July 11, 1967 J. E. HYLAN 3,330,398

PRINTING HEAD CONTROL ALLOWING HEAD TO STRIKE IN FREE FLIGHT AND BE POSITIVELY RETRACTED

Filed Sept. 13, 1965 2 Sheets-Sheet 1

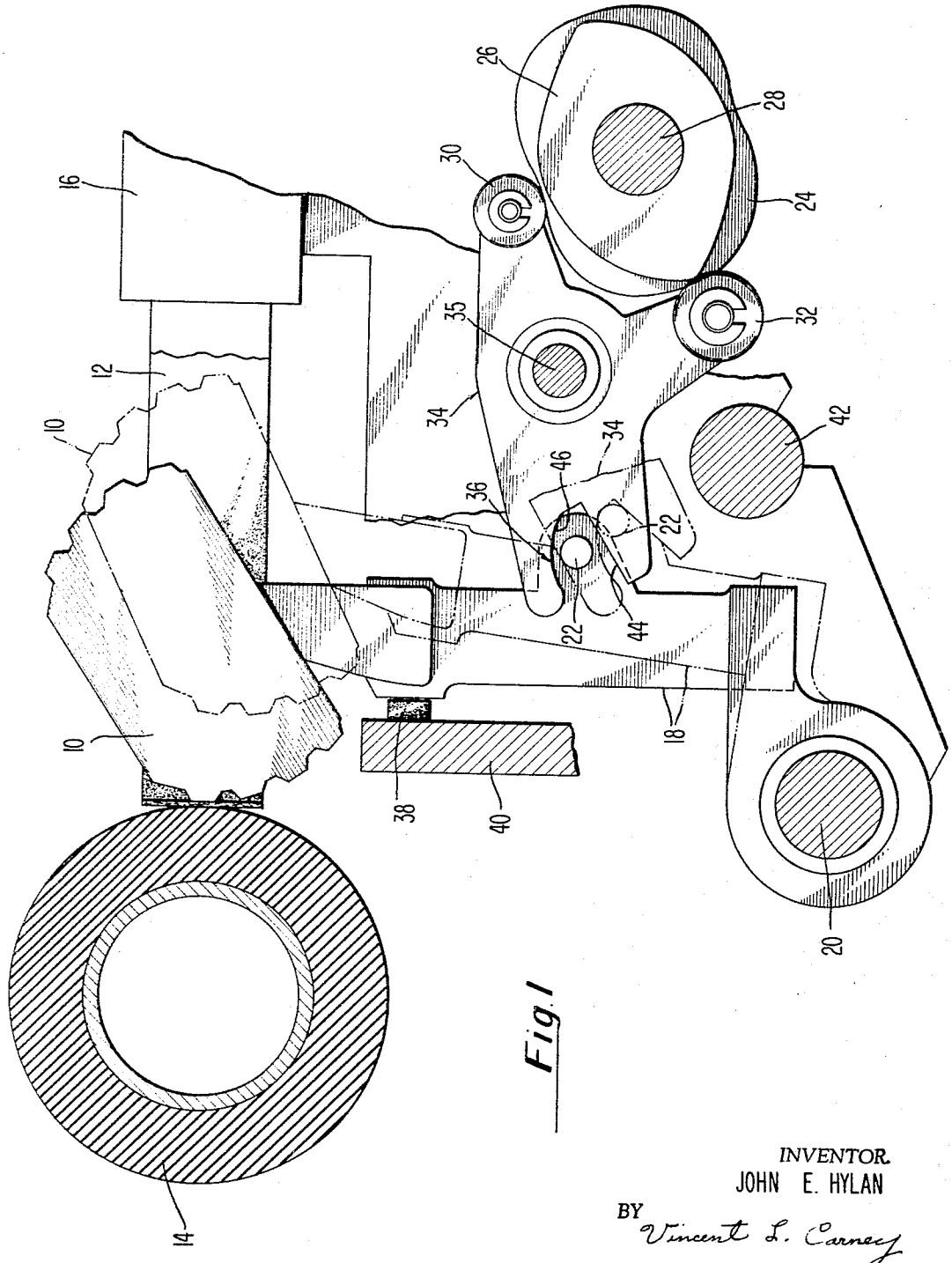


Fig. 1

INVENTOR.
JOHN E. HYLAN

BY Vincent L. Carney
ATTORNEY

July 11, 1967 J. E. HYLAN 3,330,398

PRINTING HEAD CONTROL ALLOWING HEAD TO STRIKE IN FREE FLIGHT AND BE POSITIVELY RETRACTED

Filed Sept. 13, 1965 2 Sheets-Sheet 2

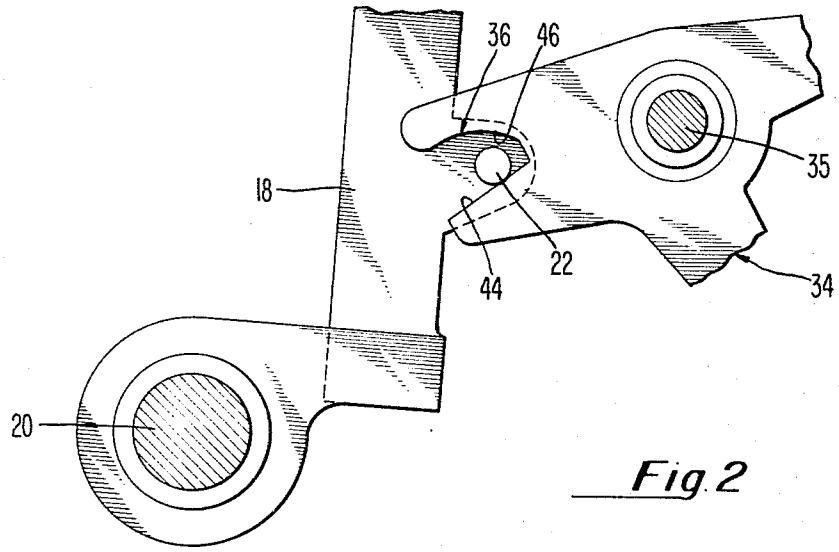


Fig. 2

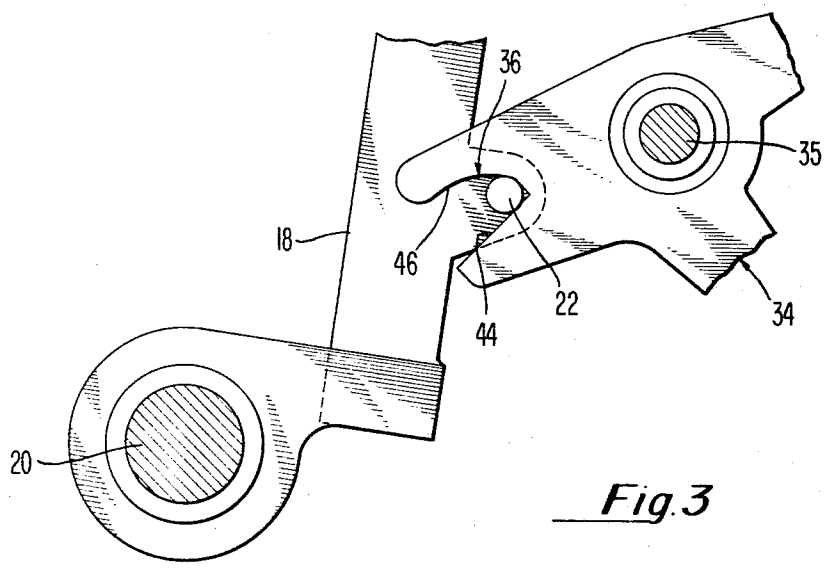


Fig. 3

INVENTOR.
JOHN E. HYLAN

BY
Vincent L. Carney
ATTORNEY

United States Patent Office 3,330,398 Patented July 11, 1967

3,330,398

PRINTING HEAD CONTROL ALLOWING HEAD TO STRIKE IN FREE FLIGHT AND BE POSITIVELY RETRACTED

John E. Hylan, Birmingham, Mich., assignor to Burroughs Corporation, Detroit, Mich., a corporation of Michigan

Filed Sept. 13, 1965, Ser. No. 486,846
2 Claims. (Cl. 197—16)

This invention relates to apparatus for controlling the impression made by a printing element, and more particularly, relates to apparatus for controlling a single element printing head so as to be in free flight when impacting upon plural sheets of paper and sheets of carbon paper.

Single element printing heads are low-velocity high-mass printing elements having a surface containing a plurality of characters. A selected character is indexed by positioning the printing head prior to impacting it upon the paper through an ink-carrying ribbon. When a single element printing head is used with a plurality of sheets of paper having sheets of carbon between them, the character is blurred on the carbon copies if the printing head is impacted under a constant pressure such as that provided by a spring. Moreover, the printing head frequently bounces several times unless it is restrained after printing. This also causes a blurred impression. To prevent this, it is desirable to have the printing head in free flight when it impacts on the paper and to have the printing head restrained immediately after printing on the paper.

However, when carbons are not desired, the impact momentum is too great if the head has been in free flight. Also, the printing head should be held firmly when it is not being impelled in free flight towards the paper. Accordingly, it is an object of this invention to provide an improved control for a printing element.

It is a further object of this invention to provide apparatus for impelling a single element printing head in free flight towards the paper upon which it is to make an impression.

It is a further object of this invention to provide simple apparatus for reducing the momentum of a printing head when carbon copies are not desired.

It is a still further object of this invention to provide an apparatus which is able to drive a printing head towards the paper in free flight and is yet able to prevent repeated bouncing of the printing head upon the paper.

It is still a further object of this invention to provide apparatus for controlling a printing head so as to impel it in free flight towards the paper during the printing stroke and which is still able to hold the printing head firmly during other portions of the printing cycle.

In accordance with the above objects, apparatus is provided having a driving means including complementary cams and complementary cam followers, a printing element, and a control surface on the printing head assembly which control surface forms a driven mating part with the driving means.

The complementary cam followers include a tapered slot. The control surface on the printing head assembly is rigidly held by this slot during a first portion of the printing cycle and is loosely held in the slot during the printing stroke portion of the printing cycle. When the cam followers impel the driving means into the printing stroke portion of the printing cycle, the control surface of the printing head is held loosely by the slot. Just before the printing head strikes the paper the cam followers dwell so that the printing head strikes the paper in free flight, i.e., with no pressure applied to the printing head from an external source in the direction of the paper. After the printing head impacts on the papers one of the surfaces of the slot in the driving means catches the printing head and moves it away from the papers before it has time to bounce.

If a single sheet of paper is used the printing head must move further towards the platen before impacting the paper. A cushioned bumper is positioned so that the printing element hits it before hitting a single sheet of paper. The bumper subtracts some of the energy from the printing head to prevent it from cutting the paper. When several carbons are desired the top paper is held further away from the platen by the other sheets of paper and sheets of carbon paper so that the printing head does not hit the cushioned bumper.

The invention and other improvements thereof will be understood better and more completely from the following detailed description when considered with reference to the accompanying drawings in which:

FIG. 1 is an elevational view of a platen, a single element printing head, and a control for the single element printing head;

FIG. 2 is a partial front view of the driving means and its mating driven control surface for a single element printing head during the stroke portion of the printing cycle; and

FIG. 3 is a partial front view of a driving means and the mating control surface of the driven means during another portion of the printing cycle.

In FIG. 1 a single element printing head **10** is shown with solid lines as it is positioned during the stroke portion of the printing cycle and with broken lines as it is positioned during another portion of the printing cycle. The printing head **10** impacts through an ink ribbon **12** onto papers held by a platen **14**. The ribbon is held by the ribbon mechanism housing **16**.

The printing head **10** is supported by a support member or lever **18** that is pivoted about the point **20** causing the printing head to impact upon the platen **14**. The support member **18** is rigidly attached to an abutment or pin **22**, forming a control surface, shown as a solid line in FIG. 1 as it is positioned during the stroke portion of the printing cycle and as a broken line as it is positioned during another portion of the printing cycle.

Complementary cams **24** and **26** are mounted on the common shaft **28** and are driven together. The complementary cam follower surface **30** is mounted to be driven by the cam **24** and the complementary cam follower surface **32** is mounted to be driven by the cam **26**. The complementary cam follower or rocker **34** is pinned at **35** so as to receive rotational forces in two directions from the cam follower surface **30** and the cam follower surface **32**. A slot **36** on the cam follower **34** drives the control surface of the driven means. The slot **36** is shown as a solid line during the stroke portion of the printing cycle and as a broken line during another portion of the printing cycle.

A resilient bumper, preferable a neoprene rubber bumper **38** is positioned with respect to the support member **18** so that the support member **18** strikes the rubber bumper after traveling approximately 0.325" which is just before the printing head attached to the support member **18** strikes a single sheet of paper placed upon the platen **14**. If several sheets of paper are placed one upon the other on the platen **14**, the printing head **10** strikes the top sheet of paper before the shaft **18** strikes the rubber bumper **38**.

The rubber bumper **38**, the ribbon housing **16**, the cams and cam followers are all attached to a rigid carrier **40** shown in part in FIG. 1. The carrier **40** is movably mounted on the shaft **42** which runs parallel to the platen **14** so that the carrier **40** may be moved from the printing position to printing position. This type of printing element is described more fully in Patent No. 2,879,876 to Palmer et al., issued Mar. 31, 1959. The printing head

may be indexed to a particular character by the mechanism described in patent application Ser. No. 319,836, now Patent No. 3,250,464, to Caspari, filed Oct. 29, 1963, and assigned to the same assignee as this application.

Each time the cams **24** and **26** are driven through a half cycle, the cam follower **34** impels the printing head **10** towards the platen **14** and withdraws the printing head **10** from the platen **14** after it has impacted upon paper on the platen. The slot **36** of the cam follower **34** drives the pin **22** during the first part of the stroke portion of the printing cycle and hesitates while the printing head and supporting member **18** move in free flight towards the platen to impact with the papers placed upon the platen. Then the slot **36** is reversed in direction by the cam follower **34** to catch the pin **22** and pull the printing head away from the platen. If there is only one sheet of paper on the platen **14**, the supporting member **18** hits the rubber bumper **38** before the printing head hits the single sheet of paper on the platen **14**. When the slot **36** in the cam follower **34** is pulling the printing head away from the platen, the pin **22** is positioned in the narrow portion of the slot **36** so as to be held rigidly. Complementary cams may be designed to provide the desired motion by the method described on pages 112–114 of Cams by Harold A. Rothbart, John Wiley and Sons, Inc., New York, N.Y., 1956.

In FIG. 2 a front view is shown of the slot **36**, the pin **22** and the supporting member **18** as they are positioned with respect to each other during the stroke portion of a printing cycle. During this portion of a printing cycle, the surface **44** is in contact with the pin **22** so as to drive the supporting member **18** about its pivot point **20** in the stroke portion of the printing cycle. It will be noted that the slot **36** is large enough at this outward portion so that there is free play between the pin **22**, the surface **44** and a cam surface **46** of the slot **36**. When the cam follower **34** pauses under the control of the cam (not shown) the pin **22** moves towards the surface **46** in the cam slot **36** so that the printing head (not shown) is in free flight as it moves towards the platen. Immediately after impact the cam follower **34** is reversed in direction by the cam so that the surface **46** contacts the cam pin **22** so as to pull the printing head away from the platen and the pin to the end of the slot.

In FIG. 3 a front view is shown of the slot **36**, the pin **22** and the shaft **18** as they are positioned with respect to each other during another portion of the printing cycle. When the printing head is not being driven towards the platen, the pin **22** is in a narrower portion of the slot **36** so that the slot **36** holds it firmly between its surfaces **44** and **46**. In this position there is no free play in the motion of the printing head.

It can be seen that the control for the printing head of this invention enables the printing head to be in free flight when it is used to print on several pages with carbon paper in between and yet controls the momentum of the printing head so that it will not cut the paper when the printing is to be done upon only a single sheet of paper. Even though it drives the printing head into free flight during the stroke portion of the printing cycle, the driving means holds the printing head firmly during other portions of the printing cycle. Moreover, the driving means prevents bouncing of the printing head by catching it immediately after impact and pulling it away from the platen.

Of course, many modifications and variations in the invention are possible in the light of the above teachings. It is therefore to be understood, that within the scope of the appended claims, the invention may be practiced otherwise than as specifically described.

What is claimed is:

1. In a single element printing device comprising:
- a platen adapted to support paper on which characters are to be typed;
- a printing head having a plurality of characters upon at least one surface and being capable of being indexed so as to select one of said characters for printing upon said paper;
- a shaft rigidly connected to said printing head for controlling the motion of said printing head;
- a bumper rigidly positioned with respect to said shaft so as to stop the forward motion of said shaft as said printing head approaches within the thickness of three sheets of paper of said platen;
- a complementary cam follower;
- a pin rigidly attached to said shaft;
- said complementary cam follower having a tapered slot and being positioned so as to engage said pin loosely during the positions of said shaft which are closest to said bumper and positioned so as to engage said pin tightly when said shaft is positioned furthest away from said bumper; and
- cam means for driving said complementary cam follower so as to cause said slot to drive said pin in such a direction that said printing head approaches said platen, for causing said tapered slot to dwell just before said printing head impacts with said paper on said platen, and for moving said tapered slot so as to move said pin in such a direction as to pull said printing head away from said platen immediately after said printing head has impacted with said platen.

2. In a single element printing device comprising:
- a platen adapted to support paper on which characters are to be typed;
- a printing head having a plurality of characters upon at least one surface and being capable of being indexed so as to select one of said characters for printing upon said paper;
- a shaft rigidly connected to said printing head for controlling the motion of said printing head;
- a resilient bumper positioned with respect to said shaft so as to yieldingly oppose the forward motion of said shaft as said printing head approaches said platen;
- a complementary cam follower;
- a pin rigidly attached to said shaft;
- said complementary cam follower having a tapered slot and being positioned so as to engage said pin loosely during the positions of said shaft which are closest to said bumper and positioned so as to engage said pin tightly when said shaft is positioned furthest away from said bumper; and
- cam means for driving said complementary cam follower so as to cause said slot to drive said pin in such a direction that said printing head approaches said platen, for causing said tapered slot to dwell just just before said printing head impacts with said paper on said platen, and for moving said tapered slot so as to move said pin in such a direction as to pull said printing head away from said platen immediately after said printing head has impacted with said platen.

References Cited

UNITED STATES PATENTS

749,914	1/1904	Blickensderfer	197—16
1,667,773	5/1928	Degener	197—17
1,755,197	4/1930	Von Reppert	197—17
1,803,082	12/1943	Von Reppert	197—17
2,847,105	8/1958	Barkdoll	197—29
3,126,823	3/1964	Benson	101—93
3,144,821	8/1964	Drejza	101—93
3,155,033	11/1964	Nelson et al.	101—93
3,195,453	7/1965	Thiemann	101—93
3,233,715	2/1966	Flieg	197—16 X
3,239,049	3/1966	Voit	197—16
3,241,480	3/1966	Cunningham	101—93

ROBERT E. PULFREY, *Primary Examiner.*

E. S. BURR, *Assistant Examiner.*