

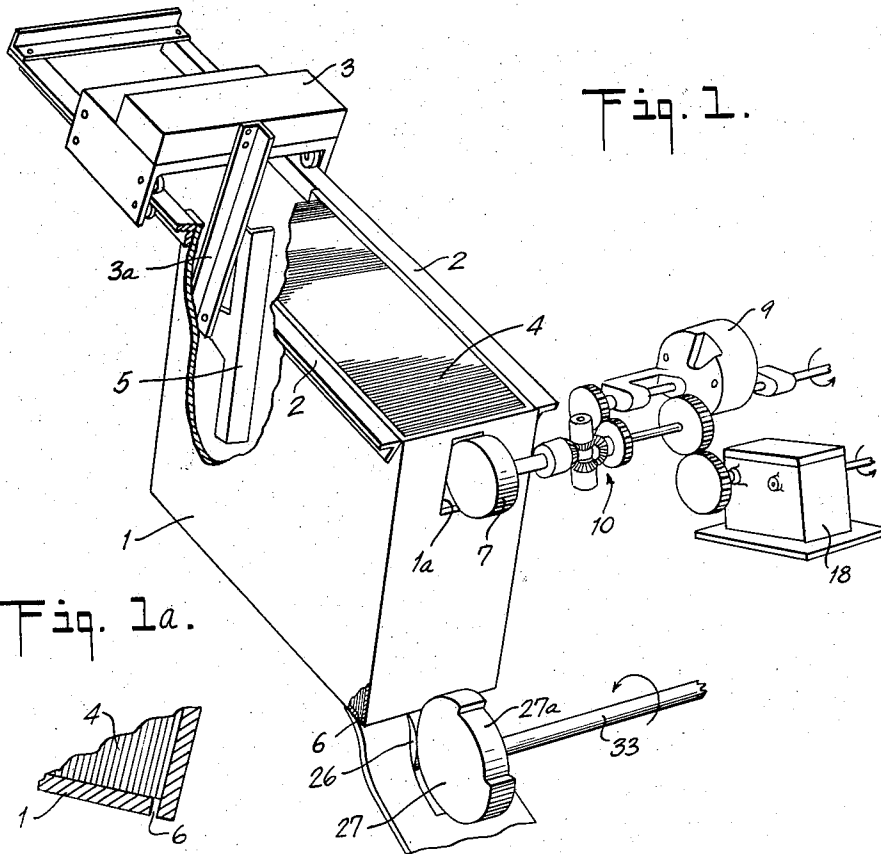
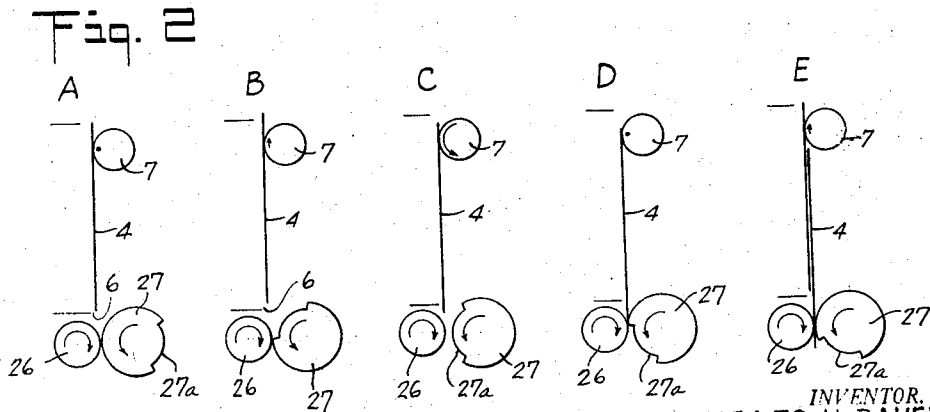
Jan. 20, 1959

C. H. BAUER
SHEET FEEDING APPARATUS

2,869,869

Filed May 17, 1955

3 Sheets-Sheet 1



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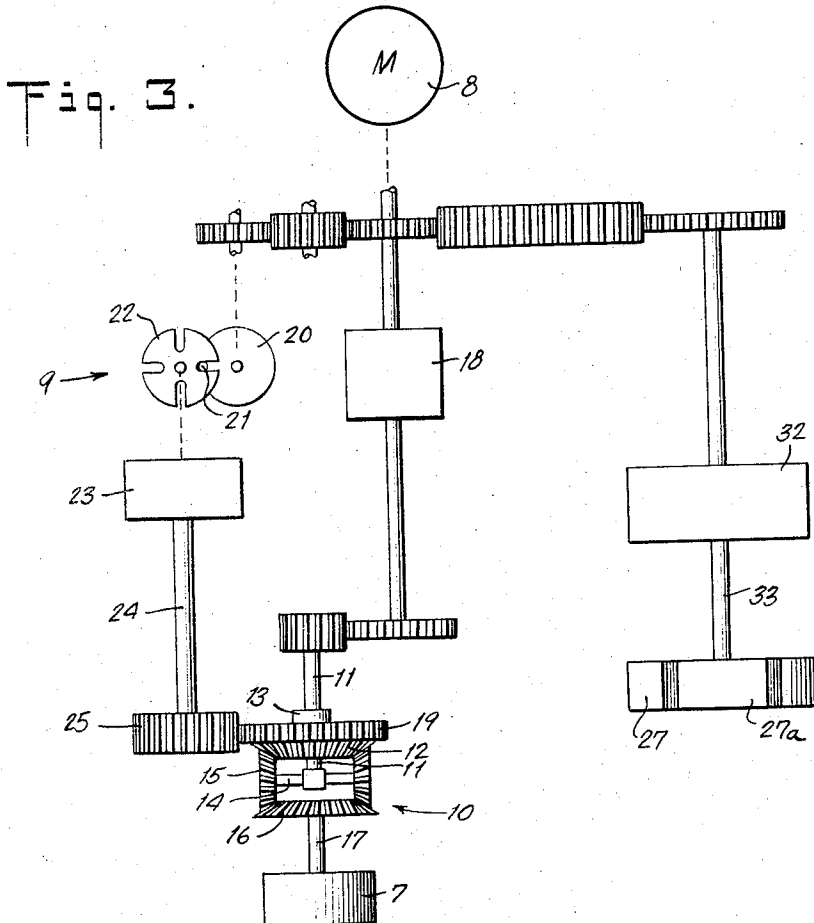
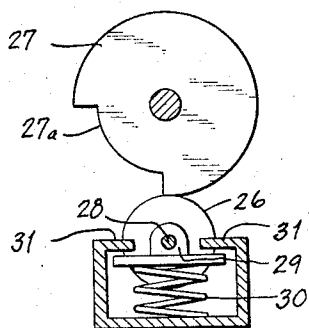
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3 Sheets-Sheet 2



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3 Sheets-Sheet 3

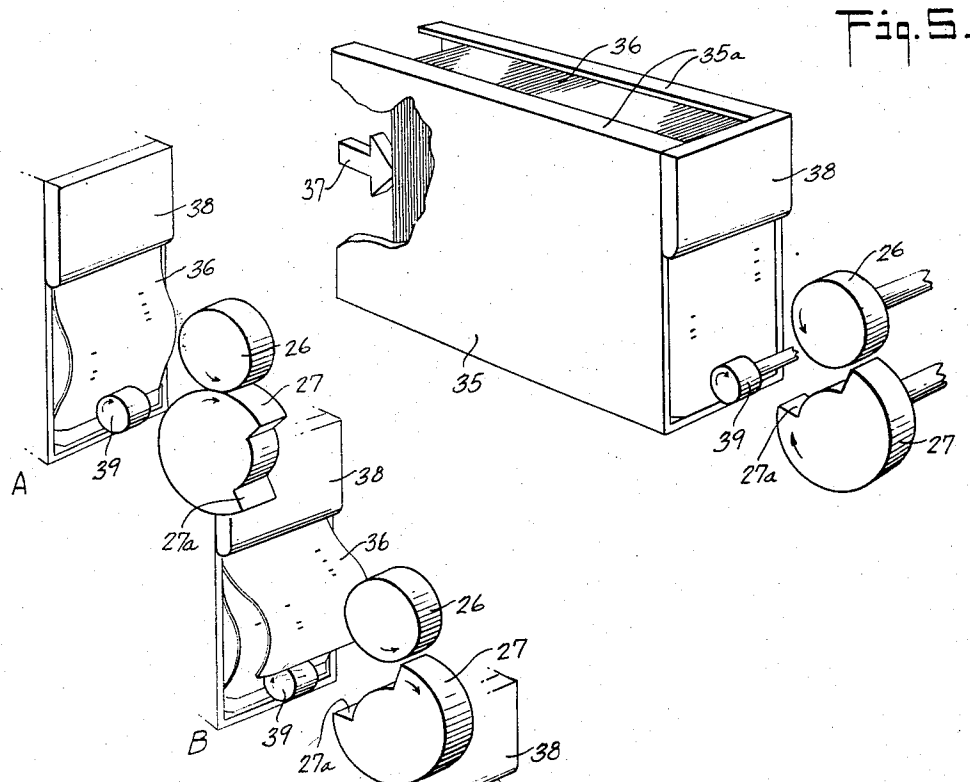
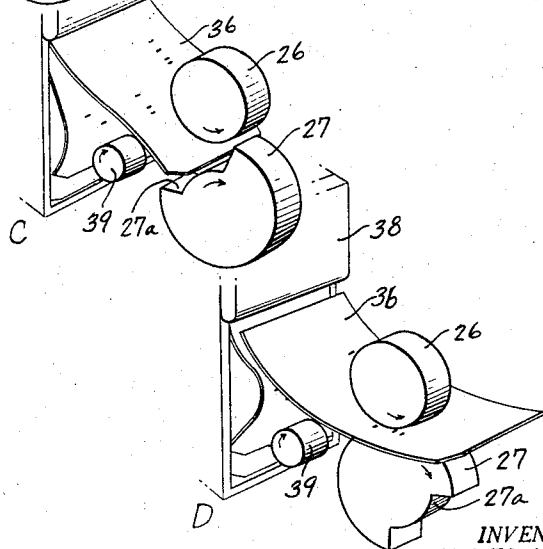


Fig. 6.



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SHEET FEEDING APPARATUS

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Application May 17, 1955, Serial No. 508,912

2 Claims. (Cl. 271—36)

This invention relates to sheet feeding apparatus and particularly to apparatus for feeding cards at high rates of speed.

Modern high speed computers perform their computing functions at very high rates of speed, making a great many computations in a second. In many cases, the factor which limits the speed of such a computer is the speed with which data for the computations can be supplied to it. One of the most convenient ways of supplying data to a computer is to supply it on punched accounting cards. In such an arrangement, the speed of the computer is limited by the speed with which the punched cards can be fed to it. Feeding rates of the order of thousands of cards per minute may be handled by the computer, the limitation on the card feeding rate being the rate at which the feeding apparatus can operate.

In feeding and handling cards at such high rates, one of the most difficult problems is the prevention of burring or deforming of the card edges, which may result in jamming of the cards, or in errors in the reading of the cards in the computer.

An object of the present invention is to provide improved mechanism for feeding sheets, such as cards, at very high rates.

Another object is to provide card feeding mechanism of the type described including improved means for separating individual cards from a supply stack and improved means for rapidly accelerating the individual cards after their separation from the stack.

Another object is to provide improved means for separating individual cards from a stack.

Another object is to provide means for rapidly accelerating a sheet or card.

The foregoing and other objects of the invention are attained, in the apparatus described herein, by providing improved means for separating individual cards from a stack, and improved means for accelerating separated cards. Two different card separating means are provided. One card separating means includes a hopper having a gate equal in thickness to one card at one side of its discharge end, and a somewhat wider opening at the opposite side. In order to drive the cards through the gate without burring or otherwise deforming their edges, the cards are first driven away from the gate a short distance and then back through the gate. The cards are driven by a starter wheel which frictionally engages the end card in the stack. The starter wheel is operated alternately in opposite directions in accordance with a predetermined cycle, by which a card engaging the wheel is first backed away from the gate and then driven forward through the gate.

The second apparatus for separating individual cards from the stack includes a hopper which at its discharge end has an opening extending the full width of the card and the greater part of the length of the card. The end of the card at the closed side of the hopper is held against movement by that closed side. A buckling roller runs continuously against the end card, near the free end

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thereof, and is driven in a direction tending to move that free end of the card toward the fixed end. The card, being unable to move as a whole, buckles in the middle, and its free end is carried around the periphery of the buckling roller and bent out to a position spaced from the stack of cards.

The individually separated cards produced by either of the two card separating mechanisms described above are then accelerated by a mechanism including a pressure roller and a cam roller adapted to engage opposite sides of a card after it has reached a position spaced from the stack by the action of one of the card separating mechanisms described. The cam roller has a recess extending around a substantial portion of its periphery. The card separating mechanism is synchronized with the cam roller and is effective to feed a card between the two rollers at a time when the recess is adjacent the pressure roller. The cam roller thereby engages the card first at a point spaced inwardly from its edge, and does not burr or deform the edge.

Other objects and advantages of the invention will become apparent from a consideration of the following specification and claims, taken together with the accompanying drawings.

In the drawings:

Fig. 1 is a somewhat diagrammatic perspective view illustrating one form of card feeding apparatus constructed in accordance with the invention;

Fig. 1a is a fragmentary sectional view showing the hopper outlet gate of the apparatus of Fig. 1;

Figs. 2a to 2e are diagrammatic illustrations of the sequence of operation of the apparatus of Fig. 1;

Fig. 3 is a diagrammatic illustration of the driving mechanism and gear trains which are connected to the starter wheel in the apparatus of Fig. 1;

Fig. 4 is a fragmentary diagrammatic illustration of a detail of the apparatus of Fig. 1;

Fig. 5 is a somewhat diagrammatic perspective view of a modified form of sheet feeding apparatus constructed in accordance with the invention; and

Figs. 6a to 6d are diagrammatic figures illustrating the sequence of operation of the apparatus of Fig. 5.

Figs. 1 to 4

The apparatus of these figures includes a card hopper 1, inclined downwardly toward its discharge end and having extending along its top edges a pair of rails 2 on which rides a weighted car 3, having an extension 3a which projects downwardly in back of the stack of cards 4 in the hopper. The extension 3a pivotally carries a shoe 5 which engages the upper end of the stacked cards and holds the stack tightly together.

The lower end of the hopper is provided on its bottom side with a gate 6 which is just slightly wider than the thickness of one card, as best seen in Fig. 1a. For cards .007 inch thick, a gate .010 inch wide was used. The upper side of the hopper is open to a depth substantially greater than the thickness of one card. It is shown in Fig. 1 as being completely open, but it should be understood that the apparatus will work as well if the opening is only as wide as, for example, the thickness of two or three cards.

The lower end face of the hopper 1 is provided with an opening 1a. A starter wheel 7 is journaled on a suitable support (not shown) so that it projects through the opening 1a and engages the card 4 at the bottom end of the stack. The surface of wheel 7 is covered with suitable friction material, e. g. rubber, so that as it rotates it will move the end card in the stack, the friction between the wheel and the card being greater than the friction between that card and the next adjacent card.

The wheel 7 is driven by a motor 8 (see Fig. 3) through a complex train of mechanism including a Geneva mechanism 9 and a differential gear 10. The differential gear 10 has a direct input shaft 11 and a second input through a bevel gear 12 fixed on a hub 13 which is rotatable on the shaft 11. Shaft 11 drives a spider 14 carrying bevel gears 15 which engage the bevel gear 12 and also engage a bevel output gear 16 fixed on an output shaft 17 which carries the starter wheel 7.

Shaft 11 is driven by the motor 8 through a direct drive including a reduction gear 18. The hub 13 has fixed on it a gear 19 which is driven through the Geneva mechanism 9. The Geneva mechanism 9 includes a wheel 20 carrying a pin 21 cooperating with slots formed in a Geneva wheel 22. The arrangement is such that on each revolution of wheel 20, the Geneva wheel 22 is advanced one-quarter of a revolution, that advance taking place during one-quarter of the revolution of wheel 20, so that wheel 22 is stationary for the other three-quarters of a revolution of wheel 20. Note that in the construction shown, the pin 21 enters and leaves the slots in wheel 22 tangentially. Consequently, wheel 22 is accelerated and decelerated slowly at the beginning and end of its movement, and has its most rapid movement when the wheels 20 and 22 are in the positions shown. Wheel 22 is connected through a gear train schematically shown at 23 to a shaft 24 carrying a gear 25 which engages the gear 19.

The ratios of various gear trains are selected so that during the times when the Geneva wheel 22 is not turning, the motor 8 is driving the starter wheel 7 in a forward direction, so as to advance a card through the gate. When the Geneva wheel 22 starts turning, it is effective to drive the gear 19 so as to cancel out a portion of the driving movement imparted through shaft 11. As the speed of the Geneva wheel increases, the starter wheel 7 stops and, as the Geneva wheel reaches its maximum speed, the starter wheel is driven backward for a very short distance. As the Geneva wheel decelerates, the backward movement of the starter wheel 7 slows down, stops, and resumes its forward movement.

It has been found that a gate such as the gate 6 may tend to burr the edge of a card if an attempt is made to drive the card forward without the initial backward movement described. Apparently when a card first is moved into alignment with the gate, its edge may not completely clear the edge of the gate, due to the frictional drag of the hopper wall on the card edge. However, the slight backward movement described is effective to bring the card into complete alignment with the gate. The second sheet acts on the edge of the end sheet to force it into complete alignment with the gate.

Just outside the gate 6, cards leaving the hopper 1 encounter a pair of opposed rollers including a pressure roller 26 and a cam roller 27. Cam roller 27 is provided with a recess 27a shown as extending one-quarter of the way around its periphery. Various lengths of recess may be used. If the roller is run slower, two or more recesses may be used. As best seen in Fig. 4, the pressure roller 26 is supported on a shaft 28 journaled in bearings one of which is shown at 29, loaded by springs 30, so as to force the roller 26 yieldably into engagement with cam roller 27. The movement of the roller 26 toward cam roller 27 is limited by a pair of brackets 31 which engage a portion of the structure of bearings 29. The effect of this arrangement is that when the recess 27a is opposite the pressure roller 26, the rollers 26 and 27 are substantially spaced from each other. Alternatively, the cam roller 27 can be spring mounted instead of the pressure roller 26.

Cam roller 27 is synchronously driven with the starter wheel 7. As shown in Fig. 3, this synchronism may be accomplished by driving roller 27 from motor 8 through a reduction gear 33 and shaft 32.

Operation—Figs. 1 to 4

This operation is diagrammatically illustrated in Figs. 2a to 2e. In Fig. 2a, a card 4 has just come into engagement with the starter wheel 7, which is at this instant stationary, having just been stopped by the movement of the Geneva wheel 22. In Fig. 2b, the starter wheel 7 is reversed, and is driving the card 4 away from the gate 6. For cards .007 inch thick, a reverse movement of .015 inch was used. The wheel 7 reverses again and drives the card forward at a low speed until its edge clears the gate. In Fig. 2c, the starter wheel 7 is turning rapidly in the forward direction thereby driving the card 4 through the gate 6. The cam roller 27 is synchronized with the starter wheel 7, so that the recess 27a is now opposite the pressure roller 26. The leading edge of the card 4 therefore moves into the space between the rollers 26 and 27 and is not forcibly engaged by any portion of those rollers. It is preferred to have the motion of the cards stopped before the rollers 26 and 27 start accelerating them, although this is not absolutely necessary.

In Fig. 2d, the cam roller 27 has turned further, and the end of the recess 27a is engaging the card 4 somewhat back of its leading edge. The rollers 26 and 27 are about to start accelerating the card 4 rapidly. The rollers 26 and 27 can accelerate the card to its full operating velocity in about 1/8 inch of card travel without damaging the cards.

In Fig. 2e, the first card 4 is being accelerated by the rollers 26 and 27, and the starter wheel has returned to the position which it had in Fig. 2b, and is reversing the second sheet of the stack so as to carry it away from the edge of the gate 6.

Figs. 5 and 6

These figures illustrate a modified form of sheet feeding apparatus, including accelerating rollers 26 and 27 similar to the corresponding rollers of Figs. 1 to 4, and a somewhat different type of mechanism for separating the individual cards from the stack.

In Fig. 5, a hopper 35 is shown as extending horizontally, and having a stack of cards 36 within it. Pressure is applied to the left-hand end of the stack, as viewed in Fig. 5, by any suitable mechanism, indicated in Fig. 5 by the arrow head 37.

The right-hand end of the hopper 36 is open for the full width of the cards and for somewhat more than the lower half of the length. The upper portion of the end card is restrained against movement by a plate 38. The sides at the top of the hopper have flanges 35a overlying the ends of the cards. These flanges and the plate 38 cooperate to prevent upward movement of the end card in the stack. Near the bottom of the end card, there is located outside the hopper 35 a roller 39, fixed on a shaft 40 which is journaled on a suitable support (not shown). The surface of roller 39 is covered with friction material. This roller runs in contact with the end card in the stack, and engages that card with an upwardly directed frictional force which is greater than the friction between that card and the next adjacent card in the stack. This frictional force tends to drive the end card upwardly, but since its upper end is restrained, the card cannot move upwardly, so its central portion buckles as shown in Fig. 6a. The lower end of the card then follows the periphery of the rotating wheel 39, and is carried outwardly away from the stack in the hopper 35, as shown in Fig. 6b. The accelerating rollers 26 and 27 are located just to the right of the starter wheel 39, so that as the end of a card passes over the top of the wheel 39, as seen in Fig. 6b, it snaps to a position illustrated in Fig. 6c, where the end of the card lies between the accelerating rollers 26 and 27. The rollers 26 and 27 are synchronized with the starter wheel 39, so that each card 36 has its end snapped between the accelerating rollers 26 and 27 at a time when the recess 27a in roller 27 is opposite the pressure roller 26.

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The apparatus of Fig. 5 has the advantage that it can feed cards having substantial burrs on their edges when they are supplied to the machine. Such burrs might cause difficulty at the gate 6 in Fig. 1.

As in the case of Figs. 1 to 4, the accelerating rollers 5 seize the card at a locality spaced from its edge so that the edge of the card is not burred or deformed by the accelerating operation. The accelerating phase of the movement of card 36 is illustrated in Fig. 6d.

While certain preferred embodiments of the invention 10 have been illustrated, other modifications thereof will readily occur to those skilled in the art, and it is therefore intended that the invention be limited only by the appended claims.

What is claimed is:

1. A sheet feeding apparatus comprising a hopper for receiving a stack of sheets and including at least three side members adapted to guide respectively three edges of the sheets in the stack, and an end member adapted to engage the flat surface of the sheet at the discharge end of the stack, one of said side members having a gate opening adjacent said end member extending the full width of the sheet and having a dimension in the direction of sheet thickness greater than the thickness of one sheet and less than the thickness of two sheets, the side of the hopper opposite said one side member being constructed 25 to allow movement of the sheet at the discharge end of the stack away from the gate opening, a starter means in frictional engagement with the sheet at the discharge end of the stack, and means for driving said starter means 30 at a substantially low rate of speed in a direction to move said end sheet first in the direction away from the gate

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opening and then in the reverse direction at a similarly low rate of speed toward said opening, said end sheet being then guided by the next adjacent sheet, said low speed reverse movement continuing until the bottom edge of said sheet clears the edges of said opening, and thereafter to move said sheet in said reverse direction at a substantially increased and rapid speed, said starter means being adapted thereby to feed at least a portion of said sheet through said gate opening.

2. A sheet feeding apparatus as defined in claim 1, in which said starter means includes a sheet-engaging wheel in frictional contact with said end sheet, and said driving means includes a differential gear having two inputs and an output, motor means, means connecting one of said 15 inputs to said motor means for concurrent rotation therewith, a Geneva mechanism, and means including said Geneva mechanism connecting the other of said inputs to said motor means to move said other input intermittently in an opposite direction to said first input, means connecting said output to said sheet-engaging member, said 20 differential gear and said two connecting means cooperating to gradually accelerate and decelerate and reverse the movement of said wheel and thereby of said end sheet.

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