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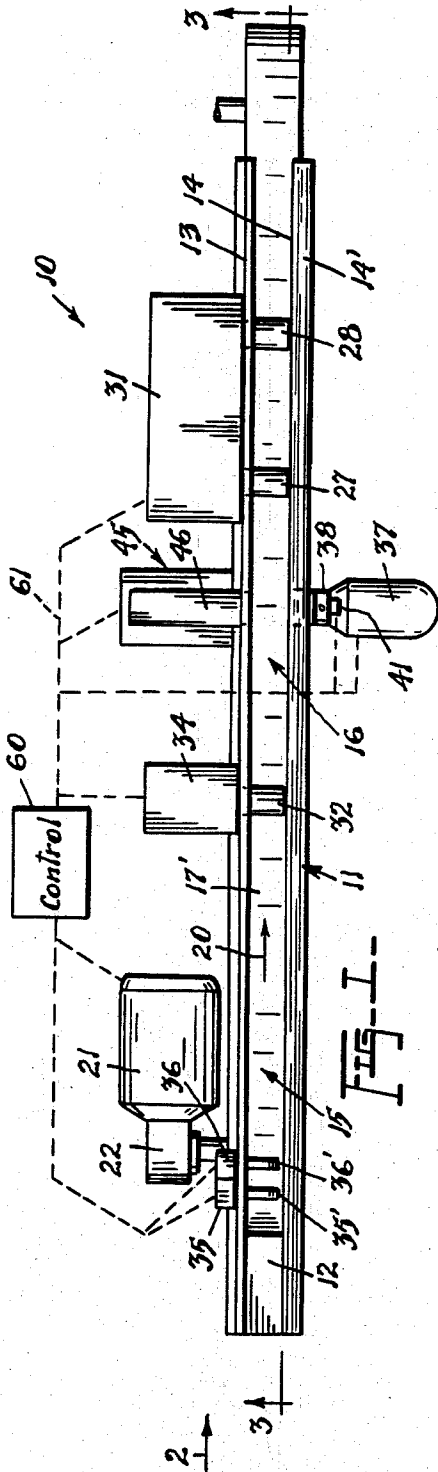
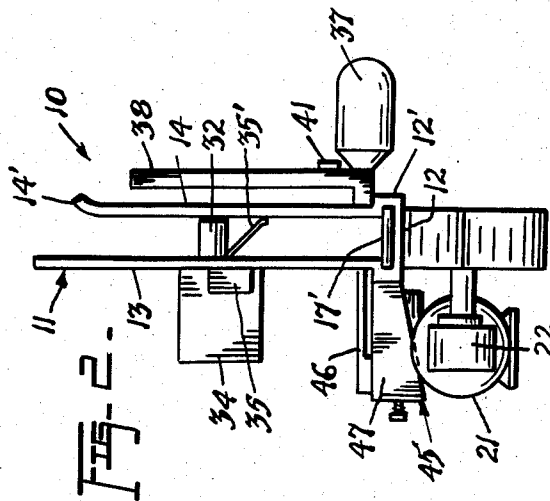
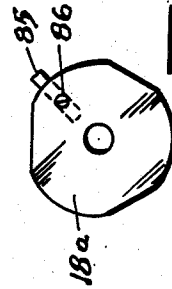
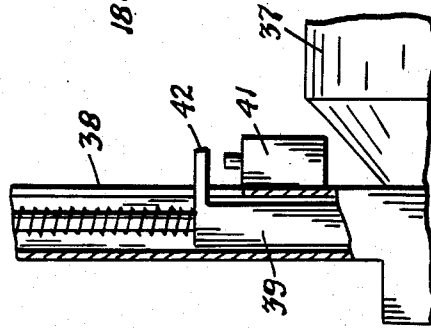
D. J. DE FRANCIS ET AL

3,248,033

APPARATUS FOR STAPLING SHEETS INTO PADS

Filed June 24, 1965

3 Sheets-Sheet 1



INVENTORS

Dominick J. DeFrancis
James M. Fooks
Louis T. Staats, Sr.

BY

Munson H. Lane

ATTORNEY

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Munson H. Lane
ATTORNEY

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3 Sheets-Sheet 3

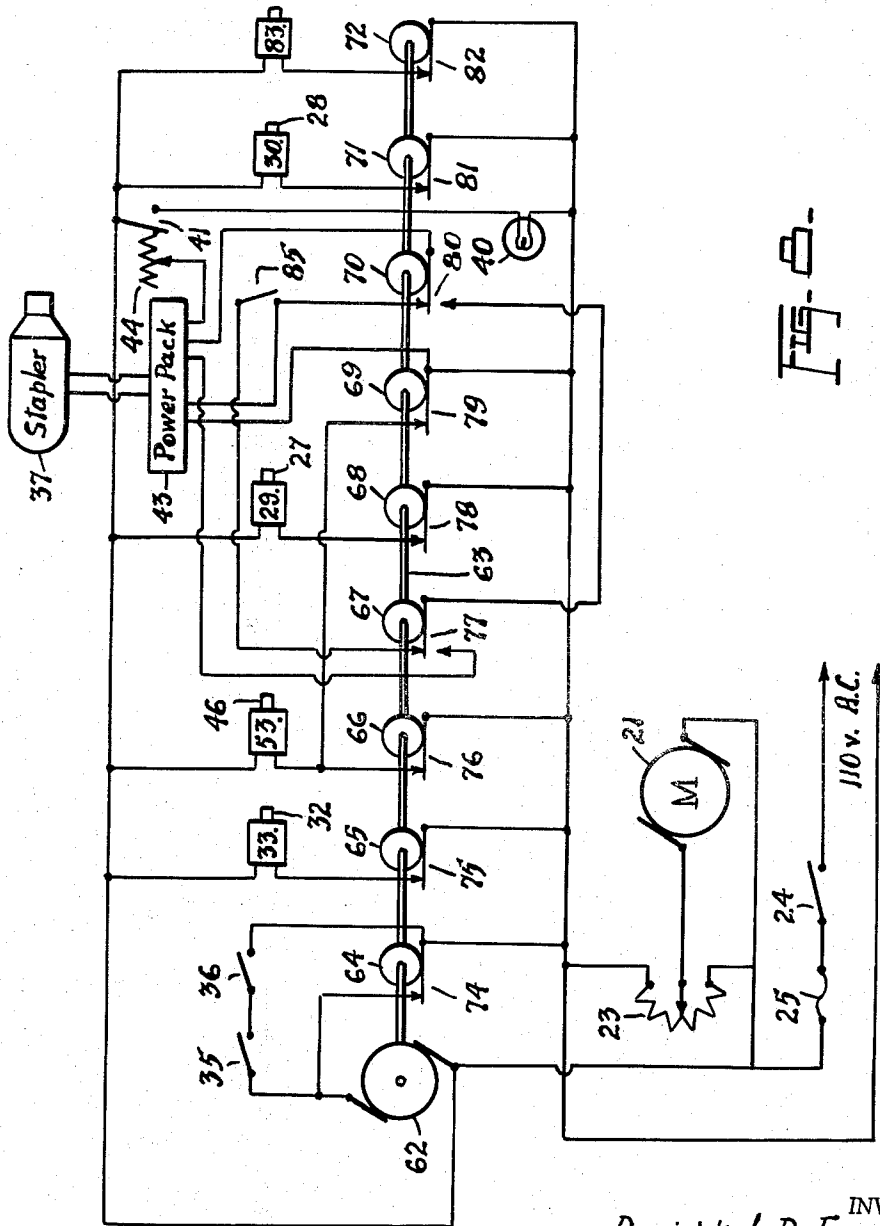


FIG. 3

INVENTORS

Dominick J. DeFrancis

James M. Fooks

Louis T. Staats, Sr.

BY

Munson H. Lane

ATTORNEY

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APPARATUS FOR STAPLING SHEETS INTO PADS
Dominick J. De Francis, 413 Eastman Road, and James
M. Fooks, 31 Paschall Road, both of Wilmington, Del.,
and Louis T. Staats, Sr., Rte. 1, Lincoln University,
Pa.

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12 Claims. (Cl. 227-100)

This application is a continuation-in-part of our co-
pending application Serial No. 275,289, filed April 24,
1963, for Apparatus for Stapling Sheets into Pads, now
Patent No. 3,191,838, issued June 29, 1965.

The apparatus in accordance with our aforementioned
earlier application includes a trough-like holder having
a loading station for receiving a set of juxtaposed sheets,
a stapling station with one or more stapling positions, and
conveyor means for delivering the juxtaposed sheets from
the loading station against a stop in the stapling station
so that the sheets are properly edge-aligned prior to
stapling.

The principal object of the present invention is to struc-
turally and functionally improve upon the apparatus of
our earlier application, one such improvement involving
the provision of means for jogging the juxtaposed sheets
at the loading station into proper edge-alignment and also
into proper contact with the conveyor means, so that the
properly positioned set of sheets may then be transferred
by the conveyor means from the loading to the stapling
station.

Another feature of the invention resides in the provision
of a solenoid actuated anvil at the stapling station for
coaction with the stapler, such anvil being self-adjusting
to automatically compensate for different number of sheets
and resultant thickness of the stapled pad.

Another feature of the invention resides in the provision
of a clock-driven timer switch control for sequentially
coordinating the operation of the various electrical com-
ponents of the apparatus in a cyclic manner.

Other objects and features of the invention will be-
come apparent from the following description taken in
conjunction with the accompanying drawings, wherein
like characters of reference are used to designate like parts,
and wherein:

FIGURE 1 is a top plan view of the Stapling Apparatus
in accordance with the present invention;

FIGURE 2 is an end elevational view thereof, taken
in the direction of the arrow 2 in FIG. 1;

FIGURE 3 is a vertical, longitudinal sectional view,
taken substantially in the plane of the line 3-3 in FIG. 1;

FIGURE 4 is a fragmentary, enlarged view, partly in
elevation and partly in section, of the staple magazine;

FIGURE 5 is a fragmentary, enlarged vertical sectional
view of the solenoid-actuated anvil;

FIGURE 6 is a fragmentary underside plan view of
the anvil shown in FIG. 5;

FIGURE 7 is an elevational view of a modified jogging
pulley; and

FIGURE 8 is a wiring diagram of the electrical com-
ponents of the invention.

Referring now to the accompanying drawings in detail,
the stapling apparatus is designated generally by the refer-
ence numeral 10 and, as in our aforementioned earlier
application, embodies in its construction a horizontally
elongated, trough-shaped holder 11 which includes a strip-
like bottom wall 12 and a pair of relatively high, closely
spaced side walls 13, 14, so that the trough-shaped holder
is relatively deep and narrow and is open at the top and
both ends thereof. One end portion of the holder 11
constitutes a loading station indicated at 15, while its
other end portion constitutes a stapling station indicated

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at 16. The upper edge portion of the holder side wall
14 is preferably curved outwardly as at 14' to facilitate
insertion of sheets to be stapled into the loading station,
it being understood that such sheets are inserted into the
loading station through the open top of the holder.

An endless conveyor belt 17 passes around a pair of
pulleys 18, 19 and the upper run 17' of the belt slides
along the bottom wall 12 of the holder 11 in a direction
from the loading station 15 to the stapling station 16,
as exemplified by the arrow 20. The belt 17 is driven
by an electric motor 21 through a reduction gearing 22
operatively connected to the pulley 18, the speed of the
motor being controlled by a rheostat 23 in circuit with
a master switch 24 and a fuse 25, as shown in FIG. 8.

It will be also noted at this point that the bottom por-
tion of the holder 11 is widened as indicated at 12' so
that the belt run 17' underlies the lower edges of the
side walls 13, 14 to prevent any possibility of sheets being
caught between the belt and the side walls of the holder.

Provided adjacent the stapling station 16 in the holder
11 are first and second stop pins 27, 28 which are pro-
jectable and retractable through apertures formed in the
side wall 13, so that in their projected position these pins
abut the side wall 14 but in their retracted position they
are flush with the side wall 13. The stop pins 27, 28
are projected and retracted by individual solenoids 29, 30,
respectively, contained in a housing 31 on the outer sur-
face of the side wall 13.

Similarly, provided adjacent the loading station 15 in
the holder 11 is a stop pin 32 which is projectable and
retractable through the side wall 13 by a solenoid 33 in a
housing 34 on the outside of the side wall. Also, a pair
of juxtaposed micro-switches 35, 36 are mounted ex-
teriorly on the wall 13, these switches having depressible
actuators 35', 36', respectively, projecting into the loading
station 15.

Referring again to the stapling station 16, a solenoid-
actuated stapler 37 of any suitable conventional construc-
tion is mounted at one side of the holder, for example
on the side wall 14, so as to deliver a staple through an
opening in that side wall into a set of sheets in the sta-
pling station. A conventional staple magazine 38 is as-
sociated with the stapler 37 and contains a spring-pressed
staple follower 39. In accordance with the invention
means are provided for warning when the supply of staples
in the magazine is exhausted or nearly so, such means
comprising either or both a suitable buzzer (not shown)
and a warning light 40 in circuit with a switch 41 mounted
on the magazine 38. A suitable detent 42 is provided, for
example on the follower 39, to engage and actuate the
switch 41 when the supply of staples in the magazine is
exhausted or nearly exhausted, thus energizing the warn-
ing means 40. As shown in FIG. 8, the stapler 37 is
energized through a suitable power pack 43, and if de-
sired, the switch 41 may be double-sided, having a nor-
mally open side in circuit with the warning means 40
and a normally closed side in circuit with the power pack
43 through a resistor 44, the arrangement being such
that when the switch 41 is engaged by the detent 42, the
warning means 40 become energized and supply of cur-
rent from the power pack 43 to the stapler 37 is inter-
rupted.

Provided at the relatively opposite side of the holder 11
(as on the side 13) in transverse alignment with the
stapler 37 is an anvil unit 45 which includes an anvil bar
46 having one end portion thereof slidably projectable
through an opening in the wall 13 into the stapling sta-
tion 16 so as to back up the sheets in the stapling station
against the driving force of the stapler 37 and to clinch
the staple after it is driven.

The anvil unit 45 includes a supporting bracket 47 pro-

vided at the top thereof with an opening 48, and an inertia block 49, provided at the outer end of the anvil bar 46, projects through the opening 48 into the bracket 47, as shown in FIGS. 5 and 6. A stem 50 passes slidably through the outer end of the bracket and through the inertia block 49, having its inner end connected as at 51 to the armature 52 of a solenoid 53, mounted within the bracket. When the solenoid 53 is energized, its armature 52 is driven in the direction of the arrow 54, thus projecting the anvil bar 46 into the stapling station through the wall 13 to back up the sheets therein against the driving force of the stapler. However, it will be noted that a compression spring 55 is provided in the block 49 on the stem 50, this spring becoming compressed when the anvil bar 46 comes into backing engagement with the sheets before the solenoid armature 52 reaches the inner end of its travel in the direction 54. Thus, the armature is always able to complete its full travel regardless of the combined thickness of the sheets in the stapling station and the device automatically compensates for different numbers of sheets and the resultant thickness of the stapled pad. The inertia block 49 is slidable along a pair of guide rods 56 provided in the bracket 47 and suitable springs 57 on the guide rods serve to return the block to its initial position when the solenoid 53 is not energized. It will be understood that the block 49 has sufficient mass to inertially absorb the shock of the driven staple, thus supplementing the force exerted by the compensating spring 55.

The operation of the various electrical components of the apparatus is controlled in a coordinated, cyclic manner by a control unit 60 which, as indicated in FIG. 1, may be contained in a separate housing and electrically connected to the various components by suitable conductors 61. A diagrammatic illustration of the control mechanism appears in FIG. 8, wherein it will be noted that the mechanism includes a timer control motor 62 driving a shaft 63 on which are mounted a plurality of cams 64, 65, 66, 67, 68, 69, 70, 71 and 72, actuating the switches 74, 75, 76, 77, 78, 79, 80, 81 and 82, respectively.

The switch 74 is the timer homing switch and is in circuit with the aforementioned switches 35, 36 in the loading station 15. The switch 75 is connected in series with the solenoid 33 which actuates the stop pin 32 in the loading station. The switch 76 is in series with the solenoid 53 which actuates the anvil bar 46 at the first position of sheets in the stapling station 16, while the switch 77 actuates the stapler 37 through the power pack 43 also at the first position of sheets in the stapling station. The switch 78 is in series with the solenoid 29 which actuates the stapling station stop pin 27. The switch 79 actuates the anvil 46 by energizing the solenoid 53 at the second position of sheets in the stapling station, while the switch 80 actuates the stapler 37 through the power pack 43 at the second stapling position. The switch 81 in series with the solenoid 30 actuates the second stapling station stop pin 28, while the purpose of the remaining switch 82 will be hereinafter described. A selector switch 85 is provided in circuit with the switches 77 and 80 so that a staple may be driven either at both the first and the second stapling positions or at the second stapling position only.

Before proceeding to describe the operation of the invention it should be noted that the aforementioned conveyor belt pulley 18 at the loading end of the holder 11 is provided on the periphery thereof with a plurality of flat faces 18' so that when the belt is driven and sheets to be stapled are deposited into the loading station 15, the pulley 18 causes the belt to be jogged in a vertical direction, thus also jogging the sheets and causing their lower edges to come into proper contact with the belt. FIG. 7 shows a slight modification of this arrangement wherein the belt pulley 18a is also equipped with a radially projecting jogging lug 85, ad-

justably held in place by a set screw 86, whereby the amplitude of belt jogging may be varied as desired.

In operation, the master switch 24 is closed and the motor 21 is thus energized to drive the conveyor belt 17 in a continuous manner. A plurality of juxtaposed sheets to be stapled are then inserted downwardly into the loading station 15 so that they occupy the position indicated by the dotted lines S in FIG. 3 on top of the belt run 17'. Movement of the belt in the direction of the arrow 20 causes the leading edges S' of the sheets to come in contact with the stop pin 32 projecting into the holder 11 and the jogging action imparted by the pulley 18 to the belt and to the sheets will cause the sheets to become properly seated on the belt as well as aligned with their leading edges against the pin 32 and their bottom edges against the belt. As the sheets are inserted into the loading station, the actuators 35', 36' of the switches 35, 36 become depressed, this causing the switch 35 to open and the switch 36 to close. The open switch 35 prevents the timer control motor 62 from being energized, but as the jogging of the sheets continues so that the leading edges S' of all the sheets engage the stop pin 32, the trailing edges S'' of all the sheets clear the switch actuator 35' and permit the switch 35 to close.

With the switch 36 still closed, closing of the switch 35 energizes the timer control motor 62 which rotates the shaft 63 with the several cams 64-72 thereon for sequentially actuating the several switches 74-82. First, the cam 64 closes the switch 74 to keep the motor 62 energized independently of the switches 35, 36 for the duration of the entire cycle of operation. The cam 65 also closes the switch 75, thus energizing the solenoid 33 which retracts the stop pin 32, allowing the sheets to be conveyed by the belt 17 from the loading station 15 to the stapling station 16 where the leading edges of the sheets come into engagement with the first stop pin 27 as indicated at Sa.

The cam 66 then closes the switch 76 which energizes the solenoid 53, causing the anvil bar 46 to project into the holder against the sheets in the stapling station, whereupon closing of the switch 77 by the cam 67 energizes the stapler 37 and causes a staple to be applied to the sheets at the first stapling position. The switches 76 and 77 are then opened by their respective cams, permitting the anvil bar 46 to be withdrawn and the stapler power pack 43 to be recharged.

As rotation of the shaft 63 continues, the cam 68 closes the switch 78, thus energizing the solenoid 29 and retracting the first stop pin 27 from the stapling station. This permits the stapled sheets to be delivered by the belt 17 to the second stapling position wherein the leading edges of the sheets come into abutment with the second stop pin 28 as indicated at Sb. The switch 79 is then closed by the cam 69, again energizing the solenoid 53 to bring the anvil bar 46 against the sheets, whereupon closing of the switch 80 by the cam 70 again energizes the stapler 37, causing a staple to be applied to the sheets at the second stapling position.

Thereupon the switches 75, 79 and 80 are opened by their respective cams, thereby returning the stop pin 32 to its projected position, permitting the anvil bar 46 to be retracted, and the stapler power pack 43 to be recharged. The cam 71 then closes the switch 81, energizing the solenoid 30 and retracting the second stop pin 28 so that the completed pad of sheets, stapled at two positions, may be discharged from the apparatus by the conveyor belt 17 to a pad stacking apparatus such as is shown at the right hand side of FIG. 1 in the aforementioned application serial No. 275,289. The last cam 72, actuating the switch 82, may be used for energizing a solenoid 83 for effecting the pad stacking operation which is separate from the stapling operation herein described.

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Further rotation of the shaft 63 opens the switches 78 and 81 to return the stop pins 27, 28 to their projected position, and in the final phase of the operational cycle the switch 74 is opened by the cam 64, thus discontinuing the supply of current to the timer motor 62. The apparatus is then in readiness for the next cycle of operation.

While in the foregoing there has been described and shown the preferred embodiment of the invention, various modifications may become apparent to those skilled in the art to which the invention relates. Accordingly, it is not desired to limit the invention to this disclosure, and various modifications and equivalents may be resorted to, falling within the spirit and scope of the invention as claimed.

What is claimed as new is:

1. In an apparatus for stapling sheets into pads, the combination of a holder having a loading station and a stapling station therein, said holder including a pair of horizontally spaced upright walls open at the top of the holder to receive a set of juxtaposed sheets in a substantially vertical position therebetween, endless conveyor means provided at the bottom of said holder for supporting the bottom edges of said set of sheets and delivering the set of sheets from said loading station to said stapling station, movable stop means disposed adjacent said loading station in said holder and normally positioned across the path of travel of said set of sheets, means for jogging said conveyor means and the set of sheets thereon in said loading station to frictionally engage the bottom edges of the individual sheets in the set with said conveyor means and to align leading edges of the individual sheets against said stop means, means for withdrawing said stop means from across the path of travel of said set of sheets to permit delivery thereof by said conveyor means to said stapling station, and means at the stapling station for stapling the individual sheets in the set together.

2. The device as defined in claim 1 wherein said conveyor means include an endless belt having an upper run traveling along the bottom of said holder, and pulleys provided at the ends of said belt, said jogging means being embodied in one of said pulleys and said one pulley embodying said jogging means being disposed below said loading station for imparting vertical jogging to the upper run of said belt.

3. In an apparatus for stapling sheets into pads, the combination of a holder having a loading station and a stapling station therein, said holder including a pair of horizontally spaced upright walls open at the top of the holder to receive a set of juxtaposed sheets in a substantially vertical position therebetween, endless conveyor means provided at the bottom of said holder for supporting bottom edges of said set of sheets and delivering the set of sheets from said loading station to said stapling station, means for edge-aligning said set of sheets on said conveyor means preparatory to stapling, an electrically actuated stapler provided at one side of the stapling station in said holder for stapling the set of sheets into a pad, and an electrically actuated anvil provided at the relatively opposite side of said stapling station in transverse alignment with said stapler for backing up the set of sheets against the staple driving force during the stapling operation.

4. The device as defined in claim 3 wherein said anvil is projectable into and retractable from said stapling station.

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5. The device as defined in claim 3 wherein said anvil includes an anvil bar projectable into and retractable from said stapling station, together with solenoid means for projecting said anvil bar, and resiliently compressible means reacting between said solenoid means and said anvil bar to render the same self-adjusting in compensation for different thicknesses of pads to be stapled.

6. The device as defined in claim 3 wherein said stapler includes a staple supply magazine, together with electrical warning means responsive to the presence of staples in said magazine for indicating when the staple supply is exhausted.

7. In an apparatus for stapling sheets into pads, the combination of a holder having a loading station and a stapling station therein, said holder including a pair of horizontally spaced upright walls open at the top of the holder to receive a set of juxtaposed sheets in a substantially vertical position therebetween, endless conveyor means provided at the bottom of said holder for supporting bottom edges of said set of sheets and delivering the set of sheets from said loading station to said stapling station, movable stop means disposed adjacent said loading station in said holder and normally positioned across the path of travel of said set of sheets, means for jogging said conveyor means and the set of sheets thereon in said loading station to frictionally engage the bottom edges of the individual sheets in the set with said conveyor means and to align leading edges of the individual sheets against said stop means, means for withdrawing said stop means from across the path of travel of said set of sheets to permit delivery thereof by said conveyor means to said stapling station, an electrically actuated stapler provided at one side of said stapling station for stapling the set of sheets into a pad, and an electrically actuated anvil provided at the relatively opposite side of said stapling station in transverse alignment with said stapler for backing up the set of sheets against the staple driving force during the stapling operation.

8. The device as defined in claim 7 wherein said anvil includes an anvil bar projectable into and retractable from said stapling station, together with solenoid means for projecting said anvil bar, and resiliently compressible means reacting between said solenoid means and said anvil bar to render the same self-adjusting in compensation for different thicknesses of pads to be stapled.

9. The device as defined in claim 8 together with an inertia block carried by said anvil bar and having sufficient mass to substantially supplement said resiliently compressible means in reacting against the driving force of said stapler during the stapling operation.

10. The device as defined in claim 7 together with an electric timer switch mechanism for sequentially coordinating the operation of said stop withdrawing means, said anvil and said stapler.

11. The device as defined in claim 10 together with switch means responsive to presence and proper positioning of the set of sheets in said loading station for actuating said timer switch mechanism.

12. The device as defined in claim 7 wherein said stapler includes a staple magazine supply, together with electrical warning means responsive to the presence of staples in said magazine for indicating when the staple supply is exhausted.

No references cited.

GRANVILLE Y. CUSTER, JR., *Primary Examiner.*