CONTINUOUS WEB PERFORATING MACHINE

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2 Claims. (Cl. 74—665)

This invention relates to punching perforations in a continuously advancing web and is particularly directed to the perforating of gypsum board in the manufacture of perforated gypsum lath.

This application is a division of my co-pending application Serial No. 500,751, filed April 12, 1955, now U.S. Patent 2,855,998 issued October 14, 1958.

Flat, rectangular boards comprising a set gypsum core and reinforcing paper cover sheets, having a plurality of holes extending therethrough spaced evenly apart throughout the extent of the board, are a well known form of lath, for application to building framework as a base material for subsequent application of the plaster wall surface. The perforated form of board is well known as providing improved means for keying the surface plaster to the lath.

The perforations are generally made in the gypsum board while the board is still being advanced, as a continuous web, from the board forming machine along a conveyor system on which the gypsum core becomes partially set. The perforating operation is performed near the end of this conveyor, immediately prior to the cutting of the web into individual boards for subsequent transfer to a drying kiln. The uncut board, at the time of perforating, has set sufficiently and attained enough body to retain itself about a perforation without flowing, but is still considerably wet and weak, presenting difficulty in producing the desired quality in the punched hole. The need of a punch, or punch and die combination, capable of improving the quality of perforations is recognized.

The present most common method of forming these perforations is by a machine wherein a plurality of upper bolsters, each including a plurality of punches, cooperate with a plurality of lower bolsters, each including a plurality of dies, the two sets of bolsters being mounted on oppositely rotating spiders, the relation of all bolster faces to the horizontal being controlled by associated cams riding in a camway. The design of this prior machine recognizes the desirability of maintaining the punches and dies in a generally vertical disposition throughout an operation cycle wherein the punches and dies are being acted upon the moving web of board material, and it is for this general purpose that the cam and camway are incorporated into the prior design. The bolsters make a complete rotation in each cycle, incorporating a whirp-type action during the nonoperative portion of the cycle, necessitated by the vertically maintained condition during the operative portion.

It has now been found, however, that this use of cams and camways in maintaining verticality during punching is highly subject to wear and loss of alignment, that close tolerances between punch and die cannot be maintained without excessive parts replacement, and that a new and improved punch structure, constructed in accordance with the present invention, cannot properly function in the absence of the close tolerances, within which the prior machines cannot be maintained for any reasonable period of operation. The prior design, further, includes an excessive number of power transmitting elements between upper and lower spiders, each additional power transfer permitting additional sources of lost motion or misalignment due to inaccuracies or wear.

An object of the present invention is to provide, in a machine for perforating gypsum lath or like material, a new combination, particularly with the punch and die elements as claimed in the above identified parent application, of an improved power transmitting system for the maintenance, to a very substantial degree, of the necessary tolerances between punch and die.

These and other objects and advantages will appear more fully when considered in connection with the following detailed description of a preferred embodiment of the invention and the accompanying drawings in which:

Fig. 1a is a front view of the left half of a rotary punching machine built in accordance with and embodying the invention.

Fig. 1b is a front view of the right half of the machine of Fig. 1a, parts having been broken away and parts shown in section as taken generally along line 1b—1b of Fig. 2.

Fig. 2 is a right end view of the machine of Fig. 1, cover plates having been broken away.

Fig. 3 is a front view, with cover plates broken away, to show the mechanism for raising and lowering the upper rotating elements of the machine of Figs. 1a and 1b.

General description

Figs. 1a and b and Fig. 2 show the front and right end views respectively of the lath perforating machine 20, through which a continuous web of partially hardened, paper covered, gypsum board 22 continuously passes. Although the machine 20 is capable of operating on board passing from front to rear or reversely, it will be apparent that when it is once installed for operation, usage will normally be in one direction only.

Machine 20 is supported by a frame-base 24 having fixed thereto a bed-plate 26 at each end thereof. Over each bed-plate 26 is an enclosed gear-box 28, made of a relatively light, removable, end cover-plate 30; fixed, heavier-gauge, upper-shaft supporting, front-plate 32 and rear-plate 34; and a lower-shaft supporting main-plate 36.

Machine 20 includes a lower-shaft 38, rotatably supported in opposed lower-hubs 40 which are fixedly mounted in main-plates 36 at each end of machine 20. An upper-shaft 42 is rotatably supported in opposed upper-hubs 44, which are the axially inner extent of hub supporting portions 45 of vertically-adjustably mounted upper frames 46, which entire unit is slidable mounted for vertical movement of upper-shaft 42 and its associated elements. By way of explanation, the punching operation of machine 20 is started and stopped by the lowering and raising of the upper-shaft 42 and its associated elements, while the shafts 38 and 42, and their associated elements, are rotating synchronously and the board 22 is passing therebetween. The complete mechanism associated with this feature is discussed completely further below.

Fixed on the right end of lower-shaft 38, is a bevel-gear 48. Upper-shaft 42 has a similarly disposed bevel-gear 54, fixed at the right end thereof. With the exception of bevel gears 48 and 54 and the associated conical gears and shaft disposed at the machine right end and a power input source at the right end, all discussed fully further below, the right and left ends of machine 20 are inverse counterparts and, for this reason, disclosure will be directed, generally, to the right end, as shown in Fig. 1b.

Inwardly of each end of lower-shaft 38, the shaft 38 is further supported, rotatably, in diagonal-branches 58, fixed...
to the bed-plates 26 and front plates 32. Inwardly from diagonal-braces 59, spur-gears 52 are keyed to lower-
shaft 38.

Upper-frames 46 include axially outer cross members 55 which are disposed axially inwardly of each end of
upper-shaft 42. Cross members 55 extend horizontally outward in each direction from shaft 42, as seen in Fig.
2, forming guide shaft bearing portions 57 which are slid-
ably mounted on fixed vertically extending guide shafts
59. Cross members 55, by the fixed vertical relation with
guide shafts 59, maintain upper frames 46 in true ver-
tical positions.

Inward of cross-members 55 are spur-gears 56, disposed for meshing with spur-gears 52 when upper-shaft 42 is
adjusted to its normal operating, lowest vertical position.
The lower and upper hubs 40 and 44 are disposed axially
inward of the spur-gears 52 and 56, all of which hubs are
fixed against rotation relative to the machine frame.

Referring now to Fig. 1b and Fig. 2, a power source (not shown), in any usual form, drives by means of a
drive shaft 140, a gear 142 which is constantly in mesh
with lower spur gear 52.

When the upper shaft 42 is adjusted to its normal op-
erating, lowest vertical position, a direct drive from lower
to upper shaft is maintained at each end of the machine
through the cooperative spur gears 52 and 56. During
a change from an operating to a nonoperating condition,
which is accomplished by raising the upper shaft 42, a
continuous condition of synchronism must be maintained
between the shafts 38 and 42. This synchronism is pro-
vided by means of a vertical shaft 144 at the right end of
machine 20 in Fig. 1b which is set in mesh engagement with
a respective bevel gear, one of said conical gears being slidably keyed on said connect-
ing shaft for continuous meshing with its respective bevel
gear during a change in spacing between said parallel
work-producing shafts and means for moving as a unit
said slidably keyed conical gear and the respective work-
producing shaft and bevel gear relative to said connecting
shaft and opposite work-producing shaft while all said
elements remain interconnected and in synchronized
rotation.

As will be readily seen from Fig. 3, the raising and
lowering mechanisms are contained and supported in an
closed overhead housing 166, extending between and
supported on the two gear boxes 28. A lubricant reser-
voir 168 with sight glasses 170 at each end thereof is
also disposed in housing 166. An oil pump 172, seen in
Fig. 2, is driven by drive shaft 140, through chain
173, the balance of the lubricating system not being
shown.

Having completed a detailed disclosure of a preferred
embodiment of my invention so that those skilled in
the art may practice the same, I contemplate that variations
may be made without departing from the essence of
the invention or the scope of the appended claims.

1. In a machine of the class described having a pair
of spaced parallel work-producing shafts rotatably mounted
therein and means for continuously rotating said shafts
in synchronized relation while the spacing between said
parallel shafts is being changed, said means comprising a
bevel gear fixedly mounted on one respective end of
each said shaft, a connecting shaft extending in a direc-
tion perpendicular to said pair of parallel shafts and dis-
poscd closely adjacent both said bevel gears, a pair of
conical gears mounted on said connecting shaft for posi-
tive rotation therewith, each said conical gear being in
meshing engagement with a respective bevel gear, one of
said conical gears being slidably keyed on said connect-
ing shaft for continuous meshing with its respective bevel
gear during a change in spacing between said parallel
work-producing shafts and means for moving as a unit
said slidably keyed conical gear and the respective work-
producing shaft and bevel gear relative to said connecting
shaft and opposite work-producing shaft while all said
elements remain interconnected and in synchronized
rotation.

2. In a machine as defined in claim 1, a separate frame
element mounted in said machine for reciprocal move-
ment relative to said connecting shaft in a direction paral-
lel to said connecting shaft, said frame element includ-
ing a mounting portion through which said connecting
shaft extends, said slidably keyed conical gear being rotat-
ably mounted on said mounting portion of said frame
element, and said work-producing shaft and said bevel
gear which are engaged with said slidably keyed conical
gear also being rotatably mounted on said separate frame
element, whereby, with reciprocal movement of said sep-
parate frame element, said work-producing shafts are moved
toward and apart, one relative to the other, while being
rotated in a complete synchronism.

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