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(19)

(54) IMPROVEMENTS IN AND RELATING TO BALING MACHINE

(71) We, EDBRO (HOLDINGS) LIMITED, a British Company of Lever Street, Bolton, Lancashire, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:

This invention relates to baling machines, in particular to baling machines for car bodies, and to a method of baling an article, particularly, car bodies.

According to the present invention there is provided baling apparatus comprising a working chamber for receiving a part of a compressible metal structure, and a cutting and compressing head which reciprocates along an axis thereof in a channel with a working stroke and a return stroke, such that in each working stroke that part of the structure which lies within the working chamber is compressed, and a portion of the structure is severed from the remainder of the structure by cooperation between a mobile blade on the said cutting and compressing head and a fixed blade, the head being so mounted in the apparatus as to permit it to skew in the channel, during working strokes of the head, about an axis perpendicular to the axis in which the head reciprocates. One or more rams arranged transversely of the cutting and compressing head may be provided to compress further the portion of the body received in the working chamber.

Advantageously the head and rams are hydraulically operable. The arrangement may be such that an ejection door opens to eject the compressed portion (hereinafter called bundle) after the pressure in the hydraulic fluid has reached a preset maximum value. The ejected bundle can be pushed onto an elevated steel channel and, as successive bundles enter the channel, so successive topmost bundles on the channel fall into a container.

Preferably the extent of compression is controlled by suitably positioned micro switches which are actuated when the head and rams reach predetermined positions.

Conveniently three hydraulically operable rams at right angles to each other are provided for compressing the bundle, one of which is the cutting and compressing head and one of which compresses the bundle in a vertical direction, the three rams operating in sequence.

Advantageously an electromagnetically operable valve is provided in the hydraulic fluid line to control flow of hydraulic fluid to the or each ram from the fluid supply and to the fluid drain tank.

The invention will be described further, by way of example, with reference to the accompanying drawings, in which:–

Fig. 1 is a perspective view of a baling machine according to the present invention;

Fig. 2 is a perspective view of the cutting blades of the machine;

Fig. 3 is a plan view of the machine of Fig. 1 with a part omitted;

Fig. 4 is a side elevation of the machine of Fig. 1; and,

Fig. 5 is a perspective view of a part of the machine of Fig. 1.

Referring to the drawings, a baling machine comprises a rigid bed 1 providing a bottom wall 2, a rear wall 3, side walls 4, 5 and a front wall 6. The end wall 3 comprises a trunnion bearing 7 on which is pivotally mounted the cylinder end of a hydraulic piston and cylinder unit 8 by a pin 9. The piston end of the unit is pivotally secured, by a pivot pin 10, to a ram 11 sliding on the bottom wall 2. The ram constituting a cutting and compressing head (Fig. 5) is a box-section structure comprising a front wall 12 having a height equal to the depth of waste material to be compressed, and a width which leaves a small clearance at each lateral side of the ram from respective wear plates (not shown) provided on the inner side of walls 4, 5 of the bed 1. The ram comprises a bottom wall 13, a top wall 16, side walls 14 and 15 shaped so that the sides of the ram leave a larger clearance between the sides thereof and the respective wear plates at the trailing end of the ram than at the leading edge. This permits the ram to skew slightly in the bed 1. The ram also has

pivoted to it, by pivot pins two tie rods 17 and 18, which trail rearwardly of the ram and are supported on rollers 20 and 21 respectively to pass through respective holes in the rear wall 3 of the bed 1 to extend rearwardly therefrom. The extending portions of the tie rods each bear a screw thread receiving a cylindrical stop 22, 23 so that the stop can be displaced axially on the respective tie rod portion by screwing the stop therealong. The tie rods and the piston end of the unit 8 are mounted on the ram with their longitudinal axis lying on a common transverse line, at a position slightly above the transverse line bisecting the height of the ram to assist in preventing movement of the ram during compression in the vertical plane.

The bed supports an upright plate 24 to which is secured a fixed cutting blade 25, the latter having a "V" section with the apex of the "V" directed towards the front wall 6 of the bed 1, while the ram 11 has a cutting blade 26 formed thereon at the upper forward end of the ram. The space bounded by the front wall 6 of the bed, the front wall 12 of the ram and the respective portions of the lateral and bottom walls of the bed lying therebetween constitutes the working chamber 27 of the machine with the part thereof forward of the apex of the fixed cutting blade 25 defining the volume of the working chambers into which material being baled is compressed by the ram 11.

A limit switch 28, indicated diagrammatically in Fig. 3, is positioned centrally of the width of the bed 1 and the ram 11 carries a striker (not shown) to operate the switch when the ram reaches a predetermined position as will be more fully explained below.

The ram mechanism above described constitutes a first compression stage of the machine; a second stage being provided for effecting vertical compression and a third stage being provided for effecting a final, lateral, compression of material compressed by the first two stages.

The second compression stage (Fig. 4) comprises a piston and cylinder unit 29, a ram 30, tie rods 31, 32, screws stops 33, 34 and a limit switch forming a ram mechanism in an exactly similar manner to that of the first stage; while the third compression stage comprises a piston and cylinder unit 36 bearing at the piston end thereof a ram 37 which, when the rams of the first and second stages are positioned at the end of their working compression strokes, slides in the transverse direction of the machine on the front walls of those rams and on the bottom and front walls of the bed 1 to effect a final compression of the material to be baled. When the pressure in the hydraulic supply reaches a predetermined maximum, the compression stroke of the ram 37 is terminated.

The hydraulic system employed in the machine employs a relay for each of the first and second pressure stages with a solenoid operated pressure unload valve common to all the pressure stages and operable to connect the respective ram to tank when the solenoid is deactivated; each of the relays being connected in parallel with a respective capacitor so that, after current to a solenoid coil is shut off, the relay prevents re-energisation of the valve solenoid for a delay determined by the charge rate of the capacitor, for instance, of 0.7 second. This prevents pressure shocks being transmitted through the hydraulic supply lines during the changeover, in successive actuation of the rams of the machine, from pressurizing the ram of one stage to pressurizing the ram of the next stage, and thus mitigates against bursting of the lines. This technique is also used in unloading the ram of the third stage, the delay being provided between release of the maximum pressure and the return of the ram under no-load conditions.

The machine bed has a platform 38 mounted thereon; the platform being pivoted to the lateral walls of the bed at the retracted position of ram 11 and being operable to swing from a horizontal position to a vertical position about the pivots by a pair of piston and cylinder units 39 and 40 respectively mounted on the lateral walls of the bed 1.

In use of the machine to compress scrap material such as a car to be baled, the car is deposited on the platform 38 with the latter in its horizontal position. The platform is then pivoted to its vertical position to drop the lower end of the car into the working chamber of the machine. Once the car body is in a vertical position the operator switches the machine to operate automatically. A pump unit delivers hydraulic medium to the first hydraulic ram, and the portion of the car body resting in the working chamber, which is approximately twenty four inches deep, is severed by the blades 25 and 27 from the remainder of the body. At the same time, the first ram 11 compresses the cut portion to within twelve inches of the front wall of the working chamber 27. In this action, if the moving blade 26 becomes unevenly loaded due to different toughness of the material of the car being compressed, the ram 11 can skew in the bed so as, in effect, to pivot the moving blade around the tougher material towards the fixed blade 25 thereby to "draw" the moving blade across the tougher material. By this means, additional leverage is applied to the tougher material, and this enables the moving blade to cut through material that would otherwise require a higher hydraulic pressure and, therefore, machine parts of a thicker

section. This, in turn would increase the expense of the machine. Cutting through of the material is also facilitated by the "V" shape of the fixed blade since this ensures that the cutting motion has some degree of slicing action and not merely a crushing action, thus facilitating the cutting of tougher material.

However, should the machine be overloaded, whether due to excessive material or unsuitable material, the hydraulic system is arranged so that once a predetermined maximum pressure is reached or exceeded, the pressure is maintained for a limited period, e.g. six seconds, and then released and the ram retracted to permit the excessive or the unsuitable material to be removed.

The tie rods 17 and 18 pivotally secured to the ram 11 ensure that should the ram become skewed in a compression and cutting operation, the ram 11 will, nevertheless, at the end of its stroke be left square in the bed i.e. with the front wall 12 of the ram aligned on a transverse line of the bed 1 so that the predetermined compressed volume of the material is precisely achieved.

For this purpose, the stops on the tie rods 17 and 18 are used to determine the full working stroke of the ram. Before a working operation of the machine, they are positioned so that the stops encounter the exterior face of the rear wall 3 of the bed 1 when the front wall of the ram 11 is square in the bed and has been advanced precisely to the final position required by the degree of compression to be effected; the limit switch being set up to correspond to this position. Thus, should one side of ram reach that position before the other side, the switch will not be operated and pressure will be maintained on the ram until the other side of the ram also reaches the final position and both stops on the tie rods 17 and 18 are in contact with rear wall 3 of the bed 1.

In addition to the advantage mentioned above, a further advantage of having the ram mounted so that it can skew in the bed 1 is that the tolerance to be met in forming the bed and the ram are so much easier than they would otherwise be, for instance, the tail end clearance of the ram from the respective wear plates may be one half an inch.

For this reason, the same ram mechanism is used in the vertical compression stage even though in this stage no cutting action takes place.

In the third stage it has been found adequate, in accordance with usual practice, merely to use a ram having greater length (the dimension in the direction of the stroke of the ram) than width or height to obtain the precision of movement required.

The second hydraulic ram compresses the material in the working chamber downwards to within twelve inches of the base of the working chamber.

The third hydraulic ram presses the partially compressed material from one side of the machine against a sliding door. After the pressure in the hydraulic medium supplied to the third ram has reached a predetermined pressure, in this case 2500 psi, the pressure to the ram is relieved and the sliding door is opened to enable the bundle of compressed material to be pushed out of the door by actuation of the third ram and deposited on an output channel 42. As one bundle enters the channel so the topmost bundle on the channel falls into a container. As soon as the sliding door has been opened and the bundle ejected from the chamber 27 everything returns to the starting position and a further portion of the remaining part of the car body falls into the working chamber to enable a further twenty four inch portion to be cut and baled. The bundles produced are in the form of twelve inch cubes.

WHAT WE CLAIM IS:–

1. Baling apparatus comprising a working chamber for receiving a part of a compressible metal structure, and a cutting and compressing head which reciprocates along an axis thereof in a channel with a working stroke and a return stroke, such that in each working stroke that part of the structure which lies within the working chamber is compressed, and a portion of the structure is severed from the remainder of the structure by cooperation between a mobile blade on the said cutting and compressing head and a fixed blade, the head being so mounted in the apparatus as to permit it to skew in the channel, during working strokes of the head, about an axis perpendicular to the axis in which the head reciprocates.

2. Apparatus as claimed in claim 1, wherein the fixed blade has a "V" section with the apex of the "V" disposed in the direction away from the mobile blade.

3. Apparatus as claimed in claim 1 or 2, wherein the mobile blade is directly supported on a leading edge of the head.

4. Apparatus as claimed in claim 1, 2 or 3, wherein the lateral walls of the cutting and compressing head are tapered such as to provide a greater clearance from the lateral walls of the channel in which the head reciprocates at the trailing end of the head than at the leading end thereof.

5. Apparatus as claimed in any one of the preceding claims, wherein a stop mechanism is provided to determine the working stroke of the head; the mechanism comprising a stop member disposed on each side of the median plane of the head which includes the axis of reciprocation of the head and the axis about which the head skews so that both stops act to stop the ram

only when the head has reached the end of a full working stroke and is free from skew.

6. Apparatus as claimed in claim 5 wherein the axis of reciprocation is horizontal and the stop members lie within a horizontal plane above the horizontal median plane of the head.

7. Apparatus as claimed in claim 5 or 6, wherein each of the stop members is a rod extending rearwardly from the trailing end of the head and passing through an aperture in an abutment surface formed on a fixed part of the machine; the rods carrying stops respectively to engage with the abutment surfaces when the head has reached the end of a full working stroke and is free from skew.

8. Apparatus as claimed in any one of the preceding claims, wherein movement of the head is limited by a limit means comprising a limit switch, the limit switch being so positioned as to be operated by the head to terminate the working stroke of the head when the head is positioned at the end of a full working stroke thereof and is free from skew.

9. Apparatus as claimed in any one of the preceding claims, wherein two lateral rams are provided to compress said part of the structure in the working chamber; the rams being arranged so as to compress the said part along axes which are mutually perpendicular and which are perpendicular to the axis of reciprocation of the said head.

10. Apparatus as claimed in claim 9, including means to operate the two lateral rams sequentially following the compression effected by said head.

11. Apparatus as claimed in claim 10, wherein the ram operating means include means to impart a time delay between the time at which actuation of the head ceases and the first lateral ram begins, and between the time at which actuation of the first lateral ram ceases and the second lateral ram beings, said delays mitigating against shocks to the apparatus.

12. Apparatus as claimed in claim 9, 10 or 11 as dependent on claim 5, 6 or 7, wherein one only of the two lateral rams is provided with a stop mechanism substantially identical to the said stop mechanism of said head.

13. Apparatus as claimed in any one of the preceding claims, wherein means are provided for relieving the pressure exerted by the head or a lateral ram if present should said pressure be sustained for more than a predetermined time at or above a predetermined level.

14. Apparatus as claimed in any one of the preceding claims in which the axis of reciprocation of the head is horizontal, and which includes means to feed the structure into the chamber comprising a first, upright support surface and a second support surface which is pivotable from a generally horizontal disposition in which the structure may be placed on the second surface to a generally upright disposition facing the first support surface thereby to transport the structure to a position above the chamber in which it is supported on two opposed sides thereof by the said support surfaces from which position it may move downwardly under its own weight into the chamber.

15. Baling apparatus as claimed in claim 1 and substantially as hereinbefore described with reference to, and as shown in, the accompanying drawings.

BREWER & SON
Agents for the Applicants

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1589363 COMPLETE SPECIFICATION

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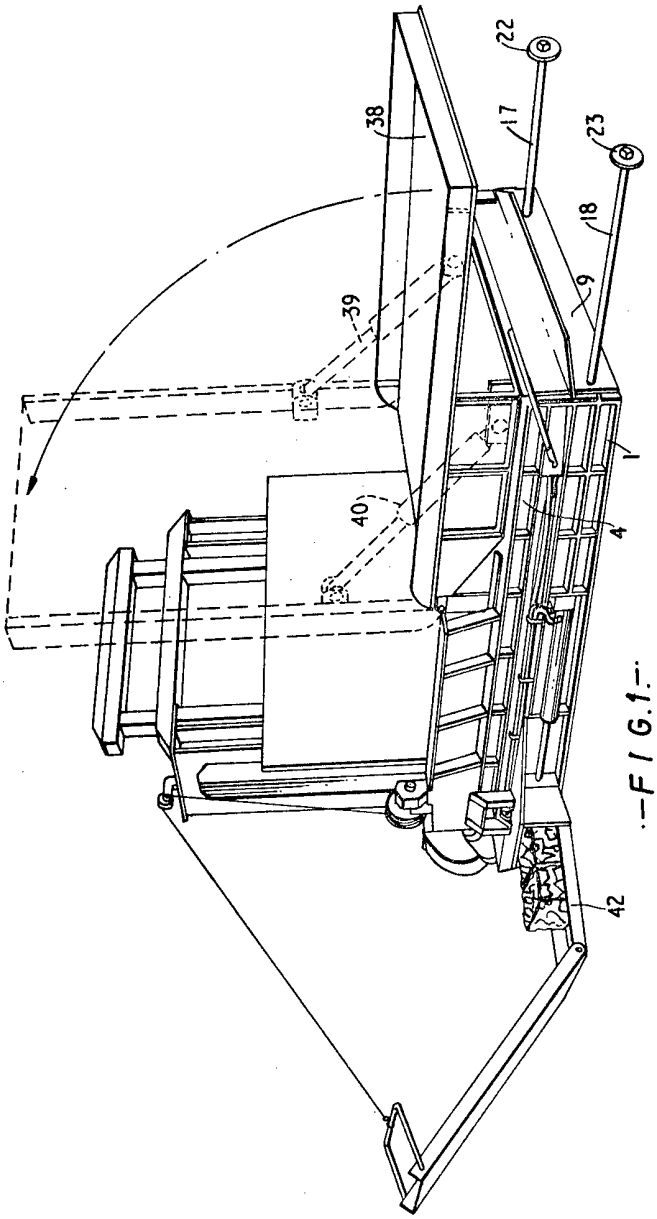
Sheet 1



-FIG.1-

1589363 COMPLETE SPECIFICATION
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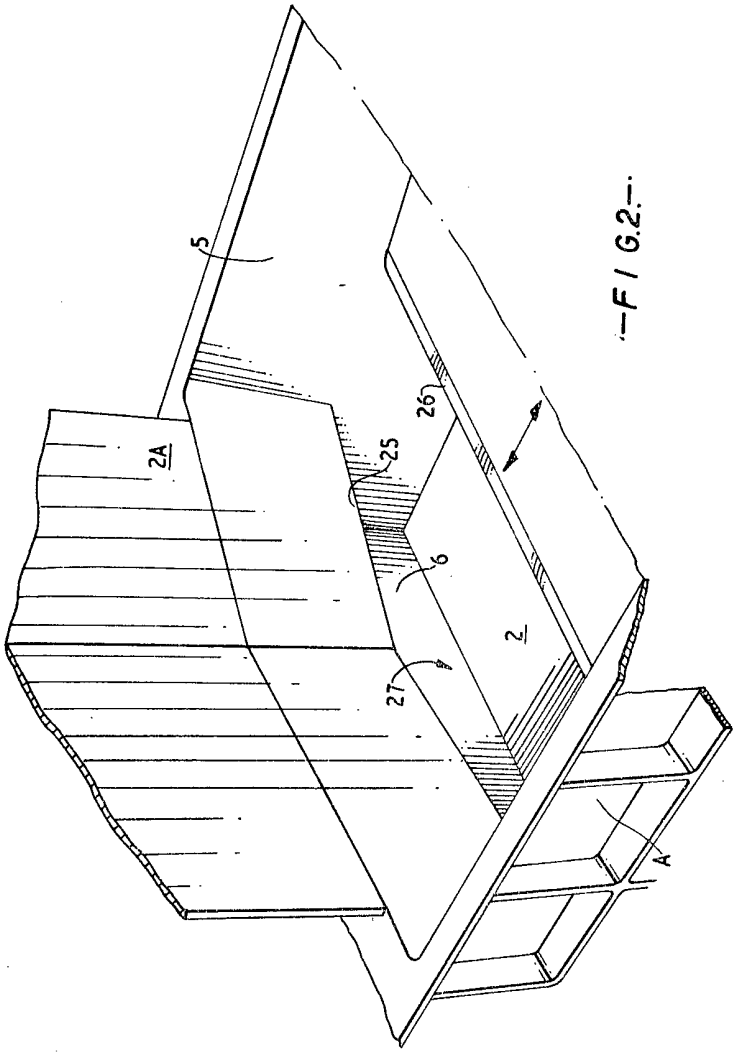

FIG.2.

1589363 COMPLETE SPECIFICATION

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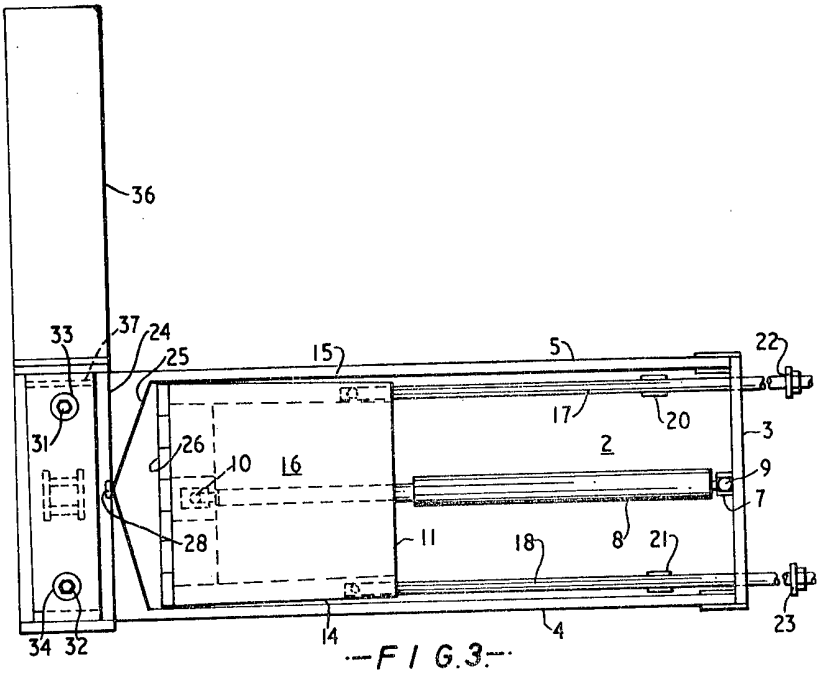

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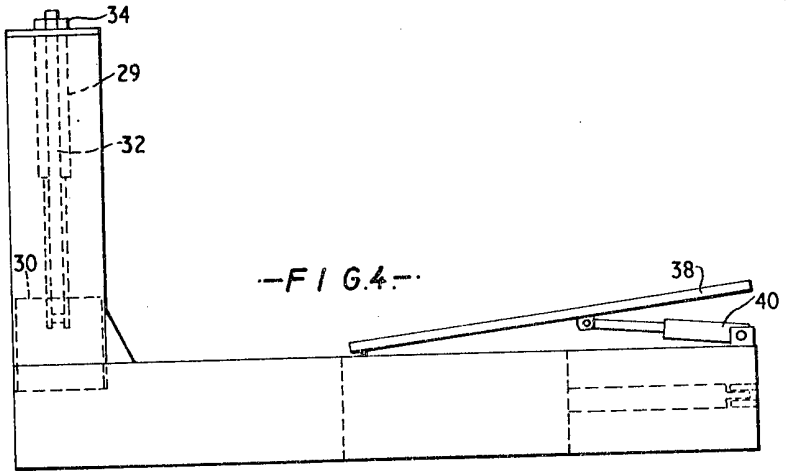

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1589363 COMPLETE SPECIFICATION
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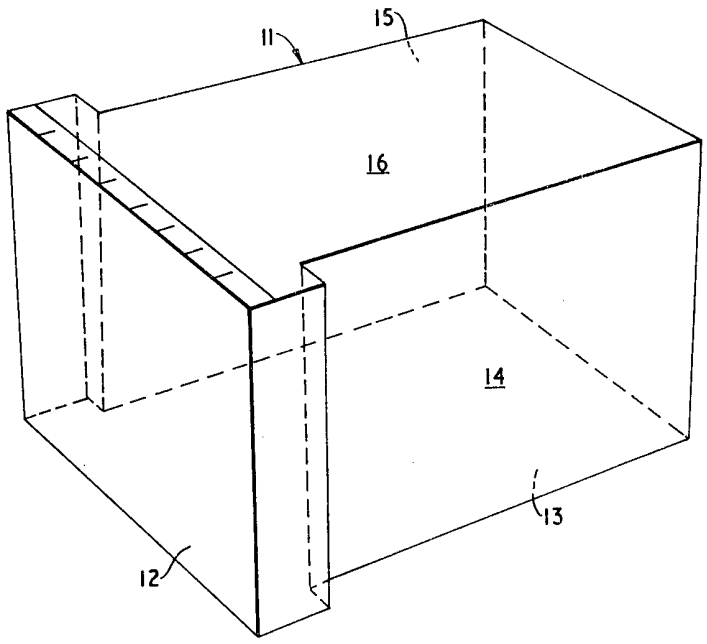
Sheet 4



-FIG.5.-