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Hot Melt Gun

This invention relates to a hot melt gun comprising a melt body having a melt chamber and feeding means for feeding a rod of hot melt material in solid form, under the control of an operator, into the melt chamber, the feeding means comprising a carriage mounted for movement towards and away from the melt body, a clamp member pivotally mounted on the carriage and a trigger connected to the clamp member by connecting means and arranged to be operated by the operator to pivot the clamp member into engagement with the rod of hot melt supported by the carriage to grip the rod and, on further pressure on the trigger by the operator, to feed the rod into the melt chamber.

Hot melt guns of the type set out in the preceding paragraph are known. Such guns are described in U.K. Patent Specification Number 1402648. Suitable hot melt materials include glue, for sticking together various articles, and sealants: rods of hot melt material for this purpose are commercially available, for example from the applicant company. While such guns have proved reasonably satisfactory in operation, feeding means of the guns described in said specifications have a multiplicity of parts which are inconvenient to assemble rapidly.

This difficulty is overcome by arranging that the clamp member has two coaxial pivot pins integral therewith projecting outwardly from opposite sides of the clamp member, each of the pivot pins having an arcuate coaxial bearing portion and a chordal flat face and the pivot pins being received in coaxial bearing openings at opposite sides of the carriage, the bearing openings being defined by circular bearing surfaces against which the bearing portions of the pins are supported, each bearing surface having an assembly opening extending around a minor arc in the surface remote from a rod of hot-melt supported

by the carriage, the openings being sufficiently wide for the pivot pins to pass through the assembly openings when the flat faces of the pins are suitably orientated relative to the assembly openings (with the flat faces generally parallel to a radius of the bearing openings bisecting the assembly openings) but when assembled in the gun the arc of pivotal movement of the clamp member being restricted so that the pivot pins cannot reach an orientation where the flat faces are sufficiently aligned with the assembly openings to permit the pins to be withdrawn through the openings.

Preferably, the carriage, clamp member, connecting means, trigger, and a spring biasing the clamp member away from the rod of hot melt and the carriage away from the melt body are constructed such that they can all be assembled to one another and into the gun body without further equipment or fastening means.

Preferably each pivot pin comprises two parallel flat faces at opposite sides of the pin, the arcuate bearing portion being in two parts separated by the flat faces.

Preferably the clamp member is in the form of a knife member having a knife portion by which the rod is engaged in the operation of the feeding means to feed the rod into the melt chamber, and the knife member comprises a projecting portion projecting downwardly below a plane in which a knife of the knife member and the axis of the pivot pins lies; a portion of a spring is received in a pocket at the rear of the projecting portion to bias the knife member away from the rod of hot melt and the carriage away from the melt body. Preferably where the knife member comprises a projecting portion as aforesaid the projecting portion comprising two parts has a channel parallel with the path of travel therebetween, and wherein the connecting means comprises a link disposed in the channel generally parallel with the path of travel of the carriage and having one end

1 portion pivoted in a boss of one of the two parts, the
other of the two parts having an assembly aperture
orientated so that the link can be introduced therethrough
to pivot the end portion in the boss but when the gun is
5 fully assembled movement of the link is restricted so that
the link cannot escape through the assembly aperture.
Conveniently, the link is in the form of a rigid wire
having an end portion bent at right angles to the main part
of the link and parallel with the axis of the pivot pins
10 received in a hole in the boss.

The feeding means also preferably comprises a
trigger pivotally mounted on a body of the gun with a pivot
portion of the link remote from and parallel with the end
portion which is received in the boss, received in a hole
15 in the trigger parallel with the hole in the boss.
Suitably an end part of the link extends beyond the pivot
portion, the end part lying generally perpendicular to the
pivot portion whereby to retain the pivot portion in the
hole in the trigger. The trigger is conveniently moulded
20 from a tough plastics material and comprises an integrally
moulded peg received in a hole in the body of the gun
parallel with the axis of the pivot pins whereby the
trigger is pivotally mounted on the body of the gun.

Suitably, the body of the gun is made in two
25 parts. Preferably the two parts are made to clip together
using clip means positioned so that access to the interior
of the gun is prevented and so that the two parts of the
body (when assembled) cannot be separated without damaging
the body, the two parts of the body also co-operating to
30 retain the feeding means in its assembled condition.
Preferably the clip means comprises a number of
co-operating pairs of clip members, one member on either
body part, each clip member having a hooked end portion
received in a recess of the other clip member of the pair,
35 the recess of one clip member being in the interior of the
body and of the other member in the exterior of the body,

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1 and each of the hooked end portions having inclined faces
which, as the body portions are pressed together to engage
the clip members, slide over one another to cam the clip
members respectively inwardly and outwardly whereby the
5 hooked end portions slide past one another and snap into
the recesses, the recesses being so deep and the hooked end
portions engaging deeply therein so that prising apart of
the clip members is prevented.

Where the glue gun comprises a spring, the spring
10 is preferably a coil spring in which the end portion remote
from the portion received in the pocket bears on a face on
the body of the gun, the body of the gun being in two parts
one part of which comprises a peg around which the spring
is coiled, the spring being retained on the peg by
15 engagement of the peg with a socket on the other part of
the body of the gun.

Both the carriage and the clamp member (with
integral pivot pins) are preferably cast from a suitable
metal.

20 There now follows a detailed description to be
read with reference to the accompanying drawings of a hot
melt glue gun embodying the invention. This gun has been
selected for description to illustrate the invention by way
of example.

25 In the accompanying drawings:

Figure 1 is a plan view of the illustrative hot
melt glue gun with part of a body of the gun broken away to
show feeding means;

Figure 2 is a perspective view of a carriage of
30 the feeding means;

Figure 3 is a perspective view of a clamp member
of the feeding means; and

Figure 4 is a fragmentary section view showing a
pair of clip members of clip means of the body positioned
35 for assembly of the two parts of the body.

1 The illustrative hot melt glue gun comprises a
body having two parts 10, 12; the part 12 of the body is
broken away in Figure 1 to show the feeding means 14, and
the other parts of the illustrative glue gun. As well as
5 the feeding means the glue gun has a melt body 16 in which
is formed a melt chamber of suitable configuration, for
example conical tapering from an inlet end to a nozzle 18
through a passage through which molten hot melt is expelled
from the melt chamber. The melt body 16 further comprises
10 a heater chamber (not shown) conveniently parallel with the
melt chamber, the heater chamber having therein a suitable
heating element, for example a so-called positive
temperature coefficient heating element (PTC), in good
thermal contact with the melt body 16. The nozzle 18 may
15 be cast integrally with the melt body 16 or provided as a
separate, screw-in nozzle which may conveniently contain a
valve e.g. a ball valve preventing leakage of melt from the
melt chamber when the gun is not in use. A heat insulating
washer 20 surrounds an outlet end portion of the melt
20 chamber adjacent the nozzle 18. An inlet sleeve 22 having
a flange 24 contacting the melt body 16 is received on an
inlet tube (not shown) projecting rearwardly from the melt
body 16 and maintained in place on the tube by a clip 26.
The washer 20, and flange 24 are received in location
25 recesses provided by mouldings 28 on the parts 10, 12 of
the gun body so that the body is spaced from and insulated
from the melt body 16. The inlet sleeve 22 has an inlet
passage coaxial with the melt chamber through which a rod
of hot melt material, for example, an adhesive or sealant,
30 is introduced into the inlet end of the melt chamber. A
guide collar 30 is mounted in the body of the gun at the
rear having a guide opening therethrough coaxial with the
melt chamber to guide a rod of hot melt and maintain the
rod properly aligned with the melt chamber. The inlet
35 sleeve 22 and guide collar 30 are conveniently made of
silicone rubber. The inlet sleeve 22 as well as guiding

1 the rod of hot melt into the melt chamber forms a seal with
the rod, militating against escape of molten hot melt
material from the chamber.

As hereinbefore mentioned, the parts 10, 12 of
5 the gun body are moulded of a tough plastics material. The
two parts 10, 12 of the body are clipped together by clip
means positioned so that access to the interior of the gun
body is prevented and so that the two parts 10, 12 of the
body (when assembled) cannot be separated without damaging
10 the body. The clip means of the illustrative gun comprises
a number of co-operating pairs of clip members 32, 34, one
member on either body part 10, 12. Each of the clip
members 32, 34 has a hooked end portion 36 adapted to be
received when the parts 10, 12 of the gun body are
15 assembled in a recess 38, the recesses 38 of the clip
members 32 being in the exterior of the body part 10 and
the recesses 38 of the clip members 34, being in the
interior of the body part 12. Each of the hooked end
portions 36 of each pair of clip members 32, 34 has an
20 inclined face 40, which as the body parts 10, 12 are
pressed together when assembling the gun body to engage the
clip members, slide over one another to cam the clip
members 32, 34 respectively inwardly and outwardly whereby
the hooked end portions 36 slide past one another and snap
25 into the recesses 38. The recesses 38 are deep and the
hooked end portions engage deeply therein so that prising
apart of the clip members 32, 34 is effectively prevented.

The feeding means 14 of the illustrative glue gun
comprises a carriage 42, mounted for sliding movement
30 towards and away from the melt body 16, by means of flanges
44 which engage in slideways 46, moulded in the gun body
parts 10, 12 parallel with the axis of the melt chamber.
The feeding means 14, further comprises a clamp member viz.
a knife member 48, mounted on the carriage 42, and a
35 trigger 50 connected to the knife member 48, by connecting
means including a link 52. The trigger 50 is arranged to

1 be operated by the operator to pivot the knife member 48,
into engagement with a rod 54 of solid hot melt material
supported by the carriage 42, inlet sleeve 22, and guide
collar 30 to grip the rod 54 and, on further pressure on
5 the trigger 50 by the operator, to feed the rod 54 into the
melt chamber. The feeding means 14 comprises a coil spring
56 by which the knife member 48 is biased in a counter
clockwise direction and the carriage 42 is biased away from
the melt body 16. The feeding means 14 comprising the
10 carriage 42, knife member 48, link 52, trigger 50, and
spring 56 are constructed such that they can all be
assembled to one another and into the parts 10, 12 of the
glue gun body without further equipment or fastening means.
The feeding means 14 has been designed to have as few parts
15 as possible, compared for example with the aforementioned
patent specifications, and to be assembled reliably and
simply in such a way that when the parts 10, 12 of the gun
body are snapped together the feeding means remains
securely assembled, as will become apparent from the
20 description following.

The carriage 42 and the knife member 48 are both
cast from a suitable metal. An upstanding part 110 of the
carriage 42 has a guide aperture 58 through which the rod
54 passes with a small clearance, the rod is thus supported
25 by the upstanding part 110. The knife member 48 is pivoted
on the carriage 42 by means of two coaxial pivot pins 60
integral with the remainder of the knife member 48, which
project outwardly from opposite sides of the knife member
48. Each of the pins 60 has two arcuate coaxial bearing
30 portions 62 and two parallel flat faces 64 at opposite
sides of the pin 60. The pivot pins 60 are arranged to be
received in coaxial bearing openings 66 at opposite sides
of the carriage 42, the bearing openings 66 being defined
by circular bearing surfaces 68 against which the bearing
35 portions 62 of the pins 60 are supported. Each of the
bearing surfaces 68 has an assembly opening 70 extending

1 around a minor arc in the surface remote from the rod 54 of
hot melt supported by the carriage 42, the assembly
openings 70 being sufficiently wide for the pivot pins 60
to pass through the assembly openings 70 when the flat
5 faces 64 of the pins 60 are suitably oriented relative to
the assembly opening 70 (with the flat faces 64 generally
parallel to a radius of the bearing openings 66 bisecting
the assembly openings 70) but when assembled in the gun,
the arc of pivotal movement of the knife member 48 being
10 restricted so that the pivot pins 60 cannot reach an
orientation where the flat faces 64 are sufficiently
aligned with the assembly opening 70 to permit the pins 60
to be withdrawn, or escape, through the assembly opening
70.

15 As hereinbefore mentioned the feeding means 14
comprises a coil spring 56 arranged to bias a single knife
72 of the knife member 48 away from the rod 54 and the
carriage 42 away from the melt body 16. The knife member
48 comprises a projecting portion 74 projecting downwardly
20 below a plane in which the knife 72 of the knife member 48
and the axis of the pivot pins 60 lies. A curved end
portion 76 of the spring 56 is received in a pocket 78 at
the rear of the projecting portion 74. An end portion 80
of the coil spring 56 remote from the curved end portion 76
25 bears on a face 82 provided on the part 10 of the gun body.
The part 10 of the body further comprises a peg 84 around
which the spring 56 is coiled. When the two parts 10, 12
of the gun body are assembled, the spring 56 is retained on
the peg 84 by engagement of peg 84 in a socket (not shown)
30 moulded integral with the part 12 of the gun body.

The projecting portion 74 of the knife member 48
has a channel between two parts 86, 88 of the projecting
portion 74. The channel between the parts 86, 88 is
parallel with the path of travel of the carriage 42. The
35 link 52 is disposed in the channel between the two parts
86, 88, lying generally parallel with the path of travel of

1 the carriage 42. The link has one end portion 90 pivoted
in a boss 92 of the part 86. The part 88 has an assembly
aperture 94 oriented so that link 52 can be introduced
through the assembly aperture 94 to pivot the end portion
5 90 in the boss 92. When the gun is fully assembled
movement of the link 52 is restricted, as will be described
hereinafter, so that the link 52 cannot escape through the
assembly aperture 94. The link 52 of the illustrative glue
gun is in the form of a rigid wire the end portion 90 being
10 bent at right-angles to the main part of the link, this end
portion 90 being parallel with the axis of the pivot pins
60 as is the hole in the boss 92 in which the end portion
90 is received, to thereby pivot the end portion in the
boss. The trigger 50 is moulded of a suitable plastics
15 material and is pivotally mounted on the body of the gun by
means of integrally moulded pegs 96 (only one visible in
the drawings) which are received in opposed holes in the
parts 10, 12 of the gun body, parallel with the axis of the
pivot pins 60. The trigger 50 has a pressure plate 98
20 arranged to be contacted by the finger of an operator to
operate the trigger 50. The arc of movement of the trigger
is restricted by engagement of the pressure plate 98 with
the gun body and by engagement of stop member 100 (also
moulded integrally with the trigger 50), with the parts 10,
25 12 of the gun body. A pivot portion 102 of the link 52
remote from and parallel with the end portion 90 is
received in a hole 104 in the trigger 50 parallel with the
hole in the boss 92. An end part 106 of the link 52
extends beyond the pivot portion 102, and end part 106
30 lying generally perpendicular to the pivot portion 102
whereby to retain the pivot portion in the hole 104 in the
trigger 50.

Power is supplied to the heater element by a
cable 108 entering the gun through a handle portion.

35 The feeding means 14 can be assembled simply: the
knife member 48 is first assembled with the carriage 42 by

1 introduction of the pivot pins 60 into the bearing openings
66. The link 52 is also assembled with the knife member
48, with the end portion 90 received in the hole in the
boss 92, the link being introduced through the assembly
5 aperture 94 as hereinbefore described. The assembled
carriage 42, knife member 48, and link 52 are assembled
with the spring 56 and positioned in the part 10 of the
body portion with the flange 44 of the carriage 42 received
10 in the slideway 46 in the part 10 and with the spring
positioned around the peg 84, as shown in Figure 1 of the
drawings. The end part 106 of the link 52 is then
introduced through the hole 104 in the trigger and the
appropriate peg of the trigger introduced into the hole
(not shown) in the part 10. When the feeding means 14 is
15 assembled, the carriage 42 will be urged by the spring 56
to a rear-most position along the slideway 46 and the knife
member will be urged in a counter-clockwise direction, so
that the knife 72 is clear of the rod 54; the link will be
in the position generally parallel with the slideway 46.
20 The stop member 100 will engage the part 10 of the body,
preventing further clock-wise movement of the trigger
(viewing Figure 1): the orientation of the knife member 48,
relative to the carriage 42, is such that the pins 60 are
unable to escape from the bearing opening 66 through the
25 assembly opening 70 and likewise the link 52 is unable to
reach an orientation which would allow it to escape from
the channel between the parts 86, 88 through the assembly
aperture 94. When the feeding means 14 (and the other
parts of the glue gun), including the melt body 16, inlet
30 sleeve 22, guide collar 30, electric leads and heater
element, are properly assembled in the parts 10 of the gun
body the part 12 of the body is aligned with the part 10
and the two parts pressed together, the clip members 32, 34
snapping together to lock the body parts 10, 12 to each
35 other. When the part 12 is assembled with the part 10, the
peg 96 of the trigger 50 enters a co-operating hole in the

1 part 12 and the peg 84 of the body part 10 is received in
the corresponding socket in the part 12: the trigger 50 is
thereby held in place by the two pegs in the body parts 10,
12 and the spring 56 is maintained in position about the
5 peg 84 by the socket of the body part 12. The uppermost
(viewing Figure 1) of the flanges 44 is engaged in a
slideway, parallel with the slideway of the body part 10,
in the body part 12.

When the trigger is moved in a counter-clockwise
10 direction by pressure on the pressure plate 98, the knife
member is pivoted by the link 52 in a clock-wise direction
to move the knife 72 through an opening in the carriage 42
into engagement with the rod 54 and further pressure on the
trigger causes the carriage 42 to move towards the melt
15 body 16 (leftwardly viewing Figure 1), engagement of the
knife 72 with the rod 54 causing the rod 54 to be gripped
between the knife 72 and the upstanding part 110 and moved
with the carriage 42 towards the melt chamber - the feeding
means is shown in an intermediate position in Figure 1.
20 Continued pressure on the pressure plate 98 will rotate the
trigger 50 in a counter-clockwise direction to a maximum
extent governed by contact of the pressure plate 98 with
the body parts 10, 12 in which the upstanding part 110 of
the carriage 42 is adjacent an inlet end of the inlet
25 sleeve 22. In this forward most extreme position of the
feeding means 14 the knife member 48 is at an orientation
in which the pins 60 are unable to escape from the bearing
openings 66 and the link 52 is likewise retained in the
channel between the parts 86, 88.

30 When the trigger 50 is released the spring 56
urges the knife member 48 in a counter-clockwise direction
(viewing Figure 1) so that the knife 72 is moved out of
contact with the rod 54 which is held against movement
rearwardly by the collar 30 and inlet sleeve 22. The
35 carriage 42 slides rearwardly under the pressure of the
spring 56 to an extent determined by engagement of the stop

1 member 100 with the body parts 10, 12, the carriage sliding
relative to the rod 54 so that on a subsequent operation of
the trigger 50 a fresh part of the rod 54 is gripped by the
knife 72 and upstanding part 110 of the carriage 42. The
5 illustrative hot melt glue gun operates in known manner: as
the rod 54 is urged into the melt chamber by the feeding
means 14, heat supplied to the melt body 16 by the heating
element melts the material of the rod 54 and the molten
material is dispensed through the nozzle 18 under pressure
10 applied by the feeding means 14 to the rod 54. Relaxation
of pressure on the trigger 50 stops feed of rod 54 into the
melt chamber and thus molten material ceases to be
dispensed through the nozzle 18.

The illustrative hot melt glue gun is, as has
15 been described, simple and quick to assemble and cannot be
disassembled without breaking the body parts 10, 12, thus
preventing unauthorised access to the inside of the gun
which could prove dangerous. The feeding means 14 is
especially attractive in that it consists of few moving
20 parts and is extremely simple to assemble rapidly.
Furthermore, because of the ingenious construction of the
feeding means, there is no possibility of the feeding means
14 becoming disassembled inside the gun body, a problem
which has sometimes arisen in previously known designs of
25 trigger-operated glue guns.

1 Claims:

1. A hot melt gun comprising a melt body having
a melt chamber and feeding means for feeding a rod of hot
5 melt material in solid form, under the control of an
operator into the melt chamber, the feeding means
comprising a carriage mounted for movement towards and away
from the melt body, a clamp member pivotally mounted on the
carriage and a trigger connected to the clamp member by
10 connecting means and arranged to be operated by the
operator to pivot the clamp member into engagement with the
rod of hot melt supported by the carriage to grip the rod
and, on further pressure on the trigger by the operator, to
feed the rod into the melt chamber, wherein the clamp
15 member has two coaxial pivot pins integral therewith
projecting outwardly from opposite sides of the clamp
member, each of the pins having an arcuate coaxial bearing
portion and a chordal flat face and the pivot pins being
received in coaxial bearing openings at opposite sides of
20 the carriage, the bearing openings being defined by
circular bearing surfaces against which the bearing
portions of the pins are supported, each bearing surface
having an assembly opening extending around a minor arc in
the surface remote from a rod of hot melt supported by the
25 carriage, the openings being sufficiently wide for the
pivot pins to pass through the assembly openings when the
flat faces of the pins are suitably orientated relative to
the assembly openings (with the flat faces generally
parallel to a radius of the bearing openings bisecting the
30 assembly openings), but when assembled in the gun, the arc
of pivotal movement of the clamp member being restricted so
that the pivot pins cannot reach an orientation where the
flat faces are sufficiently aligned with the assembly
openings to permit the pins to be withdrawn through the
35 openings.



1 2. A gun according to claim 1 wherein each
pivot pin comprises two parallel flat faces at opposite
sides of the pin, the arcuate bearing portion being in two
parts separated by the flat faces.

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 3. A gun according to either one of claims 1
and 2 wherein the clamp member comprises a projecting
portion projecting downwardly below a plane in which a
knife of the clamp member and the axis of the pivot pins
10 lies, and in that a portion of a spring is received in a
pocket at a rear of the projecting portion to bias the
knife of the clamp member away from the rod of hot melt and
the carriage away from the melt body.

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 4. A gun according to either one of claims 1
and 2 wherein the clamp member comprises a projecting
portion projecting downwardly below a plane in which a
knife of the clamp member and the axis of the pivot pins
lies, the projecting portion comprising two parts having a
20 channel parallel with the path of travel therebetween, and
wherein the connecting means comprises a link disposed in
the channel generally parallel with the path of travel of
the carriage and having one end portion pivoted in a boss
of one of the two parts, the other of the two parts having
25 an assembly aperture orientated so that the link can be
introduced therethrough to pivot the end portion in the
boss but when the gun is fully assembled movement of the
link being restricted so that the link cannot escape
through the assembly aperture.

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 5. A gun according to claim 4 wherein the link
is in the form of a rigid wire having an end portion bent
at right-angles to a main part of the link and parallel
with the axis of the pivot pins, received in a hole in the
35 boss.



1 6. A gun according to claim 5 wherein the
trigger is pivotally mounted on a body of the gun and in
that a pivot portion of the link remote from and parallel
with the end portion in the boss is received in a hole in
5 the trigger parallel with the hole in the boss.

 7. A gun according to claim 6 wherein an end
part of the link extends beyond the pivot portion, the end
part lying generally perpendicular to the pivot portion
10 whereby to retain the pivot portion in the hole in the
trigger.

 8. A gun according to claim 7 wherein the
trigger is moulded from plastics material and comprises an
15 integrally moulded peg received in a hole in the body of
the gun parallel with the axis of the pivot pins whereby
the trigger is pivotally mounted on the body of the gun.

 9. A gun according to claim 3 wherein the
20 spring is a coil spring in which the end portion remote
from the portion received in the pocket bears on a face on
a body of the gun and in that the body of the gun comprises
a peg around which the spring is coiled, the spring being
retained on the peg by engagement of the peg in a socket on
25 another part of the body of the gun.

 10. A gun according to any one of the preceding
claims wherein the clamp member comprises a single knife
for engagement with the rod of hot melt material.

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 11. A gun according to either one of claims 1
and 2 wherein a body of the gun is made in two parts which
clip together using clip means positioned so that access to
the interior is prevented and so that the two parts of the
35 body (when assembled) cannot be separated without damaging



1 the body, the two parts of the body co-operating to retain
the feeding means in its assembled condition.

12. A gun according to claim 11 wherein the clip
5 means comprises a number of co-operating pairs of clip
members one member on either body part, each clip member
having a hooked end portion received in a recess of the
other clip member of the pair, the recess of one clip
member being in the interior of the body part and that of
10 the other member in the exterior of the body part, and each
of the hooked end portions having inclined faces which as
the body parts are pressed together to engage the clip
members, slide over one another to cam the clip members
respectively inwardly and outwardly whereby the hooked end
15 portions slide past one another and snap into the recesses,
the recesses being so deep and the hooked end portions
engaging deeply therein so that prising apart of the clip
members is prevented.

20 13. A hot melt gun comprising a melt body having
a melt chamber and feeding means for feeding a rod of hot
melt material in solid form, under the control of an
operator into the melt chamber, the feeding means
comprising a carriage mounted for movement towards and away
25 from the melt body, a clamp member pivotally mounted on the
carriage and a trigger connected to the clamp member by
connecting means and arranged to be operated by the
operator to pivot the clamp member into engagement with the
rod of hot melt supported by the carriage to grip the rod
30 and, on further pressure on the trigger by the operator, to
feed the rod into the melt chamber, substantially as
hereinbefore described with reference to and as illustrated
by the accompanying drawings.