the actuating mechanism of the pinch rollers 106, 106' for paper sending, then the paper transferring pinch rollers 106, 106' are rotated with the signal through the actuating mechanism that is a clutch (not shown in the drawings) provided on an axle for the pinch rollers 106, 106', thus the protective paper 102 is sent out without causing crease by the action of the gas pressure by the blow out nozzle 124, then the protective paper 102 is made to contact the forward end guide 114 while crease is prevented by gas pressure of the blow out nozzle 126 and is turned into the vertical direction, thus the protective paper 102 is made to erect itself and is transferred in the vertical direction crossing the transferring pass line of the steel sheet.

In this case in order to have the forward end of the protective paper 102 arrive earlier than the forward end of the steel sheet at the crossing point of the transferring pass line of the steel sheet and the protective paper 102, the pinch rollers 106, 106' are actuated by the detecting device 108, and the forward end of the protective paper 102 which blocks the proceeding direction of the steel sheet is pushed, and bent by the pinch rollers 109, 109', then the detecting device 108 detects the rear end of the steel sheets and the signal is transmitted to the cutter actuating mechanism that is the cutter cylinder 120 to actuate the same, and the fixing stand 107'', the blade stand, blade edge 107 are made to ascend and descend to cut the protective paper 102 with the blade receiving stand 105'' and the blade edge 107, and at the same time the brake (not shown in the drawing) for the pinch roller 106, 106' is actuated by the signal from the detecting device to stop rotation of the rollers, stopping the sending of the protective paper to wait for next sending.

When elastic material is used in the forward end guide 114 as the protective paper 102 is made to vertically cross the transferring pass line of the steel sheet and to advance to the proceeding direction after having its forward end folded by the pinch rollers 109, 109', the guide 114 is deformed as shown in FIG. 11. Thus the change from the state of FIG. 10 to FIG. 11 is done rapidly, therefore it is not necessary to use particularly strong paper as the protective paper 102, and creasing of paper is prevented by the forward end guide 114.

The guide device consists of 105, 105' and 105'', and particularly 105'' works as the receiving stand to receive the cutter blade edge 107 at the time of paper cutting, and in this case the receiving stand 105'' is provided only at rear end but not at front end, thereby the protective paper 102 is prevented from being caught or tucked in.

EXAMPLE 3

This example shows a modification of the pinch rollers in the apparatus of the present invention. The pinch roller is so made as to have the shape shown in FIG. 14, that is to have an indented part with suitable length at about center of the pinch roller 209'. That is, the central portion of the pinch roller 209' has a stepped shape so that when the protective paper 202 is folded, only both end parts are folded while the central part is not folded but only bent (refer to FIG. 15).

The protective paper 202 is as in the foregoing Examples is made to vertically protrude so as to crossing the transferring path direction of the steel sheet perpendic-

ularly, so that the forward end of the steel sheet pushes the protective paper 202 to bend the same and further folding of the same is done by the pinch roll.

As the central part of the upper pinch roller 209' is made to have a stepped shape as shown in FIG. 14 in this case, the folding of the paper is done only at both end parts of the pinch roller 209' while the central part is only bent without having folding line (mark) as shown in FIG. 15, and the paper in such shape is sent into a lifter by a conveyor and a vacuum conveyor, thus the folded part of the paper is made to erect by sliding in of the steel sheet or by blowing in of gas if necessary, preventing such shortcoming that unevenness in the surface of the steel sheet or unevenness in the piling height of paper insertion is generated causing collapse of pile.

What is claimed is:

1. A method of inserting film shape protective material, such as paper, between individual sheets of plate-shape material, such as steel sheets, aluminum sheets, glass plates and the like, including moving individual sheets of the plate-shape material along a first path of travel to a stacking position, locating a signal-emitting member along the first path of travel of the plate-shape material upstream from the stacking position for sensing the movement of a sheet of the material along its path of travel, feeding a continuous strip of protective material along a second path of travel toward the first path of travel so that the two paths of travel intersect, positioning a cutting member in the second path of travel for cutting the strip of protective material, wherein the improvement comprises synchronizing the speeds of travel of the protective material and the plate-shape material for movement at the same speed along their respective paths of travel, locating the cutting member closer to the point of intersection of the first and second paths of travel than the signal-emitting member, actuating the movement of the strip of protective material as the leading end of each individual sheet of plate-shape material passes the signal-emitting member so that the leading end of the strip of protective material advances across the first path of travel before the sheet of plate-shape material, which actuated the signal, reaches the point of intersection of the two paths of travel so that the leading end of the plate-shape material contacts the strip of protective material rearwardly of the leading end of the strip, folding over the strip of protective material on the leading end of the sheet of plate-shape material, and cutting the strip of protective material in response to a signal emitted when the trailing end of the sheet of plate-shape material being covered by the protective material passes the signal-emitted member.

2. A method, as set forth in claim 1, wherein folding only a portion of a leading end of the strip of protective material on the leading end of the sheet of plate-shape material so that the portion of the leading end of the protective material not folded re-opens subsequently when the covered sheet of plate-shape material is placed in a stack.

3. An interleaver for inserting a layer of protective material between individual sheets of plate-shape material piled in a stack, comprising means for conveying individual sheets of plate-shape material to a stacking device and forming a first path of travel for the individual sheets, means for feeding a continuous strip of the protective material along a second path of travel inter-

secting the first path of travel so that the protective material extends transversely along the first path of travel, a detecting device positioned adjacent the first path of travel for sensing the passage of individual sheets of plate-shape material along the first path of travel, said detecting device located upstream along the first path of travel from the point of intersection of the first and second paths of travel, a cutting device located along the second path of travel upstream from the point of intersection of the first and second paths of travel, a guiding device for the protective material located in the second path of travel between said cutting device and the point of intersection of the first and second paths of travel, said guiding device including an opening for blowing gas in the direction of movement of the protective material and a forward end guide for directing the protective material to the point of intersection of the first and second paths of travel, a pair of pinch rollers located downstream from the point of intersection of the paths of travel in the first path of travel of the plate-shape material to be stacked, wherein the improvement comprises that said cutting device is located in the second path of travel closer to the point of intersection of the first and second paths of travel than said detecting device located in the first path of travel, said detecting device arranged to actuate said means for feeding the protective material when the leading end of an individual sheet of the plate-shape material passes said detecting device and for stopping said means for feeding the protective material and for actuating the cutting device when the trailing end of the same sheet of plate-shape material passes said detecting device, said means for conveying the individual sheets of plate-

shape material and said means for feeding the continuous strip of protective material arranged to operate at the same speed so that, upon actuation by said detecting device, said means for feeding the continuous strip of protective material feeds the strip along the second path of travel until it extends transversely across the first path of travel downstream from the leading end of the sheet of plate-shape material which caused the detecting device to actuate said means so that the leading end of the strip extends across and beyond the first path of travel and as the leading end of the sheet of plate-shape material reaches the point of intersection of the first and second paths of travel, it carries the leading end of the protective material into said pinch rollers with the leading end being folded over on the leading end of the sheet of plate-shape material and as the trailing end of the same sheet of plate-shape material passes said detecting device, the operation of said means feeding the continuous strip of protective material is discontinued and said cutting device is actuated for cutting off the desired length of the strip for covering the sheet of plate-shape material.

4. An interleaver, as set forth in claim 3, wherein said pinch rollers are arranged with a first portion of their surfaces in contacting relationship and a second portion of their surfaces in spaced relationship so that only a portion of the leading end of the strip is folded over on the leading end of the sheet of plate-shape material with the remaining portion capable of re-opening the time of the stacking of the sheets of the plate-shape material.

* * * * *

35

40

45

50

55

60

65

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,837,636 Dated September 24, 1974

Inventor(s) Nobumitsu Hagi et al

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

In the Heading of the Patent:

The number of the Japanese priority application of October 29, 1971 should read:

--46-86003--.

Signed and sealed this 3rd day of December 1974.

(SEAL)
Attest:

McCOY M. GIBSON JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents