Vibrations produced by looms in a wire cloth factory

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PREPARED FOR Capital Wire Cloth and Manufacturing Company, Ltd., Hinton Avenue, Ottawa

SUBJECT VIBRATIONS PRODUCED BY LOOMS IN A WIRE CLOTH FACTORY

One of the outside walls of the weaving shed of the Capital Wire Cloth and Manufacturing Company Ltd., Ottawa, had been gradually deteriorating because of vibrations caused by weaving looms, particularly by one that had been mounted differently from the rest. Comparative measurements of wall and floor vibrations were made with this loom operating in its original position, both before and after attempting to reduce the vibration; final measurements were taken when the loom was moved to a new foundation.

GENERAL

The building in question is a large brick shed with a heavy concrete floor. Certain sections have mezzanine floors for office accommodation. The concrete floor is at bedrock at the east end of the factory, but is about 15 ft from bedrock at the west end. The looms, with one exception, were mounted on the concrete floor, and the level of vibration they caused did not appear to be excessive. The one exception was a loom underneath the office section which was set on a concrete pad isolated from the main floor and bedrock. This loom, which was one of a series of smaller looms in the shed, initiated a periodic motion in the floor and wall of the building nearest the loom, so much so that the brickwork showed diagonal cracks around the windows corresponding to the weakest horizontal sections of the wall. The vibrations were caused by the impact of the combined reed and heavy batten against the weft, which tightens the woven cloth after each passage of the shuttle.

OBSERVATION OF VIBRATIONS

Transducers which are sensitive to particle velocity were used to measure the vibrations. Three transducer positions were used: on the wall beside the loom at floor level, on the wall, 6 ft above floor level between two windows, and on the floor between the loom and the wall. Vibrations caused by an average loom further along the same row of looms towards the east were measured as a comparison.

Referring to Table I, it can be noted that both looms gave rise to equal vibration levels of the main floor. There was, however, an increase in wall vibration about tenfold in the vicinity of the troublesome loom. It appeared that energy from this loom on the isolation pad excited the soil below it which in turn excited the wall. This was confirmed by a vibration measurement in the soil outside the building opposite the loom about 6 ft from the wall.

The management decided to isolate the outside wall from the concrete floor by excavating a trench in the floor at the junction of the wall along the length of the wall. When this was completed a reduction by a factor of approximately 2 was obtained for the wall vibration (Table I), but this was still well above the value produced by the average loom. Because of this and for other reasons the management arranged to move the loom to another location, setting it in concrete down to bedrock. This required an excavation of about 17 ft. When the new foundation was completed, vibration measurements were taken at corresponding positions on the wall and floor. The result was a reduction about tenfold from the original figure. The vibrations caused by the neighbouring loom to the west of the new foundation were measured as a comparison, and it was found they were about three times greater than those from the troublesome loom on its new foundation. As far as could be determined this level was not disturbing.

TABLE I

VIBRATION OBSERVATIONS

Component of velocity	Transducer Position			
	9 ft above floor level on wall beside loom	Bottom of wall beside loom	Floor beside loom	
	Horizontal peak velocity in./sec	Horizontal peak velocity in./sec	Horizontal peak velocity in./sec	Vertical peak velocity in./sec
Original troublesome loom	0.91	0.25	0.12	0.18
Average loom in shed	0.08	-	0.17	0.35
Original loom after trench excavation	0.58	0.13	0.14	0.17
Loom in new concrete foundation	0.09	-	-	0.14
Adjacent loom	0.24	-	-	0.11

Frequency of wave train caused by the impact was approximately 20 cycles per second.