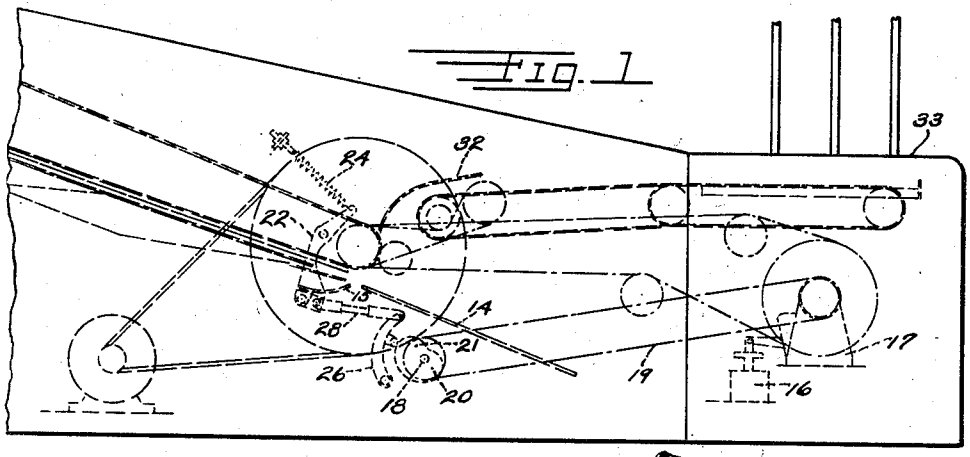
Jan. 28, 1958 J. R. PETRE 2,821,386

OPERATING MECHANISM FOR FOLDING BLADE

Filed Dec. 3, 1954

Fig. 1



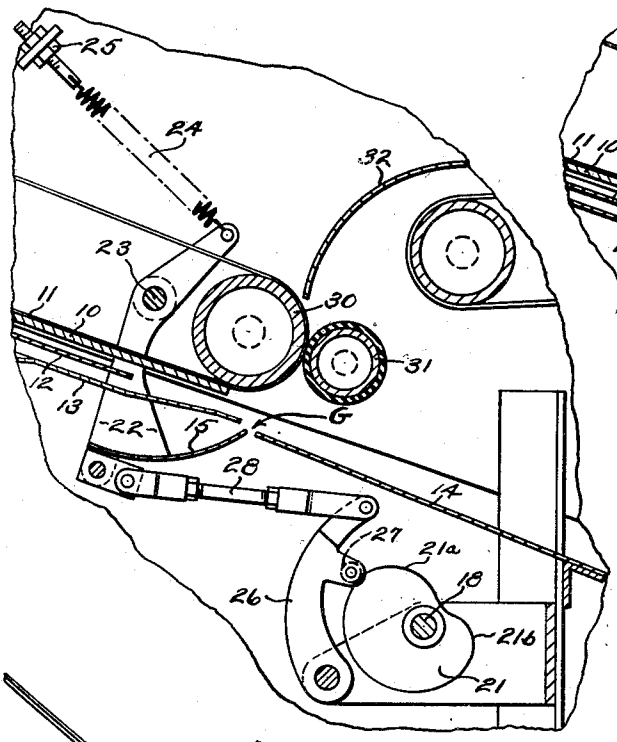


Fig. 2

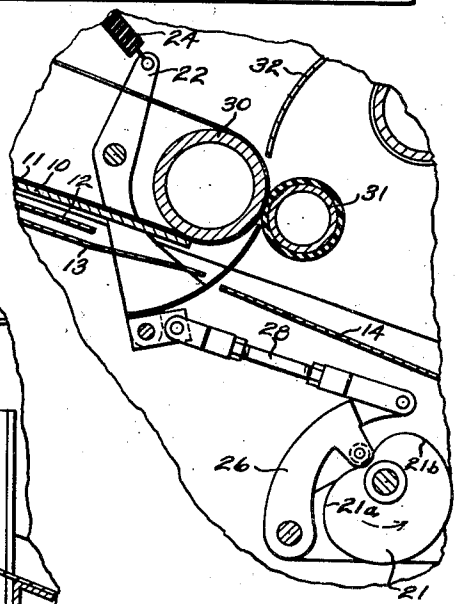


Fig. 3

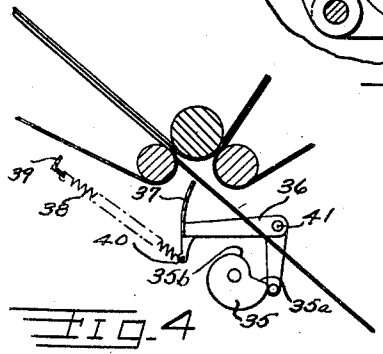


Fig. 4

INVENTOR.
JOHN R. PETRE

BY Hyde, Myers, Baldwin & Doran

ATTORNEYS

United States Patent Office 2,821,386 Patented Jan. 28, 1958

2,821,386

OPERATING MECHANISM FOR FOLDING BLADE

John R. Petré, Cincinnati, Ohio, assignor to The American Laundry Machinery Company, Cincinnati, Ohio, a corporation of Ohio

Application December 3, 1954, Serial No. 472,843

2 Claims. (Cl. 270—80)

The invention relates to folding mechanisms for the folding of flat work articles moving in succession on conveyor means. Since one commercially important exemplification of this type of flatwork articles consists of laundered flatwork pieces, the invention will be described in this connection.

In laundry folding machines, in one of the most conventional methods, a preselected zone of the article is inserted into the bite of a pair of folding rolls, usually by an elongated blade or equivalent means. Folding blades have been mounted in various ways, probably the most familiar being the pivoted type wherein the blade is hinged for arcuate movement, being actuated by a lever under the impulse of power means. The required power impulse is imparted in various ways, for instance by a solenoid, servomotor, or rotating cam, the last-named means having the advantage of being positive, and efficacious.

In use a cam is adapted to be operatively connected, by means of a clutch or otherwise, to a rotating driver, the cam being periodically energized, for example, by a one-revolution clutch mechanism, or a fractional movement clutch mechanism.

Heretofore, when a folding blade was actuated by a rotating cam, it was conventional practice to hold the idle blade and operating lever (these two being often integrally united) by means of a tension spring with the operating cam in contact with the cam follower part of the lever or actuatable portion of the folding blade means. It will be obvious that when the cam is operatively rotated, it must exert sufficient force to overcome inertia and spring bias, and enough additional force to give the lever and blade enough acceleration to execute the folding operation at the precise moment when the preselected part of the article comes to registry with the folding rolls. In certain types of flatwork folders, such as the so-called "small piece" folders, the articles are travelling at relatively high speed, and the folding blade must necessarily come to folding position at high speed. The required high acceleration rate of the blade necessitates a high cam force, to which must be added sufficient impetus to overcome the opposed pull of the spring. High accelerations produce forces and stresses within moving members due to inertia, and in many arrangements of this conventional system the retractor spring adds to these stresses, which in some instances have caused deformation of the moving members. In such prior art system the one-revolution cam was often quite steep on its rising face to insure the required fast speed of the blade in the forward movement of the working stroke, which created substantial stress, and required a relatively high torque.

An object of the present invention is to overcome the difficulties hereinabove mentioned by an arrangement wherein the blade and lever are spring biased towards folding position, not away from such position as previously, and wherein the cam now acts as a controller or restrainer to normally hold the folding blade retracted against the

bias of the spring. Other objects and advantages will be apparent as the description proceeds.

In my novel and improved system, the cam has what migh be called a negative contour in the zone which has contact with the blade-operating lever part during forward or folding movement of the blade. This portion of the cam track drops away from the follower during this forward increment of the blade movement, and actually the spring bias is so applied during this increment that the follower tends to assist in the rotation of the cam. Thus the cam during such forward increment exerts no driving force against the blade lever and requires no driving torque.

The return of the blade to idle position can be much more leisurely than its advance to working position, so that the arcuate extent of this return portion of the cam rotation (conventionally in the neighborhood of 270 degrees) may comprise a gradual, uniform rise, to retract the blade and re-tension the spring with a corresponding lower acceleration and lower stress.

My present system, therefore, provides a free-acting blade operator capable of producing a blade movement having any desired speed without undue stress. In this system, if the cam drop is cut back or reversely shaped quite sharply in its first portion, the follower will barely contact the cam in their complementary movement so that in this case the equation Force=(Mass)×(Acceleration) is substantially met. Thus, with the potential energy of the spring force "F" already stored up, the releasing action of the cam permits this force to be immediately effective on the mass comprising the blade and its operating parts so as to produce the acceleration. In contradistinction, in the prior art system wherein the blade was held in retracted position by spring bias, the force "F" required to produce actuation of the blade had to meet the equation

$$F=(\text{Mass})\times(\text{Acceleration})+(\text{Force of overcoming spring bias}).$$

Proceeding now to the drawings:

Fig. 1 shows schematically the folding end of a small piece folder assembly, arranged in accordance with my invention.

Figs. 2 and 3 are fragmentary vertical sectional views showing, respectively, the blade and operating mechanism in retracted and folding positions.

Fig. 4 shows, diagrammatically, a modified form of the invention.

For a detailed description of the general type of small piece folder here shown, the reader is referred to U. S. Letters Patent No. 2,579,746, granted December 25, 1951, to Clifton S. Malott, Jr. Referring to Figs. 1 and 2, an article to be folded, such as a towel or the like, is conveyed to the right on top of plate **10**, being advanced by frictional contact with the lower flight of the endless conveyor **11**. As more fully described in the aforesaid Patent No. 2,579,746, lateral portions of the article overhang the lateral edges of plate **1** and are turned up and under, sequentially, by the guide plates **12** and **13** as the article advances. In the operation of my invention it is immaterial whether the article is thus longitudinally folded, although it is frequently so folded, since the present novel apparatus is shown and will be described in connection with the execution of a transverse fold. The leading edge of the article crosses the gap G shown between guide plate **13** and plate **14** and begins to travel downwardly on plate **14**.

In its course of travel the article has passed an initiating switch, trigger, or other means for instituting operation of a measuring timer, with the result that the folding blade **15** is operated when the proper transverse zone of the

article registers with gap G. The structure for producing this operation will now be described.

When the timer calls for operation of blade **15**, a solenoid **16** is momentarily energized which initiates operation of a one-revolution clutch mechanism **17**, the latter having a constantly rotating drive member rotated by a chain from the drive system of the machine. A sprocket on clutch **17** drives a cam shaft **18** by means of a chain **19** and sprocket **20**. The shaft **18** has a cam **21** secured thereto. The cam is rotated counterclockwise from the position of Fig. 2 to that of Fig. 3.

The blade **15** is attached on the end of a swingable arm **22** which is pivoted at an intermediate point **23**, the other end of the arm **22** being attached to a tension spring **24** which is fixed at **25** on the frame. From the structure so far shown, it is obvious that the blade is spring biased to folding position, but it is normally restrained by the linkage now to be described.

A pivoted rocker arm **26** has a follower roller **27** in contact with cam **21**. The end of the rocker arm is connected to the blade arm **22** by a link **28**, the said link being pivoted at both ends respectively to the rocker arm and the blade arm. Consequently, as cam **21** rotates counterclockwise, roller **27** rides down the rapid drop **21***a* of the cam permitting link **28** to move to the right, as shown in Fig. 3, under the bias of spring **24**. This drop, from the crest to the trough of the cam track, can take place over any angular extent desired, although in the present instance it is about 90° from the starting point of Fig. 2 to the finish as shown in Fig. 3. This short arcuate portion of cam rotation is actually desirable in restraining the operation just the amount required for swift, but not violent action. Were the situation reversed, and were the prior art structure being used, a rise from trough to crest over an arc of 90° would require an inordinate torque and would be inclined to set up quite undesired stresses in moving the blade with the same speed.

In this particular embodiment it was desired to have the folding blade move back quickly out of the way of the article, and consequently the cam rise **21***b* was shaped to give a fast but uniform initial retraction followed by a slow completion of the remaining retraction. The transversely folded article, emerging from rolls **30** and **31** is carried along curved plate **32** in any suitable way, being eventually delivered to a stacker **33**.

The form of the cam, as well as the blade mounting, spring connection, etc., can be varied in accordance with the particular folding apparatus as long as the significant feature is retained, namely the spring biasing the blade towards operating position, with cammed return of the blade to idle position. One somewhat modified arrangement is indicated in the device shown at Fig. 4 in which the cam **35** operates directly against the end of a bell crank lever **36** which carries the blade **37**. The spring **38**, of course, biases the blade towards folding position. Here also, with the cam **35** rotating clockwise, the drop along the cam track portion **35***a* is quite sudden, to permit exceptionally rapid blade operation, after which the cam rise **35***b* is somewhat more gradual. The combination of the spring, blade assembly, and cam could advantageously be so arranged that the forces are utilized most beneficially. For instance, as suggested in Fig. 4, the points of spring attachment **39** and **40** and the pivot point **41** for the blade crank arm lie practically in a straight line when the blade is arriving at folding position, so that movement of pivot point **40** past this straight line begins to be restrained by the spring thereby reducing the inertia force required to stop and reverse the blade motion, and consequently reducing the torque applied to the cam in withdrawing the blade. One of the advantages of my invention resides in this, that the cam contour can be utilized to control acceleration and deceleration while the spring provides a stored impetus, always applicable when needed.

From the above description, it will be apparent that the essentials of the invention reside in a movable folding member, a spring biasing the member towards operating position, and a cam operatively effective on the member to restrain it in opposition to the spring bias, the cam being adapted to be rotated to permit the spring bias to take effect. Whenever a cam follower is mentioned herein or in the appended claims, it will be understood that any part of the folding blade assembly which is in contact with the cam track may serve as a cam follower, and it will be further understood that the folding blade assembly includes not only the blade itself, but any mounting means, rocker arms, linkages, or other mechanical devices suitable to permit or facilitate movement of the folding blade, it being of course feasible to substitute a sliding, reciprocatory blade instead of the pivoted, arcuate swinging blade herein shown and described.

What I claim is:

1. In a folding device wherein an article is moved along a path towards a folding zone, means for folding said article comprising a frame, a folding arm, means on said frame providing a pivot point for said arm, a swingable end of said arm having a folding blade thereon, a tension spring having one end attached to said frame and the other end to said arm and so disposed that, when otherwise unrestrained, the two ends of said spring and the pivot point of said arm assume a co-linear position on a center line, said arm being swingable away from said center line, against spring bias, either forwardly towards said folding zone or rearwardly away from said folding zone, and a cam having a track portion abuttable against said arm and effective thereon to normally maintain said arm and blade over center away from said folding zone, said track having a cam-drop portion permitting said arm and blade to return over center towards an operating position in said folding zone.

2. A folding device of the character described in claim 1 wherein said cam track has a cam-rise portion following said cam-drop portion, said cam-drop portion being relatively precipitate to permit rapid arm swing to folding position, and the cam-rise portion being more gradual, to cause positive but more restrained arm movement away from folding position.

References Cited in the file of this patent

UNITED STATES PATENTS

1,465,440	Houston	Aug. 21, 1923
1,961,633	Ehlig	June 5, 1934
2,335,970	Schmidt	Dec. 7, 1943
2,355,105	Preston	Aug. 8, 1944