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**Erba et al.**

[11] **3,865,020**

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[54] **DEVICE TO SELECTIVELY CONTROL THE EXPELLERS OF AUTOMATIC MACHINES TO PUNCH CARDBOARD SHEETS OR THE LIKE**


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[51] **Int. Cl.** ..... **B31b 1/74**

[58] **Field of Search** ..... 93/36 R, 36 A, 59 ES; 192/67 R, 67 P



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[57] **ABSTRACT**

The device is designed for application in punching machines to sever and to remove scraps or waste material from the punched cardboard sheet.

The device comprises a toothed clutch member **62, 64** inserted between the driving shaft **66** of the punching machine and a driven shaft **52,** whereby a first cam **56** is keyed to said driven shaft. Said first cam is designed to control the pierced table **22** of the punching machine on which the punched sheet is arranged, whereas a second cam **102** is integral with the first cam and actuates a shaft **95** connected by means of a counter-lever **104** with a guide-rail **93** to a support **40–42** to retain the punching tools **20** and **22,** provided with springed expellers **26,** said tools and the springed expeller means being arranged on a corresponding table, operated with the desired synchronism with respect to the other parts of the punching machine, to remove and expel the scraps from the punched sheet.


**10 Claims, 4 Drawing Figures**

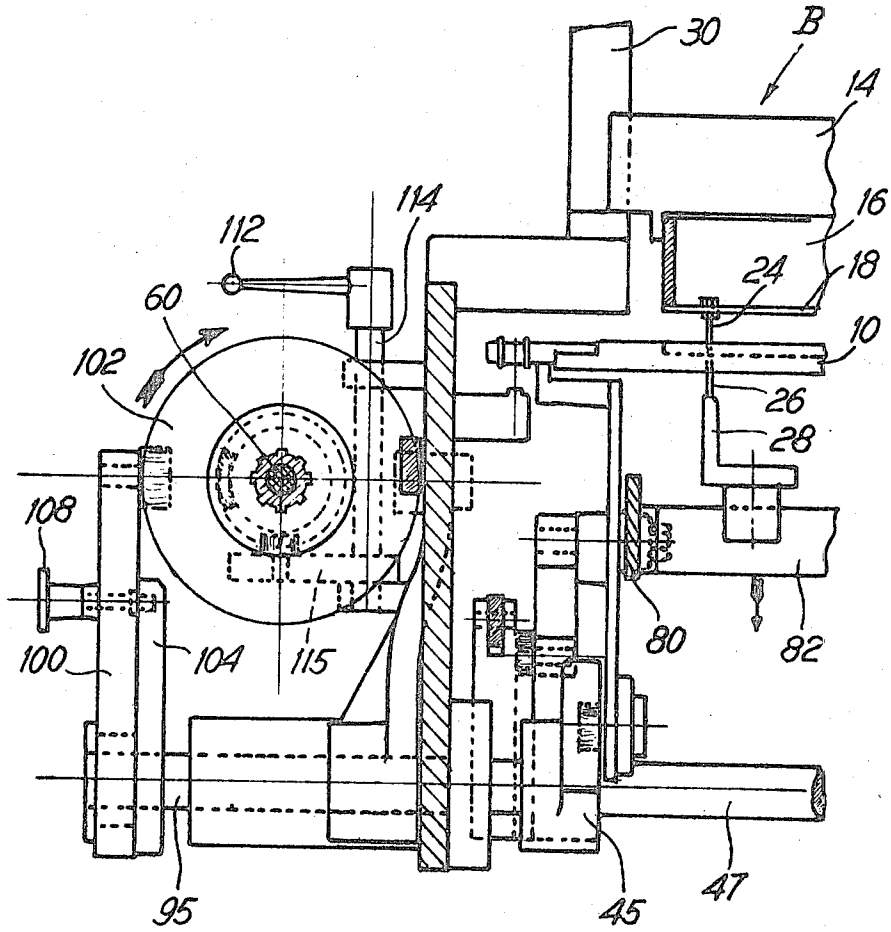


FIG. 1A

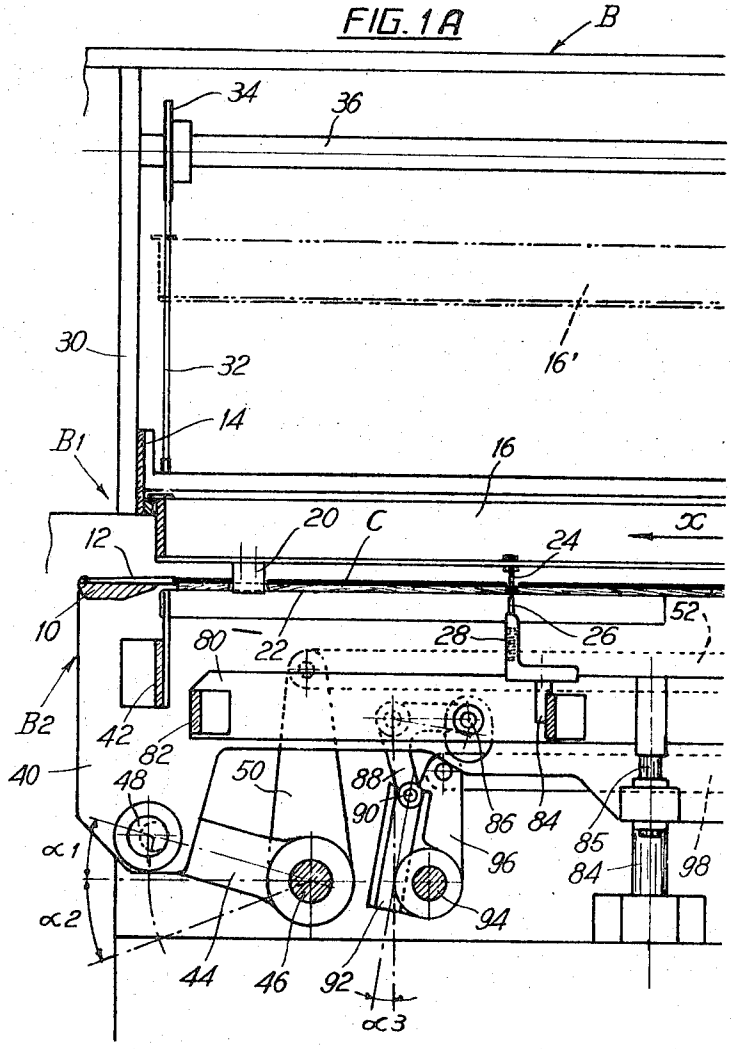

B
34
36
30
32
16'
B1
14
16
20
C
X
12
24
10
52
80
22
28
26
B2
42
82
40
48
50
88
90
86
84
85
84
98
96
α1
α2
94
44
46
92
α3

FIG. 2

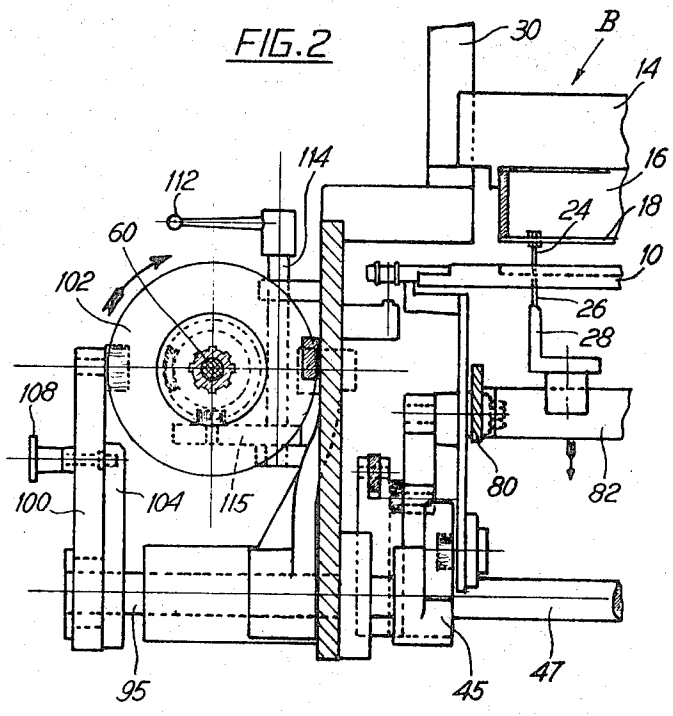

30
B
14
16
18
24
10
26
28
112
114
60
102
108
100
104
115
80
82
95
45
47

FIG. 3

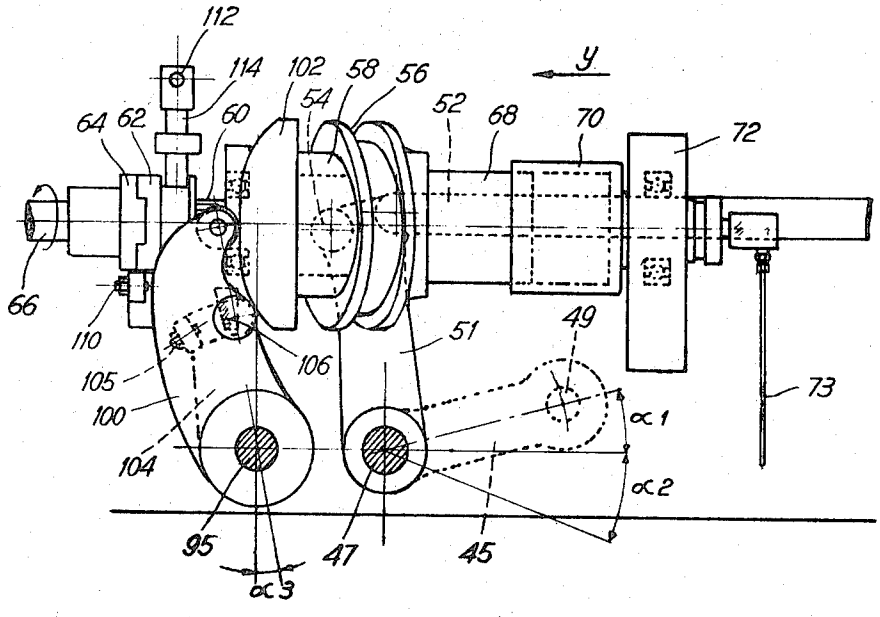
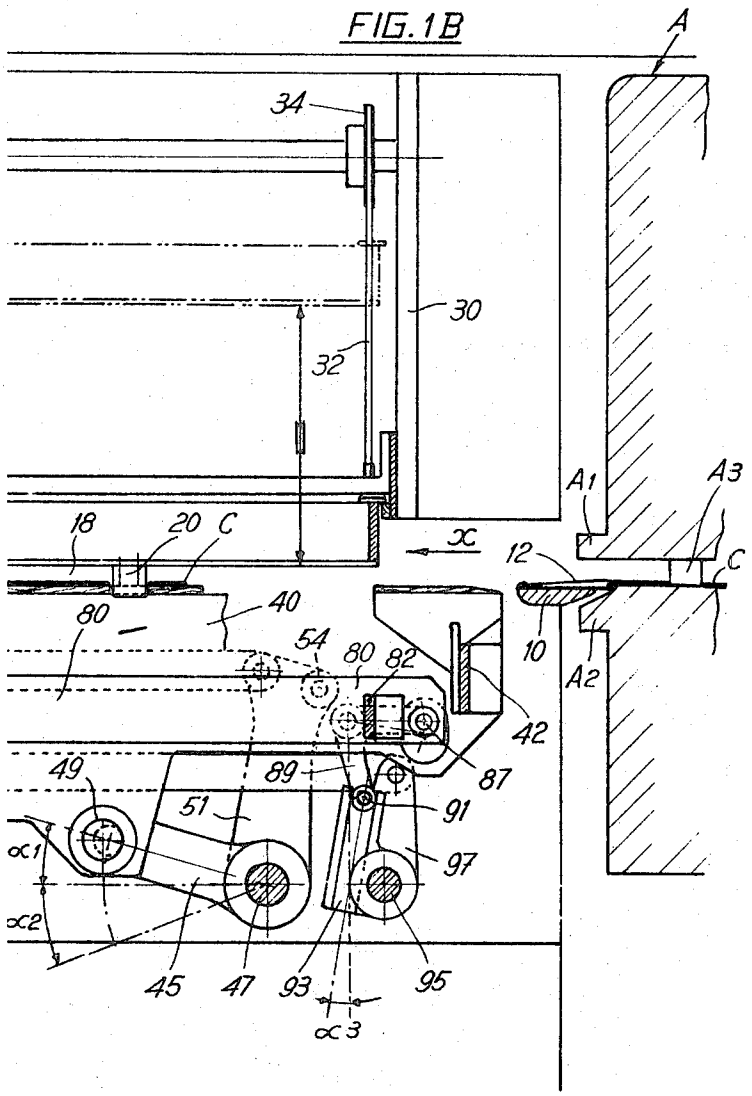

112
114
102
58
56
54
52
68
70
72
y
64
62
60
66
110
105
100
104
106
51
49
73
α1
α2
α3
95
47
45

FIG. 1B


A
34
30
32
A1
A3
18
20
C
X
12
C
40
80
54
80
82
10
A2
42
49
89
87
51
91
97
α1
α2
45
47
93
95
α3

# DEVICE TO SELECTIVELY CONTROL THE EXPELLERS OF AUTOMATIC MACHINES TO PUNCH CARDBOARD SHEETS OR THE LIKE

This invention relates to a device designed for application in machines to punch used cardboard sheets for the production of boxes or the like and to control the actuation and deactivation of the expellers of said machines designed to sever and to remove scrap material or the like from the punched cardboard sheet.

In automatic punching machines of the type known in the art, the cardboard sheets are processed through several successive working stages, for instance conveyed through a number of processing stations, where said sheet is scored, cut and creased and where scraps or waste material are removed, at least in part, in order to realize the desired box.

The tools with which the above mentioned punching machines are equipped with require a synchronous control and, therefore, special transmissions. In the practice, it often occurs that certain tools are excluded from the operating cycle, due to the features of the objects to punch; for instance, the punching machines already known in the art have expeller units for two or several types of scraps, such units being actuated simultaneously in all cases and the disconnection whereof would require considerable modifications, to consent to the use of coupling members capable of re-instating, each time, the necessary synchronism of the various moving parts. Due to the presence of said members in the traditional punching machines, the structure thereof is most complicated and such as to jeopardize, in many cases, the realization of the desired purposes. Therefore, it is both advantageous and economically convenient, to maintain the whole number of tools of said machines connected and in operation. But, on the other hand, said solution causes quick wear and other drawbacks, because said known punching machines work at high speeds.

The purpose of the present invention is to permit the quick and uncomplicated connection and disconnection of the expeller control of an automatic punching machine, as well as to ensure the synchronism of the movable members of said machine.

Another purpose of the invention is to realize selected controls to actuate a predetermined number of expeller units in punching machines, i.e., to operate only such expellers as are necessary to perform exclusively such operations as the punching machine is expected to provide.

The device of the present invention, designed for application in punching machines wherein the carboard sheets are conveyed through a certain number of successive working stations including a scrap expeller station, such machines being provided with expeller tools and with a moving table which is actuated in synchronism with the other punching machine parts, is characterized in that the coupling members are inserted in the kinematic chain of said machine to connect the driving shaft of the punching machine with the driving members of the expeller tools, such coupling members being combined with means designed to ensure, at any time, the exact angular position between the driving and the driven shaft, in order to ensure the necessary synchronism between the various parts of the punching machine on one hand and the movable expeller tools on the other hand.



The invention will be now explained in the following description with reference to the annexed drawings, showing, by way of example, a preferred embodiment of the device mounted on an automatic punching machine provided with two expeller units.

In the drawings:

FIGS. 1A and 1B is a schematic, longitudinal cross-section of the punching machine at the expeller station.

FIGS. 2 and 3 are close-ups of FIG. 1 in enlarged scale, in cross-section and in elevation.

The punching machine to which the device of the present invention is applied, is of the type which comprises several working stations. In the drawings, the punching station is marked A and the next successive expeller station B.

The punching machine has bars **10** of the well known type, the ends whereof are connected with a pair of endless flexible members (not shown in the drawings), which extend all along said punching machine and each of said bars **10** is provided with advantageously actuated tweezers **12**, to engage the front edge of cardboard sheet C and to convey said sheet in the direction of arrow X in FIG. **1**, through the different working stations of the punching machine concerned.

The scoring and cutting station A comprises a fixed table $A_1$ to retain tools or punches $A_3$ and a movable table $A_2$, operated in synchronism with the other tools of the punching machine. The illustrated expeller station B includes furthermore a fixed table $B_1$ and a movable table $B_2$ situated below said fixed table. The fixed table $B_1$ has a frame **16** provided with traverses **18**. Small profiled expelling blocks **20** are fixed to said traverses, such blocks being shaped according to the scrap material to be removed from sheet C. Said blocks **20** project, with a limited play, into corresponding openings provided in a table **22** situated below, for instance into a wooden table which formed part of movable table $B_2$.

In the illustrated case, frame **16** retains two expeller units, the first whereof consisting of shaped blocks **20** and the second of projections **24** or the like, to remove the scraps having small surfaces from punched sheet C. The projections **24** project into openings formed in table **22** especially provided for this purpose, and cooperate with spring-urged opposed projections **26** mounted by supporting bars **28** which are retained by movable table $B_2$, as will be explained in the following.

Frame **16** slides along vertical guides **30** and said frame is connected, by means of flexible members **32**, with appropriate driving means. Said drives consist of cylinder-piston units fed with a pressurized fluid, for the quick removal of frame **16** from movable table $B_2$, whereby said frame is shifted upwardly to position **16'** of FIG. **1**, in order to allow the substitution and the arrangement of expellers **20** and **24** on the traverses **18**.

As previously mentioned, movable table $B_2$ has two supporting members co-operating, in the desired succession, with the two expeller tools **20** and **24** respectively. The first supporting member consists of a frame formed with longitudinal beams **40** and with transversal beams **42**. Said table **22** is fixed to the above-mentioned frame **40–42**. Frame **40–42** is vertically movable, in order to take three different positions, the first whereof, i.e., the maximum lifting position, is shown in FIG. **1**. The second of said positions is the intermediate position, in which table **22** is moved away from expellers **20** and **24**, in order to consent to the

passage of cardboard sheet C and of bars **10**, and whereas the third position corresponds to the off-work position (in which table **22** remains inactive) and is further lowered (with respect to the above mentioned second position).

Frame **40–42** is shifted by means of twin-cranks **44** and **45** keyed to corresponding shafts **46** and **47**, the free ends whereof are connected with the longitudinal beams **40** by means of eccentric pivots **48** and **49** which permit the easy adjustment of the parallelism of frame **40–42** with fixed table $B_1$.

In consideration of the foregoing, twin-cranks **44–45** perform two angular displacements **1** and **2** respectively, to lift frame **40–42** from its lower active position to its upper active position (shown in FIG. **1**), as well as to lower said frame to its deactivated position.

Counter-cranks **50** and **51**, which are connected to each other by means of connecting rod **52**, are keyed to shafts **46** and **47**. Counter-crank **51** shows, at the free end thereof, a small roller **54** which comes into engagement with the grooved profile of an annular cam **56**, shown in FIG. **3**.

Cam **56** shows a slider **58**, which is axially slidable along a grooved shaft **60** keyed to one of the elements **62** of a toothed coupling, the other element **64** whereof is integral with a shaft **66**, i.e., with the driving shaft of the punching machine wherefrom the drives to actuate the other punching machine tools are derived. Grooved shaft **60** is co-axial with shaft **66** and said shafts are torsionally connected to each other when coupling **62–64** is engaged, in such a way that the mutual angular position of said shaft is, at any time, duly ensured. For this purpose, coupling **62–64** has been realized in such a way as to show one projection and one single notch only, to meet the above-mentioned kinematic requirements.

Furthermore, a piston **68** is integral and co-axial with cam **56**, said piston being slidably arranged in a corresponding cylinder **70**, the chambers whereof are connected, by means of a rotatable sealing member **72**, with a duct **73** ending in a distributor connected with a pressurized air tank.

When the punching machine is operated as usual, cylinder-piston unit **68–70** is fed with pressurized air, in order to disengage coupling **62–64** and neutralise the displacement of cranks **44** and **45**, thereby annulling the displacements $\alpha_2$ of said cranks.

When toothed clutch **62–64** is operated, cam **56** causes an angular displacement $\alpha_1$ (FIG. **1**) of cranks **44** and **45** which causes, in turn, frame **40–42** either to lift or to lower. Supporting bars **28** for projections **26**, are retained by means of a complemental frame, which is parallel with frame **40–42** and is made of longitudinal girders **80** and of transversal girders **82**, designed to retain traverses **84** designed to retain, in turn, the above-mentioned bars **28**.

Main frame **40–42** and complemental frame **80–82** are guided during the sliding motion thereof, along respective columns **84** and **85** shown by the main frame and by other parts of the punching machine. The vertical displacement of complemental frame **80–82** is derived from the drive of main frame **40–42**. In other words, longitudinal girders **80** of the complemental frame engage, by means of pivots **86** and **87**, one of the ends of square levers **88** and **89**, fulcrumed to the longitudinal girders **40** of frame **40–42**. The other arms of square levers **88** and **89** are provided with rollers **90** and **91** which are in engagement with corresponding grooves of leverlike guide-rails **92** and **93** provided with keying means and with respective shafts **94** and **95** such as to form orientatable links. Cranks **96** and **97** are keyed to the above-mentioned shafts **94** and **95**, said cranks being connected to each other by means of a connecting rod **98**. A lever **100** (see FIGS. **2** and **3**) is loosely mounted on shaft **95** and the free end of said lever cooperates with the profile of a cam **102** integral with the aforementioned cam **56**. Furthermore, a counter-lever **104** is keyed to shaft **95**, said lever being provided with adjustable stops **105**. A nose **106**, which is integral with the main frame of the punching machine, co-operates with said adjustable stops **105**. Lever **100** and counter-lever **104** can be locked to each other by means of a springed latch **108** mounted on lever **100** and which can be brought in engagement with a hole of said counter-lever **104**. In such a way it is possible to realize a kinematic connection between shaft **66** and **95**, to drive auxiliary frame **80–82**.

The adjustable stops **105** shown by counter-lever **104** are advantageosly adjusted in such a way to impart, to guide-rails **92–93**, two limit-positions within angle $\alpha_3$, i.e., between a vertical position of crank **100** (which excludes the drive of auxiliary frame **80–82**) and an inclined position, to actuate said frame **80–82** with the necessary synchronism.

Another adjustable stop **110** retains lever **100** in a position of permanent disengagement from cam **102**, when latch **108** is disengaged from counter-lever **104**, whereas clutch **62–64** is actuated by means of a grip **112** integral with a rod **114** and said grip acts on a lever **115** which engages a groove shown by the movable element **62** of clutch **62–64**. From the foregoing, the performance of the above described device in relation with the operation of the punching machine can be clearly and readily understood.

Supposing that the work to carry out with the punching machine of the present invention requires the operation of both expeller units **20** and **24**, then both clutches **62–64** and **108** are operated.

Pressurized air is fed into the cylinder-piston unit **68–70** (FIG. **3**) to displace piston **68** and cam **56** in the direction of arrow Y. Therefore, counter-cranks **50–51** are forwarded to the intermediate position which lies between limit-position $\alpha 1$ and $\alpha 2$ and coupling **62–64** is engaged. When shaft **66** rotates, it actuates cams **56** and **102**, the first whereof imparts to crank-mechanisms **44–45** and oscillatory motion having an angular width $\alpha 1$, to move frame **40–42** upward.

Expellers **20** and **24** are thus brought into engagement with the punched areas of cardboard-sheet C, to detach and expel said areas or scraps, and whereas cam **102** also actuates lever **100** and counter-lever **104** and therefore guide-rails **92, 93** which perform as oscillation $\alpha_3$, to incline the axis of said rails with respect to the vertical. As square levers **88–89** are fulcrumed to frame **40–42**, said levers are caused to oscillate during the to-and-fro motion of said frame and, during the lifting motion of main frame **40–42**, auxiliary frame **80–82** is also lifted, in order to engage the springed urged projections against the lower surface of the scraps which are contacted by said projections **26**, to ensure the removal of the small-sized scraps, since frame **40–42** moves downward with a certain delay with respect to the downward motion of complemental frame **80–82**, in such a way that projections **26**, which are subjected

to the action of springs, provide for the removal of the scraps from carboard-sheet C. Furthermore, owing to the special profile shown by cam **102**, frame **80–82** is caused to move downward first and then frame **40–42**, whereafter said frame **40–42** which is the main frame and said secondary frame **80–82** are returning simultaneously to their upper position and table **22** is in its starting position, in order to repeat the above-described operating cycle.

If it is necessary to process sheet C in accordance with certain special requirements, the motion of expellers **26** can be stopped by releasing latch **108** from counter-lever **104**, so as to disengage lever **100** which, as it disengages from cam **102**, is retained in said disengaged position by means of stop **110**. Furthermore, counter-lever **104** is caused to oscillate over a certain width — which is established by adjustable stops **105** — in order to dispose guide-rails **92–93** in a vertical position. It follows that during the upward and downward motion which is performed by main frame **40–42**, auxiliary frame **80–82** is at a standstill with respect to the main frame, that is, said auxiliary frame follows the motion of said main frame.

The disengagement of clutch **62–64** stops the to-and-fro motion of main frame **40–42**, as well as of auxiliary frame **80–82**. When cylinder-piston unit **68–70** is deactivated and the pressurized air discharged from cylinder **70**, piston **68** is again caused to enter into said cylinder and cam **56** and hence also lever **51** are moved in a direction opposite to that of arrow Y, whereas cranks **44–45** are shifted over angle $\alpha 2$, in order to drag frame **40–42**, together with auxiliary frame **80–82**, downward. It is thus possible to provide of ample space between the upper surface of table **22** and bars **10**, to consent to the introduction of frames **40–42** and **80–82**, as well as the extraction thereof and of such equipments as must be laid on table $A_2$, whereas the necessary checking and adjusting operations can be easily performed without encountering obstacles and without the need to remove said frames from the punching machine.

Modifications and variations can be brought to the above described and illustrated device, according to the requirements which must be met, without exceeding the limits of the protection sought for the present invention which extends as well to the punching machine which incorporates the device claimed with the above described and illustrated invention.

We claim:

**1.** An apparatus for ejecting cut-out portions of a sheet, comprising:

ejector frame means having a plurality of first ejecting elements projecting therefrom;

table means disposed opposite said frame means and coacting therewith for permitting said ejecting members to remove the cut-out portions from said sheet, said table means including a first support device and a table fixed to said support device, said table being adaptable to have said sheet deposited thereon and also having a plurality of openings therein which cooperate with the first ejecting elements for permitting removal of said cut-out portions;

a second support device movably mounted relative to said first support device and a plurality of second ejecting elements mounted on said second support device and disposed on the side of said table opposite said frame means, said second ejecting element being disposed directly opposite at least some of the first ejecting elements whereby the sheet when supported on said table is positionable therebetween;

drive means for causing relative movement of said table means toward and away from said frame means so that said first ejecting elements remove said cut-out portions when said frame means and table means are moved relatively toward one another, said drive means including aligned driving and driven members and first linkage means drivingly connected between said driven member and one of said first support device and said frame means;

said drive means further including first disengageable clutch means coacting between said driving and driven members for permitting said driven member to be drivingly coupled to said driving member only when said members are in a selected angular relationship with one another, thereby insuring the necessary synchronism of the various parts of the apparatus; and

said drive means still further including second linkage means drivingly connected between said driven member and said second support device for causing movement of said second ejecting elements toward and away from said first ejecting elements, said second linkage means including second disengageable clutch means for permitting deactivation of the second support device and the second ejecting elements independently of said first ejecting elements.

**2.** An apparatus according to claim **1**, wherein said first linkage means is drivingly coupled to said first support device and includes a plurality of spaced crank mechanisms for causing said first support device and the table mounted thereon to undergo an oscillating motion.

**3.** An apparatus according to claim **2**, whereby said second linkage means includes a second plurality of crank mechanisms drivingly connected to said second support device for causing same to undergo an oscillating motion.

**4.** An apparatus according to claim **1**, wherein said first linkage means includes a first cam nonrotatably coupled to said driven member and first lever means having first follower means engaged with said first cam for causing oscillation of said first lever means in response to rotation of said first cam, and said second linkage means including a second cam nonrotatably coupled to said driven member and second lever means having second follower means associated therewith and engageable with said second cam for causing oscillation of said second lever means in response to rotation of said second cam.

**5.** An apparatus according to claim **4**, wherein said second linkage means includes third swingable lever means positioned adjacent said second lever means, said first and second lever means each being swingable about a common pivot axis, and said second clutch means coacting between said second and third lever means for permitting same to be drivingly coupled together.

**6.** An apparatus according to claim **5**, wherein said second linkage means includes intermediate lever means pivotally connected between said third lever

means and said second support device, said intermediate lever means being fulcrumed on said first support device.

7. An apparatus according to claim 1, wherein said first linkage means causes said first support device, when said first clutch means is engaged, to be moved toward said frame means from a first operative but disengaged position into a second engaged position wherein said first ejecting elements project into the openings formed in said table, and auxiliary driving means coacting with said first linkage means for selectively permitting said first support device to be moved away from said frame means into a third inactive position which it is spaced on the other side of said second position from said first position.

8. An apparatus according to claim 7, wherein said first linkage means includes a rotatable cam which is nonrotatably coupled to said driven member, and said auxiliary driving means including a fluid pressure cylinder drivingly coupled to said cam for shifting same axially to cause a corresponding movement of said first linkage means and of said first support device between said first and third positions.

9. An apparatus according to claim 1, wherein said first linkage means includes a pair of first crank mechanisms drivingly coupled to said first support device and each including a first crank having a pair of arms, each crank being pivotally mounted relative to a stationary base of the machine and having one arm thereof pivotally coupled to said first support device, said first cranks being disposed with the pivot axes thereof parallel but transversely spaced from one another, and a connecting rod extending between and pivotally coupled to the other arm of said first cranks for causing said first cranks to move synchronously with one another, said first linkage means also including first cam means drivingly coupled to said driven member and coacting with one of said first cranks for causing angular oscillation thereof in response to rotation of said first cam means.

10. An apparatus according to claim 1, wherein said second linkage means includes a pair of crank mechanisms pivotally connected to said second support device, said crank mechanisms each including a first crank pivotally fulcrumed on said first support device and having a first arm portion pivotally connected to said second support device, said first cranks being disposed with the pivot axes thereof parallel but transversely spaced from one another, each of said crank mechanisms including a second pivotally supported crank which is pivotally connected to a second arm of a respective one of the first cranks, an elongated connecting rod extending between said second cranks for causing synchronous movement thereof, and intermediate link means connected between one of said second cranks and said driven member, said intermediate link means including a cam nonrotatably coupled to said driven member and said second clutch means being associated with said intermediate link means.

* * * * *