This invention relates to a machine for folding garment components, such as fabric pieces that are to be used as pockets, etc.

In the garment industry, various components of a particular garment must often be folded along one or more edges thereof, prior to being assembled with other components of the garment by stitching. The purpose of the folding operation is to facilitate easier stitching, and also to produce more uniformly shaped garment components.

This practice in and of itself is well known in the garment industry, and machines are employed for the purpose of folding the components. Such machines are generally known as folding machines, edge-creasing machines, or turning-in machines.

The present invention aims to provide a machine of the character described that will be newly constructed in such a manner as to provide a generally improved folding operation, that will result in more productivity per unit cost of manufacture.

By way of background, it may be noted that in general, a folding machine has three basic motions. The first of these is the lowering of a die or template, having the shape of the desired finished article, onto the cloth that is to be folded. With the die in position, the second motion is carried out, that is, folding members are shiftable over the edges of the die to effect edge-folding or turning-in of the piece. Following this motion, the third motion is employed, and constitutes an application of pressure along a line normal to the planes of the die, fabric piece, and folders, such as to cause the folders to press the cloth over the die. Since the bed of the machine is normally heated by electric heating elements, the application of pressure will produce a sharply defined fold which, of course, will in turn produce a piece of fabric having the shape of the die and folded along a selected number of edges. The motions are then reversed to return the machine to a loading position. The previously folded article is then removed and another piece inserted for folding.

In this way, the removed article, having sharply folded edges, is prepared for assembly with other components of the garment.

One object of the invention is to provide a folding machine in which all of the motions referred to will be brought about through the oscillating movement of a single cam means, in such a manner that the shifting of the cam means by the operator will cause the various motions to be produced in successively following order, at a predetermined, desired interval and with full uniformity. One can, thus, merely by depressing the cam, set into operation the various movable components of the apparatus, which in turn lower the die, cause the folders to wipe over the die, and apply the pressure, with these steps being carried out in conjunction with the application of steam to the article, in an arrangement such that the steam can be applied at any particular time during the complete cycle that includes the several motions referred to.

Another object is to provide a device of the character stated which will be so designed that on depression of the treadle to swing the cam in one direction, the cam will be held in the position to which it is swung by a ratchet mechanism, that takes hold automatically, and will hold a sustained pressure against the piece of fabric, until released by a timing mechanism that is placed in operation responsive to depression of the treadle.

Another object is to include, in the machine, a thermostat control that will insure the proper application of heat, at a selected temperature, to the fabric article.

Another object is to provide a machine which will direct a spray or jet of steam to the material being folded at a predetermined and preset point in the cycle of operation, with the construction being such as to permit selected variations with respect to the time at which the steam is applied to the material.

Still another object is to provide a folding machine wherein the pressure is applied by means of a mechanism that will take full advantage of a mechanical gain inherent in the mechanism, thus to relieve the operator of unnecessary physical exertion during the application of pressure in the event the machine is manually operated. It is further proposed to provide a mechanism as stated which will eliminate the need for unnecessary power, in the event the machine is power-driven rather than manually operated.

Another object is to provide a folding machine so designed that the die will automatically align itself with the folders when lowered into engagement with the work, the die thus being self-adjusting with respect to its operative position.

Still another object of importance is to provide apparatus as stated in which the application of pressure will be self-compensating so as to bear evenly when there are variations in the thickness of the goods being folded, as for example a pocket having a thick hem.

Yet another object is to provide a folding machine so designed that the several purposes mentioned will, due to the use of the single, oscillating cam, be synchronized in a way such that their timing with respect to the machine cycle and their sequence with respect to each other cannot be adversely affected by the changing moods of the operator, physical fatigue, or by any other human element. With further reference to this purpose of the invention, the initiation of the cycle, resulting from the depression of a treadle by the operator, has the effect of causing all stages of the cycle to be carried out in predetermined, following order, and has the further effect of presetting the length of time that the single cycle will require, with all steps being carried out in an exact sequence desired and in an exact, timed relationship to each other, as well as in a predetermined, accurate relationship as regards the extent of movement or pressure involved in each step of the operation. These matters, thus, are removed from the discretion of the operator due to the particular, novel construction of the apparatus, so that the only function of the operator is to oscillate the cam.

Another object is to provide a machine as stated in which, due to the use of the oscillating cam, any means for causing the machine to operate may be employed. In other words, by providing an oscillating cam as stated, said cam can be oscillated, by a mechanical linkage; by an eccentric mechanism; by air under pressure; by hydraulic means; or by electrically operated means.

For further comprehension of the invention, and of the objects and advantages thereof, reference will be had to the following description and accompanying drawings.
and to the appended claims in which the various novel features of the invention are more particularly set forth.

In the accompanying drawings forming a material part of this disclosure:

Fig. 1 is a side elevational view of the folder machine according to the present invention, in which portions have been broken away.

Fig. 2 is a front elevational view of the machine, portions being broken away. Fig. 3 is an enlarged, fragmentary perspective view of the lower portion of the machine, showing the foot treadmill and the oscillating cam together with associated components.

Fig. 4 is a top plan view of the machine on the same scale as Figs. 1 and 2.

Fig. 5 is a plan sectional view substantially on line 5–5 of Fig. 1, showing the folder plates.

Fig. 6 is an exploded perspective view of the cover plate, folder plate assembly, and folder housing frame.

Fig. 7 is an enlarged, detail sectional view substantially on line 7–7 of Fig. 5, showing the means for shifting the folder plates between their operative and retracted positions.

Fig. 8 is a transverse sectional view substantially on line 8–8 of Fig. 7.

Fig. 9 is an enlarged, detail sectional view substantially on line 9–9 of Fig. 1, showing the means for applying steam to the work piece.

Figs. 10, 11 and 12 are somewhat diagrammatic views showing the work and the adjacent work-engaging components of the machine in the first, second, and third basic motions, respectively, of the machine.

Fig. 13 is an enlarged perspective view of the work piece before it is operated on by the machine.

Fig. 14 is a perspective view of the work piece after it has been folded by means of the machine.

Referring to the drawings in detail, the apparatus constituting the present invention includes a flat, rectangular base 10 (Figs. 1–3). Rigid with the base and offset to one side of the center of the base is an upright 12 formed as a flat, vertically elongated, rectangular, thick plate disposed in a vertical plane. Upright 12 and base 10 cooperate to define a stationary support frame generally designated 14, which frame can be bolted or otherwise secured to a floor surface, in any manner desired.

Referring now to Figs. 1, 5 and 6, a folder housing frame generally designated 16 has a rectangular outer configuration and is disposed in a horizontal plane. Frame 16 is fixedly mounted upon the upper end of the upright 12, with the upright being offset laterally to one side of the center portion of the folder housing frame, so as to leave the center portion of the frame 16 clear for receiving the work and for permitting movement of the various components that are in position to directly act upon the work.

The folder housing frame, and the components supported thereon, will be described in greater detail hereinafter. At this time, it is proposed to describe the cam and guide means that effect the several basic motions together with ancillary steps involved in the operation of the machine. Thus, referring particularly to Figs. 1 and 3, it will be seen that an elongated arm 18 is pivotally attached by means of a pin 20 to one side surface of the upright 12, in a position spaced laterally outwardly a short distance from the upright. The arm 18 projects forwardly beyond the upright, so that its forwardly projecting end is disposed for fixed connection to a foot treadmill 22, which is adapted to be depressed by the user for the purpose of swinging the arm 18 downwardly from its normal position shown in Fig. 3.

The area of the work piece to be processed is progressively increased in width in a direction away from the treadmill 22 and at its opposite end is integrally or otherwise rigidly formed with a cam 23.

Referring to Figs. 1 and 3, disposed adjacent the arm 18 is a die-operating lever 24, having one end pivoted at 26 upon the upright to swing about an axis parallelizing that of the arm 18. The other end of lever 24 is pivotally connected to an elongated connecting rod 28, which extends upwardly along the upright to terminate rearwardly a short distance from the back of the top portion of the upright as shown in Fig. 1. Connecting rod 28, at its upper end, is connected to a normally inclined die support arm 30, at the rear end of the arm, by means of a pivotal connection 32. Arm 30, intermediate its ends, pivots about a horizontal axis extending parallel to and slightly above the back edge of the frame 16. To provide for the pivotal connection of the die support arm 30 there are pivotally mounted brackets 34, mounted upon the back portion of the frame 16 at opposite sides of the frame 16. A pin 36 is connected at its ends to the brackets 34, and spacer sleeves 38 receive the end portions of the pin. Pin 36 extends through an opening formed in the arm 30, with the arm, whichever is opposite sides, at the location of the opening, to receive the inner ends of the spacer sleeves 38 that hold the arms centered upon the folder housing frame.

Loosely embracing the forward portion of the arm 30 are brackets 44 having short slots 46 receiving pins 48 that project outwardly from opposite sides of the arm 30, thus providing a lost motion connection of the brackets to the arm such that the brackets may move transversely of the arm along lines normal to the pivot axis of the arm, in each position to which the arm is swung. Fixedly secured to the brackets 44 is a flat, relatively thin die 42, which, as shown in Fig. 2, is of generally rectangular configuration, with forward corners that are rounded slightly in the illustrated embodiment.

The die, of course, can be of any shape that it is desired to impart to the finished work piece. The die would be removable, so that various work pieces of different shapes can be acted upon by the apparatus, although ordinarily the apparatus would be used for a substantially long period of time in folding the edges of identical pieces, during large-scale production of a particular garment.

Spaced longitudinally of arm 30 are bolts 50 which are threaded in the arm. The bolts 50 bear against the inner ends of compression coil springs 52, the outer ends of which are engaged with lugs provided upon the upper surface of the die 42. The bolts, it should be noted, are recessed within the arms, so that the springs 52 are engaged in the recesses thereby provided in the arm 30.

The construction, as will be appreciated, is one which causes the die plate 42 to be continuously sprung biased downwardly, outwardly from the arms 30 due to the tendency of the springs 52 to expand. Thus, the brackets 44 slide upon the pins 48 to permit the die 42 to move outwardly under the pressure of the springs. If the pressure or tension of the springs 52 can, of course, be adjusted variably by threading of the screws 50, inwardly or outwardly of the arm, the die will further be noted that when the die is lowered the springs 52, while holding the die firmly against the article, are free to compress, to permit the die to move toward the arm 30, while yet bearing with a strong pressure against the work piece. The brackets 44, it may be noted, are sufficiently loose upon the pins to permit a slight wobbling or transverse swinging movement of the die 42, such that the die can adjust itself to the plane of the particular work piece against which it is shifted. The die is thus self-aligning in respect to the work piece, and positions itself properly to bear uniformly against the full area of the work piece regardless of the thickness of the work piece at a particular part of its area, and regardless of the nature of the material of which the work is formed, that is, cotton, heavy wool, etc.

The folder housing frame will now be described in detail, and referring to Fig. 6, is seen to include a pair
of side bars 54, fixedly connected at their opposite ends to front and back bars 56. The front and back bars are fixedly secured to the top surface of the upright 12, and to protect the various components that are located below the folder housing frame there is provided on apron plate 58, fixedly secured to and depending from the front bar 56 of the folder housing frame, as best shown in Figs. 1 and 2.

The folder housing frame further includes front corner plates 60 (Fig. 6), which are approximately square, and are formed with a plurality of openings receiving bolts that engage in threaded openings in the front and side bars. Also constituting a part of the folder housing frame are rear corner plates 62 which are somewhat smaller than the front corner plates as shown in Fig. 6.

A cover plate generally designated 64 overlies and is spaced upwardly a short distance from the folder housing frame 16. The cover plate in the illustrated example is sectionally constituted, to comprise relatively thick, planiform front and rear plate sections, 66, 68, respectively, the adjacent inner edges of which are formed with confronting recesses 70, 72. When the sections are in the contacting relation, peripheral openings therein receive the bolts that pass through the corner plates and bars of the folder housing frame, so as to doubly connect the cover plate to the folder housing frame 16.

The recesses 70, 72 define an opening, when the sections are connected to provide a cover plate such as shown in Fig. 4, into which the die 42 moves when lowered from its normal position shown in Fig. 1. Within this opening, in a manner to be discussed in full detail hereinafter, the work piece will be disposed.

As previously mentioned, the cover plate is closely spaced from the folder housing frame 16 and this may be used to particular advantage from Figs. 7-9. In this small space between the cover plate and frame 16, a pair of folder plates 74, 76, disposed in a common plane, are mounted for movement between operative, work-folding positions and retracted positions in which they are wholly clear of the work.

The folder plates also are shown to particular advantage in Fig. 6, and as will be noted, are disposed in side-by-side relation, with the inner edges thereof being formed with confronting, angular recesses 78, 80. The recesses extend over only part of the front-to-back dimension of the folder plates, and open upon the back edges of the folder plates as shown to best advantage in Fig. 6. The inside edges of the folder plates, forward of the recesses, are oppositely, sharply beveled at 82, 84. The purpose of this arrangement is to permit the folder plates to move inwardly toward each other into positions in which the edges 82, 84 will be in overlapping relation while the folder plates still remain in a common horizontal plane. Normally, the edges are not overlapped, and are disposed as shown in Figs. 6 and 9. In this position of the folder plates, the edges of the recesses 78, 80 are retracted so as to be clear of the work piece. Said edges of the recesses, 78, 80, in this connection, may also be sharpened or bevelled, so as to provide a more effective folding action, although this is not critical to successful operation of the machine.

The plates 74, 76, when moved from their retracted to their operative positions, are bodily shifted in angularly related paths that converge toward the work-receiving opening of the cover plate, that is, toward the back of the machine. The folder plates, in this connection, are carried by slide blocks, movable in guide slots 86, 88, milled in the corner plates 60 (Fig. 6). The angular relationship of the slots, which can be seen also in Fig. 5, determines the path in which the folder plates will shift toward each other. From Fig. 5, it will be noted that the slots converge in a direction away from the front edge of the folder housing frame, at an angle of approximately ninety degrees toward each other, with the slots each being substantially at an angle of forty-five degrees to a line bisecting the folder housing frame from front to rear of the apparatus.

The slide blocks have been designated at 90, and are shown to particular advantage in Figs. 6-8. Each slide block is of inverted T-shape in cross section, so as to include a longitudinal, upwardly projecting tongue 92, which engages in the associated slot 86 or 88 as the case may be. Formed in each tongue 92 are longitudinally spaced, threaded openings receiving screws 94, the heads of which are engaged in countersunk openings formed in the respective holder plates 74, 76.

Normally, the slide blocks are retracted by means of pull-back, contractile springs 96 connected between the front corners of frame 16 and the adjacent ends of the slide blocks.

Depending from the respective slide blocks are integral pins or studs 98 and connected to the studs are cables 100 (Figs. 1, 2, 3, 5 and 7). The cable 100 are so arranged as to pull the slide blocks toward the work-receiving opening of the cover plate, against the restraint of the springs 96, from the normally retracted positions of the slide blocks. As will be noted from Fig. 5, adjacent the inner, convergent ends of the slots 86, 88 there are provided pulleys 102 rotating about vertical axes, with the cables 100 being trained about said pulleys and diverging toward the back of the machine. In this position, toward the rear corners, adjacent which the cables 100 are trained about direction-changing pulleys 104 rotating about inclined axes. The pulleys 102 are mounted upon angle bracket 106 carried by the upright. Since the upright is spaced laterally from the center opening of the cover plate, and since the pulleys 102 are disposed adjacent the front corners of said center opening, it will be understood that both pulleys 102 will be disposed at one side of the upright. This is true, in fact, of all the various components of the apparatus, with the exception of a few specifically named components to be particularly mentioned hereinafter.

Referring to Fig. 2, the pulleys 104 are disposed on opposite sides of the upright 12, and it will be understood that the cable 100 extending to that pulley 104 shown at the right in Fig. 2 would be extended through a suitable horizontal slot provided in the top portion of the upright.

In any event, after being trained about the pulleys 104, (see Fig. 2), the cables 100 are extended downwardly, converging toward the base 10, with the right-hand cord 100 passing through a vertical, elongated slot provided in the upright 12. The lower, convergent ends of the cords 100 are connected to opposite sides of a folder plate operating lever 108 (Fig. 3) which is fulcrumed on the pivot pin 26. It is apparent, thus, that the levers 24, 108 both swing about a common center, although being pivoted for swinging movement independently of each other so as to swing at different times during the cycle of operation of the machine.

The top surface of the cam 23 is so formed as to cause the swinging of the levers 24, 108 at different times, in predetermined succession, during the operation of the machine and this characteristic of the cam will be described in greater detail hereinafter.

Normally, the cam and the arm 18 are disposed in a retracted, inoperative position by reason of the pull of a contractile spring 110 (Fig. 3) which is connected between the cam and the lower end of the upright 12. Swinging movement of the arm and cam counterclockwise in Fig. 3, under the pull of the spring, into the inoperative position of the cam, is limited by a stop 112, that engages the cam and projects outwardly from the upright 12, in the path of movement of the cam when the cam is moved in a counterclockwise direction but is out of the path of movement when in a clockwise direction.

The cam is swung to initiate the operation of the machine in a clockwise direction, viewing the same as in Figs. 1 and 3, responsive to depression of the treadle
2,858,967 7 22. When the cam has been swung to the maximum extent with the treadle fully depressed, it is held in the depressed position by a ratchet arm 114 rigid at its lower end with the arm 18 and in turn supported by the brackets 118 projecting upwardly from base 10. The arm 114 is normally swung toward the arm 18 of the cam, due to the provision of a screw 120 that projects upwardly from the upper end of the arm 114, and is connected to one end of a contractile spring 122, the other end of which is connected to an eye carried by the upright.

The inner surface of the arm 114 is formed with a series of ratchet teeth 124, and on the adjacent side of the arm 18 there is fixedly secured, a hardened, complementarily toothed lug 126. Thus, when the treadle is depressed, the lug 126 will ratchet along the teeth 124 and when the treadle is fully depressed, the arm 154, under the pull of the spring 122, will be held in locking engagement with the lug 126 to hold the arm 18 at the lower limit of its swinging movement.

The apparatus is so designed that when the treadle is depressed in this manner, electrical means is placed in operation in such a manner as to cause the arm 114 to be swung out of engagement with the arm 18 after a predetermined lapse of time. This is done automatically, so that the operator need do no more than depress the treadle and remove his foot. Thereafter, after the lapse of the predetermined amount of time, arm 114 will be swung outwardly from arm 18 against the restraint of spring 122, by energizing of a solenoid 128 having a core 130 bearing against the upper end portion of arm 114. The solenoid is of a type such that the core 130 is normally retracted with the core being pushed outwardly from the coil of the solenoid when the solenoid is energized. It will be apparent that in these circumstances the plunger or core will shift the arm 114 out of engagement with the arm 18, so that the arm 18 immediately swings back to its normal position under the pull of spring 118, thus completing a single oscillation of the cam effective to cause operation of the apparatus through a single cycle.

Means is provided that responds to the depression of the treadle for the purpose of effecting energizing of the solenoid 128 after the treadle has remained in depressed position for the predetermined period of time. This means, shown to best advantage in Fig. 3, includes an arm 132 which is connected adjustably to the arm 18 and extends downwardly from the arm 18. Arm 132 has a connection to the arm 18 and can be swung about the axis of its connection 133, and can also be adjusted in the direction of its length upon the connection.

At its outer end, arm 132 has a cam surface, and a switch 134, secured to the upright 12, has an arm 136 disposed in the path of the cam surface when the arm 18 is depressed. As a result, the cam surface of the arm or finger 132 engages the edge of switch arm 136, closing switch 134. This closes a switch to an electric timer 144 mounted upon the upright. The timer is a device conventional per se, and includes an electric motor which goes into operation when the switch 134 is closed. After the motor of the timer has operated for a predetermined period of time, the timer acts to close a switch to the solenoid to energize the solenoid and thus release the arm 18 for return movement to its upper position.

Considering now the means for swinging the levers 24 and 108, secured to and projecting outwardly from said levers are closely spaced rollers 138, 140, respectively, bearing against the top surface of the cam 23. The roller- engaging surface of the cam 23 is so designed as to include a plurality of steps or undulations, having a particular relationship to the rollers such that when the downward movement of arm 18 begins, roller 138 will immediately receive the full upward force of the cam, so as to be swung upwardly. Since roller 138 is secured to the lever 24, this causes the outer end of the lever 24, that is, the end connected to the rod 28, to be immediately swung upwardly. Rod 28 is thus shifted upwardly in the direction of its length. This is then at Fig. 1 lowering die 42 into the cover plate opening against the work piece.

This is the first motion of the apparatus and is shown in Fig. 10, in which figure of the drawing the die 42 is illustrated in full engagement with the work piece.

As the downward movement of the arm 18 continues, the roller 140 is now acted upon by the cam, so as to be shifted upwardly, thus rocking the lever 108 on its fulcrum 26 to exert a downward pull on the cords 100 for the purpose of shifting the folder plates inwardly along the convergent paths thereof previously described, into work-folding positions. This operation will be described in greater detail hereinafter.

It is appropriate now to discuss a means for supplying the steam to the work during the cycle of operation. In this connection, the steam can be supplied at any time desired during the cycle, and the construction is such as to permit the application of the steam to the work at a selected, adjusted time. In the illustrated embodiment, the steam is applied at about the last half of the movement of the folder plates to their closing or operating positions. While this appears to be at present the most desirable time for the spray of steam, it is possible to apply the steam at any other time, and an important feature of the invention resides in the fact that the timing of the steam application can be adjusted merely by adjusting the position of an actuating member of finger carried by the cam 23 and described in greater detail hereinafter.

The steam supplying means has been shown to particular advantage in Fig. 9 and also in Fig. 2. As will be noted, this assembly includes a steam supply pipe 142, extending from a suitable source of steam under pressure. Below and parallel to the pipe 142 is a return pipe 144, extending back to the source of steam under pressure. Pipe 142 is connected to a T 145, and extending upwardly from the T 145 is a connecting pipe or nipple 146. Extending downwardly from the T is a pipe 148 connected by an L 149 to the return pipe 144.

This arrangement is designed to provide a steam trap, and is an important feature of the invention. The steam supplied to the work should be as condensation-free as possible and the construction is designed to produce this characteristic. Thus, steam supplied through the pipe 142, on passing into the T 145, will have a certain amount of condensation, and this condensation will drop downwardly within the pipe 148 to be returned to the source through pipe 144. The steam supplied through pipe 146, thus, will be condensation-free.

The steam travels into a valve 150 which is, per se, conventional. Valve 150 (Fig. 9) is of a type commonly known in the trade as a whistle valve, and such valves are well known to garment manufacturers, since they are used for steam presses and related machinery.

The valve 150 is normally closed, and includes a valve stem 152 which is adapted to be driven by a bell crank or angular lever 154 pivoted upon a yoke 156 carried by the valve housing. Lever 154 in the position shown in full lines in Fig. 9, when the valve is closed. However, a cord 158 is connected to the lever, and when pulled downwardly swings the lever to its lower line position of Fig. 9, so that the lever engages the stem 152 to open the valve 150. When the valve is open, steam is permitted to flow through tubes 159, that extend from the valve outlet and terminate adjacent the undersides of the folder plates 74, 76.

Referring now to Figs. 1 and 3, cord 158 at its lower end is connected to one end of a rockable lever 160 mounted outwardly from the upright 12 for swinging movement, upon a bracket 162 attached to the upright about the axis defined by the support pin 164. Arm 160 is overbalanced at that side of the pin at which cord 158

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is connected by a weight 166 attached to the lever or arm 160. This causes the lever 160 to normally tend to swing counterclockwise in Figs. 1 and 3, to maintain the cord 158 taut. The weighted end of the arm, however, does not normally exert so great a downward pull on the cord 158 as to be sufficient to operate valve 150 to open position.

To cause the valve to be opened responsive to the depression of the treadle 22, a finger 165 is secured to the cam 23 and projects outwardly from the cam below the adjacent end of the lever 160. Finger 165 has a longitudinal slot receiving a screw or equivalent fastening element that is secured to the cam 23. This permits the position of finger 165 to be adjusted as desired, in respect to the oscillation of the cam to the normal position of the lever 160.

Thus, it becomes apparent that on depression of the treadle, the downward swinging movement of arm 18 will be effective to swing upwardly the finger 165, causing the finger to bear against the lever 160. This rocks the lever 160 counterclockwise in Fig. 1, to pull downwardly on cord 158 so as to swing the lever 154 (Fig. 9) to its valve-opening position.

As previously mentioned, the valve is timed to open in the illustrated example, when the folders are in the last half of their movement to their full operative position. However, by changing the position of the finger 165, the valve can be timed to open at a different time during the cycle.

The work piece is adapted to be supported upon a rectangular bed generally designated 170, which is located below the opening of the cover plate. The bed 170 is shown to best advantage in Figs. 9–12, and is mounted upon the upper end of a stem 172 slidably mounted in guide openings formed in the bracket 106 and in an angle bracket 174 fixedly secured to upright 12 below bracket 106 as shown in Fig. 1. The opening in the bracket 174 is slightly oversized in respect to the shaft 172, so that the shaft 172 in effect is permitted to tilt slightly out of the vertical for the purpose of permitting the bed 170 to adjust its position to any plane dictate by that to which the die 42 moves. In other words, should the die 42 tilt slightly to adjust itself to the plane of the work piece, as for example, where the work piece has a thicker portion at one side than at the other, the bed 170 is permitted to adjust itself correspondingly so that the work piece will be securely gripped by and between the die and the bed 170 in the manner shown in Fig. 10.

The shaft 172 is adapted to be shifted in an axial direction, and to this end is connected at its lower end to a rod 176 which is in turn threaded together with one end of a turnbuckle sleeve 178, the other end of which is similarly connected to a rod 180 having a lower end pivotally connected to the cam 23. Thus, the overall length of the rod connection between the shaft 172 and the cam 23 can be adjusted as desired, for correspondingly adjusting the normal position of the bed, as for example, for the purpose of accommodating fabrics of different thicknesses.

It will be apparent that on depression of the treadle another motion thus results, namely, the upward movement of the rods 180, 176, causing the vertical, upward shifting of shaft 172 to cause the bed to be moved upwardly for the purpose of exerting pressure against the garment piece in a manner to be described in full detail hereinafter.

A thermostat 182 is mounted upon the front or apron plate 58 and has as its purpose the controlling of the operation of a heating element that is provided within the bed. Since the bed construction will be further described hereafter, the thermostat will be also further described in conjunction with the bed.

On the front edge of the upright, there is mounted a timer 184 which as previously brought out herein is in circuit with the switch 153 and controls the energizing of the solenoid 128.

Designated at 186 is a stop, which as shown in Fig. 1 is of angular formation, including an elongated, substantially horizontal leg, the free end of which underlies the shaft 172 in position to engage the shoulder defined by connection of the shaft 172 to the rod 176. Stop 186 is pivoted at 188 at the juncture of its similarly related legs, for swinging movement in a vertical plane upon the right 12. The shorter leg of the stop extends downwardly, and is disposed adjacent a bracket 190 in which is threaded an adjusting screw 192 that bears against the shorter leg of the stop.

The position of the stop can thus be adjusted, that is, the free end of the leg 186 can be shifted upwardly or downwardly as desired. The purpose of this arrangement is to limit the downward movement of the shaft 172. This is an important feature of the invention, to be considered of an importance equal to the various features previously described.

The importance of the adjustable stop is found in the fact that the stop provides a quick means of adjusting the clearance between the die 42 and the folder plates 74, 76 when the folders move over the die in the manner shown in Figs. 11 and 12. When the die is in its lowered position shown in these figures of the drawing, it will be pressed against the bed 170 because of the action of the compression springs 52. Therefore, since the folders 74, 76 always remain in the same plane, when the point at which the bed drops into engagement with the stop 186 is adjusted the clearance at which the folder plates move over the die will be correspondingly adjusted. This quick adjustment is desirable when changing from a thin cloth such as cotton, to a thick cloth such as a heavy wool.

Referring now to the particular construction of the bedplate, as shown in Figs. 10–12, this includes top and bottom plate members 194, and 198, respectively, between which electric heating elements 196 are disposed. The bottom plate member is designated 198, and as shown in Fig. 9, a thermostat bulb 199 is mounted in proximity to the heating elements 196, and is connected in communication with a tubular, flexible member 200 which is connected to the thermostat 182. The thermostat, in turn, is in circuit with a switch controlling operation of the electric heating elements, but not shown in the several drawings. It will become apparent, thus, that a uniform heat is maintained in the bed, since the heating elements will be energized whenever the temperature on the cloth-contacting face of the bed drops below a certain point, said heating elements being automatically deenergized when the temperature rises above a maximum predetermined value according to the particular materials being used in the garment components.

Considering the operation of the device, as previously noted a single depression of the treadle 22 effects the entire cycle of operation. As the movement of arm 18 downwardly begins, cam 23 throws lever 24 to cause die 42 to be lowered to its Fig. 10 position. The die, when so lowered, bears against the top surface of the work piece 202 which is supported upon the bed 170. This causes the work piece edges 204, which are disposed beyond the periphery of the die, to be turned upwardly as the work piece is forced downwardly through the opening of cover plate 64. In the illustrated example, as shown in Fig. 14, three edges of the work piece 202 are to be folded, but it will be understood that a smaller or greater number of edges can be turned, merely by particular shaping of the cover plate opening, die, and folders, and by selective movement of the folders between their inoperative and operative positions.

In any event, in the illustrated example three edges are to be folded. Therefore, after the die has been lowered by upward movement of lever 24, causing the
first basic motion shown in Fig. 10, almost immediately the folder plates move from their retracted, Fig. 10 positions to their extended, Fig. 11 positions. This is caused by further downward movement of the arm 18, tending to cam lever 108 to a position effective to exert pull on the slide blocks, tending to shift the folder plates in their convergent paths. The folder plates are thus moved to positions in which their beveled edges overlap, with the angularly related edges of the recesses 78, 80 all moving toward each other to reduce the size of the opening defined by said recesses 78, 80. This causes the edges of the recesses of the folder plates to move over the periphery of the die 42 as shown in Fig. 11. As a result, the upwardly projecting edges of the work piece designated at 204 are folded inwardly over the die, as shown in Fig. 11. This is the second basic motion of the machine. As previously mentioned, during the last half of the second motion, steam is applied by tripping of the lever 160 as the cam is rocked during depression of the treadle.

Further downward movement of the treadle causes the shaft 172, and hence the bed 170, to be moved upwardly to exert pressure tending to close the fold lines of the work piece. This is shown in Fig. 12 and it will be noted that the cover plate, in effect, receives the full effect of the pressure, rather than the die or other components that might tend toward breakage or faulty operation.

In any event, the pressure is applied substantially simultaneously with the application of the steam, so as to iron or crease the folded edges 204 of the work piece 202.

It becomes further apparent that when these three basic motions have been carried out, they will have been carried out in a predetermined, following order, with the successive motions occurring at predetermined times in a manner such as to take the control of the timing of the motions away from the operator. In other words, by depressing the treadle, the operator sets into motion the various successively acting components, in a manner such that the machine and not the operator will control as to the timing of the steps of the operation. This assures more uniform creasing, and increases productivity without loss of accuracy.

On the treadle has been fully depressed, the parts are to remain in their Fig. 12 position for a predetermined length of time, to assure the full creasing of the folder edges. This is done, as previously brought about, by causing the arm 18 to be locked in its lowered position automatically by the ratchet arm 114. The timer 154 of course is immediately placed in operation, due to the fact that switch 134 is closed responsive to depression of the treadle. After a predetermined time, the ratchet disengages the arm 18, and spring 110, being now free to contract, returns the arm 18 to its normal position. As the arm swings upwardly, the various motions previously described herein are carried out in a reverse order, so as to ultimately result in the die being raised to permit removal of the folded garment component.

Although not specifically illustrated and described herein, various other means may be employed for operating the cam 23, in a single oscillating movement to cause a complete cycle to be carried out. The drawing shows a manually operated means, that is, the foot treadle. Instead, one may use an air cylinder, and in this event one would employ a delayed time air valve, this being well known in the garment trade since it is used extensively on pneumatic presses. The air cylinder would be so designed as to effect the controlled depression of the arm 18.

A hydraulic operation may also be provided, by utilizing a hydraulic cylinder the ram of which is connected to the arm 18 with the ram being shifted responsive to operation of a treadle type switch, which when operated by a user will energize a solenoid, the plunger of which is directly connected pivotally to the arm 18 so as to rock the arm in one direction. Still further, an electrically controlled eccentric drive may be employed, wherein an eccentric mounted upon the upright, and driven by a motor through suitable reduction gearing, may reciprocate a pitman having a connection to the arm 18.

These various modifications are mentioned, though not being illustrated, for the specific purpose of showing that the manner in which the cam 23 is rocked from its Fig. 1 position to the opposite extreme position of the cam in a clockwise direction in Fig. 1 can be varied as desired, and that a particular means for so rocking the cam is not critical to successful operation of the invention.

Regardless of the means employed, the construction is such that the folding machine can be rapidly operated in the mass production of folded garment components.

While I have illustrated as described the preferred embodiment of my invention, it is to be understood that I do not limit myself to the precise construction herein disclosed and that various changes and modifications may be made within the scope of the invention as defined in the appended claims.

Having thus described my invention, what I claim as new, and desire to secure by United States Letters Patent is:

1. A machine for edge-folding a fabric work piece comprising a support frame, a bed adapted for supporting said work piece and mounted for upward movement on the frame to a position in which the bed applies pressure upwardly against the supported work piece, a die mounted on the frame for lowering into a position overlying the work piece for clamping the work piece between the die and bed, folder plates mounted on the frame for movement to a position in which said folder plates fold inwardly the edges of the clamped work piece, and means for shifting the die, bed, and folder plates to said position thereof, in a predetermined, timed sequence, the movement of the die to said position thereof being first in the sequence, the folder plates moving next in the sequence, and the bed moving to its position last in the sequence, said means including a cam rockably mounted upon the support frame, and cam-operated connections extending from the cam to the die, folder plates, and bed for shifting the same to said positions thereof responsive to rocking of the cam in one direction, the cam having also connections extending to the die comprising an arm supporting the die and rockably mounted upon the support frame, a connecting rod attached at one end to said arm, and a lever pivotally mounted upon the frame and connected pivotally to the other end of the rod, said lever including means actuated by the cam responsive to rocking of the cam for swinging the lever to a position effective to move the die to said die position, said connection extending to the folder plates comprising a lever pivotally mounted upon the upright adjacent the first-named lever, cords connected to the second-named lever, and slide blocks carried by the support frame and attached to the folder plates, said slide blocks being connected to the cords for shifting the folder plates to said positions responsive to swinging of the second-named lever by the cam in a direction to exert a pull on said cords.

2. A machine for edge-fold ing a fabric work piece comprising a support frame, a bed adapted for supporting said work piece and mounted for upward movement on the frame to a position in which the bed applies pressure upwardly against the supported work piece, a die mounted on the frame for lower ing into a position overlying the work piece for clamping the work piece between the die and bed, folder plates mounted on the frame for movement to a position in which said folder plates fold inwardly the edges of the clamped work piece, and means for shifting the die, bed, and folder plates to said posi-
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positions thereof, in a predetermined, timed sequence, the movement of the die to said position thereof being first in the sequence, the folder plates moving to said position next in the sequence, and the bed moving to its position last in the sequence, said means including a cam rockably mounted upon the support frame, and cam-operated connections extending from the cam to the die, folder plates, and bed for shifting the same to said positions thereof responsive to rocking of the cam in one direction, the connections extending to the die comprising an arm supporting the die and rockably mounted upon the support frame, a connecting rod attached at one end to said arm, and a lever pivotally mounted upon the frame and connected pivotally to the other end of the rod, said lever including means actuated by the cam responsive to rocking of the cam for swinging the lever to a position effective to move the die to said position, connection extending to the folder plates comprising a lever pivotally mounted upon the upright adjacent the first-named lever, cords connected to the second-named lever, and slide blocks carried by the support frame and attached to the folder plates, said slide blocks being connected to the cords for shifting the folder plates to said positions thereof responsive to swinging of the second-named lever by the cam in a direction to exert a pull on said cords, the folder plates being mounted for movement upon the support frame in paths converging toward the work piece.

3. A machine for edge-folding a fabric work piece comprising a support frame, a bed adapted for supporting said work piece and mounted for upward movement on the frame to a position in which the bed applies pressure upwardly against the supported work piece, a die mounted on the frame for lowering into a position overlying the work piece for clamping the work piece between the die and bed, folder plates mounted on the frame for movement to a position in which said folder plates fold inwardly the edges of the clamped work piece, and means for shifting said folder plates to said positions thereof responsive to swinging of the second-named lever by the cam in a direction to exert a pull on said cords, the first and second-named levers including as the cam-engaging means thereof rollers disposed in contact with different surfaces of the cam so as to be actuated by the cam at different stages of the rocking movement of the cam.

4. A machine for edge-folding a fabric work piece comprising a support frame, a bed adapted for supporting said work piece and mounted for upward movement on the frame to a position in which the bed applies pressure upwardly against the supported work piece, a die mounted on the frame for lowering into a position overlying the work piece for clamping the work piece between the die and bed, folder plates mounted on the frame for movement to a position in which said folder plates fold inwardly the edges of the clamped work piece, and means for shifting the die, bed, and folder plates to said positions thereof, in a predetermined, timed sequence, the movement of the die to said position thereof being first in the sequence, said folder plates moving to said position next in the sequence, and the bed moving to its position last in the sequence, said means including a cam rockably mounted upon the support frame, and cam-operated connections extending from the cam to the die, folder plates, and bed for shifting the same to said positions thereof responsive to rocking of the cam in one direction, the connections extending to the die comprising an arm supporting the die and rockably mounted upon the support frame, a connecting rod attached at one end to said arm, and a lever pivotally mounted upon the frame and connected pivotally to the other end of the rod, said lever including means actuated by the cam responsive to rocking of the cam for swinging the lever to a position effective to move the die to said position, connection extending to the folder plates comprising a lever pivotally mounted upon the upright adjacent the first-named lever, cords connected to the second-named lever, and slide blocks carried by the support frame and attached to the folder plates, said slide blocks being connected to the cords for shifting the folder plates to said positions thereof responsive to swinging of the second-named lever by the cam in a direction to exert a pull on said cords, the first and second-named levers including as the cam-engaging means thereof rollers disposed in contact with different surfaces of the cam so as to be actuated by the cam at different stages of the rocking movement of the cam.

5. A machine for edge-folding a fabric work piece comprising a support frame, a bed adapted for supporting said work piece and mounted for upward movement on the frame to a position in which the bed applies pressure upwardly against the supported work piece, a die mounted on the frame for lowering into a position overlying the work piece for clamping the work piece between the die and bed, folder plates mounted on the frame for movement to a position in which said folder plates fold inwardly the edges of the clamped work piece, and means for shifting the die, bed, and folder plates to said positions thereof, in a predetermined, timed sequence, the movement of the die to said position thereof being first in the sequence, said folder plates moving to said position next in the sequence, and the bed moving to its position last in the sequence, said means including a cam rockably mounted upon the support frame, and cam-operated connections extending from the cam to the die, folder plates, and bed for shifting the same to said positions thereof responsive to rocking of the cam in one direction, said machine further including means for applying steam to the work piece at a selected stage of the folding operation of the machine, said steam-applying means including a valve, a supply line for supplying steam under pressure through a valve, a cord disposed for opening the valve when pulled, a lever mounted pivotally on the upright and connected to the cord, and a finger carried by the cam and disposed for throwing said lever in a direction to pull the cord responsive to rocking of the cam.

6. A machine for edge-folding a fabric work piece comprising a support frame, a bed adapted for supporting said work piece and mounted for upward movement on the frame to a position in which the bed applies pressure upwardly against the supported work piece, a die mounted on the frame for lowering into a position overlying the work piece for clamping the work piece between the die and bed, folder plates mounted on the frame
for movement to a position in which said folder plates fold inwardly the edges of the clamped work piece, and means for shifting the die, bed, and folder plates to said positions thereof, in a predetermined, timed sequence, the movement of the die to said position thereof being first in the sequence, the folder plates moving to said position next in the sequence, and the bed moving to its position last in the sequence, said means including a cam rockably mounted upon the support frame, and cam-operated connections extending from the cam to the die, folder plates, and bed for shifting the same to said positions thereof responsive to rocking of the cam in one direction, said machine further including means for applying steam to the work piece at a selected stage of the folding operation of the machine, said steam-applying means including a valve, a supply line for supplying steam under pressure through the valve, a cord disposed for opening the valve when pulled, a lever mounted pivotally on the upright and connected to the cord, and a finger carried by the cam and disposed for throwing said lever in a direction to pull the cord responsive to rocking of the cam, said finger being mounted upon the cam for adjustment to selected positions, thus to in turn adjust the time at which the valve is opened.

7. A machine for edge-folding a fabric work piece comprising a support frame, a bed adapted for supporting said work piece, a die mounted upon the frame to a position in which the bed applies pressure upwardly against the supported work piece, a die mounted on the frame for lowering into a position overlying the work piece for clamping the work piece between the die and bed, folder plates mounted on the frame for movement to a position in which said folder plates fold inwardly the edges of the clamped work piece, and means for shifting the die, bed, and folder plates to said positions thereof, in a predetermined, timed sequence, the movement of the die to said position thereof being first in the sequence, the folder plates moving to said position next in the sequence, and the bed moving to its position last in the sequence, said means including a cam rockably mounted upon the support frame, and cam-operated connections extending from the cam to the die, folder plates, and bed for shifting the same to said positions thereof responsive to rocking of the cam in one direction, said machine further including means for releasing the ratchet means following a predetermined time interval, for return of the cam to its normal position.

8. A machine for edge-folding a fabric work piece comprising a support frame, a bed adapted for supporting said work piece and mounted for upward movement on the frame to a position in which the bed applies pressure upwardly against the supported work piece, a die mounted on the frame for lowering into a position overlying the work piece for clamping the work piece between the die and bed, folder plates mounted on the frame for movement to a position in which said folder plates fold inwardly the edges of the clamped work piece, and means for shifting the die, bed, and folder plates to said positions thereof, in a predetermined, timed sequence, the movement of the die to said position thereof being first in the sequence, the folder plates moving to said position next in the sequence, and the bed moving to its position last in the sequence, said means including a cam rockably mounted upon the support frame, and cam-operated connections extending from the cam to the die, folder plates, and bed for shifting the same to said positions thereof responsive to rocking of the cam in one direction, said machine further including means for applying steam to the work piece at a selected stage of the folding operation of the machine, said machine further including ratchet means mounted upon the support frame in position to engage the cam on rocking of the cam in one direction, thus to hold the die, folder plates, and bed in said positions thereof, said machine further including means for releasing the ratchet means following a predetermined time interval, for return of the cam to its normal position.

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